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**Vol 6 No 1 January 1983**

*Cover Illustration: Mark Thomas*

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### BENCHTESTS & REVIEWS

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He's sometimes wrong, he's often opinionated, he's always interesting. Who else but Guy Kewney?

CTUK! NEWS
Latest info on ComputerTown UK!

COMMUNICATIONS
This is where you get your chance to have your say!

BANKS’ STATEMENT
This month Martin Banks rambles on about ... well, you figure it out.

COMPUTER ANSWERS
Gotta problem? Sheridan Williams and his team can help.

SUBSCRIPTIONS
Save shoe leather — get PCW delivered to your door.

1982 FEATURES INDEX
A complete rundown of last year’s stuff.

TJ’s WORKSHOP
Terminal Junkies get their monthly micro fix here!

PORTABLE COMPUTER WORLD
‘Calculator Corner’ is dead; long live ‘Portable Computer World’! We’ve changed the name to reflect its broadening scope but calculator freaks need not despair: Dick will still look after you.

PCW SUB SET
More useful assembler language subroutines to get to grips with.

BEGINNERS START HERE
Our monthly quick intro for those new to microcomputing.

DIRECT ACCESS
Includes In Store, ACC News, Transaction File, CTUK! Centres, User Groups update, Network News and Diary Data.

PROGRAMS
More listings with which to while away your time. And from this month, we’re giving a ‘Program of the Month’ prize.

LEISURE LINES
J J Clessa, recovering nicely from a barrage of Manhunters, poses another of his famous brain bursters.

BLUDNERS
We try not to make them but when we do at least we’re honest to admit them (sometimes)!

BACK ISSUES
Find out what you’ve missed and how to catch up.

CHIP CHAT
Scandal, gossip, lies, libel ... none of these are ever allowed to appear in this column!
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<td>HP82104A Card Reader</td>
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Comart CP/M25 Communicator with a total of 512K Byte Memory and 10 Serial Interfaces. Includes CP/M and MP/M 5995.00

COMARD SUBSYSTEMS

Comart VIC20 6" Hard Disk Subsystem (Including HI-CON Front Panel). 3995.00

Comart VIC20 5" x 20M Byte Hard Disk Subsystem (including HDDCON or can be added to CP-1200 or CP-1102) 1995.00

Comart VIC20 Dual 20M Byte Winchester Disk Subsystem (Requires HDDCON) 3995.00

Comart VIC20 80" Floppy Disk Drive Subsystem 1495.00

Comart VP/MSHD Hardware & Software to Upgrade Communicator to MP/M, Includes CPUB88 8088 Processor Board, 4500 Second Interface Cards 1150.00

Prices Exc. VAT
### CROMEMCO Z80 COMPUTER SYSTEMS

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
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<tbody>
<tr>
<td>ROB14LP</td>
<td>High Resolution Colour Computer System</td>
<td>695.00</td>
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<tr>
<td>VOLKERCRAIG 4404WS</td>
<td>Canal WY100 Visual Display Terminal, Green</td>
<td>755.00</td>
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<tr>
<td>48KW</td>
<td>48K Byte Dual Port Graphics Colour Graphics Interface Board</td>
<td>595.00</td>
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<tr>
<td>CDOS</td>
<td>Standardised Basic Operating System</td>
<td>595.00</td>
</tr>
<tr>
<td>SGS Software Included</td>
<td>595.00</td>
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<tr>
<td>DISKETTE DRIVES, 10M Byte Winchester Drive</td>
<td>64K Memory, VDU/Printer Interface</td>
<td>2610.00</td>
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<tr>
<td>CS-1</td>
<td>21 Slot 100 Bus Computer System</td>
<td>4495.00</td>
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<tr>
<td>CS-2</td>
<td>21 Slot 100 Bus Computer System Two, BIOS, 64K Memory, High Speed B&quot; Diskette Drive</td>
<td>64K Memory, VDU/Printer Interface</td>
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<tr>
<td>CS-3</td>
<td>21 Slot 150 Bus Computer System</td>
<td>4495.00</td>
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<tr>
<td>42K RAM</td>
<td>(19&quot; Rack Mount)</td>
<td>395.00</td>
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<tr>
<td>CS-4</td>
<td>21 Slot 150 Bus, Computer System Three, BIOS, 64K Memory, Disk High Speed B&quot; Diskette Drive</td>
<td>64K Memory, VDU/Printer Interface</td>
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<td>CS-5</td>
<td>21 Slot 200 Bus, Computer System</td>
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### CROMEMCO DIAGNOSTIC SYSTEMS

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<tr>
<th>Model</th>
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<tr>
<td>CDS Diagnostic Systems</td>
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<td>IDSI O.P. Development Software</td>
<td>395.00</td>
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<td>COL Overlay Link Editor</td>
<td>395.00</td>
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<tr>
<td>RPGII Report Generator</td>
<td>395.00</td>
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<tr>
<td>STB 32K Structured BASIC (includes 64K ROM)</td>
<td>395.00</td>
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<tr>
<td>SGS Software Included</td>
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### DISKETTES

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<tr>
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### BUG -BYTE SOFTWARE

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<tr>
<th>Software</th>
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<tr>
<td>CP/M-86 Digital Research Operating System</td>
<td>94.00</td>
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</tr>
<tr>
<td>COBOL TRAIN Microcal Training Package for CIS</td>
<td>120.00</td>
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<tr>
<td>CB80 Digital Research Basic Compiler</td>
<td>115.00</td>
<td></td>
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<tr>
<td>BT-60 Digital Research Programming Facility for CP/M Systems</td>
<td>94.00</td>
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<td>EXTEND Jarogate Utility</td>
<td>34.00</td>
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<td>SYSTEM</td>
<td>CP/M-86 DISPWR Digital Research Operating System</td>
<td>94.00</td>
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<td>PLANNERCALC Comshare Financial Planning System for 16 Bit Systems</td>
<td>325.00</td>
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<tr>
<td>SUPERCALC, CBASIC &amp; WORDSTAR</td>
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### PRICES EXCL. VAT

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<th>Code</th>
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<tr>
<td>8230.00</td>
<td>MARS Sophie Business Systems</td>
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<td>4595.00</td>
<td>CROMIX Microflo Distribution Package</td>
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<td>695.00</td>
<td>WABASH 5,8&quot; Single Sided, Single Density</td>
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<td>2610.00</td>
<td>BIOS Diskette Drive</td>
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<tr>
<td>4495.00</td>
<td>Diskette Drive, 10M Byte Winchester Drive</td>
<td>64K Memory, VDU/Printer Interface</td>
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<tr>
<td>395.00</td>
<td>BIOS Diskette Drive</td>
<td>64K Memory, VDU/Printer Interface</td>
</tr>
<tr>
<td>395.00</td>
<td>CS-1 21 Slot 100 Bus Computer System</td>
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<tr>
<td>395.00</td>
<td>CS-2 21 Slot 100 Bus Computer System</td>
<td>4495.00</td>
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### THE BYTHESPOW

<table>
<thead>
<tr>
<th>City</th>
<th>Address</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>LONDON</td>
<td>The Bythespo 324 Euston Road W1 Tel: 01-387 0505</td>
<td>01-387 0505</td>
</tr>
<tr>
<td>BIRMINGHAM</td>
<td>The Bythespo 94-96 Hurst Street 0121 622 7149</td>
<td>0121 622 7149</td>
</tr>
<tr>
<td>MANCHESTER</td>
<td>The Bythespo 11 Gateway House, Piccadilly</td>
<td>061-236 4737</td>
</tr>
<tr>
<td>NOTTINGHAM</td>
<td>The Bythespo 922 Upper Parliament Street Tel: 0602 40576</td>
<td>0602 40576</td>
</tr>
<tr>
<td>SOUTHAMPTON</td>
<td>Also at XITAN Systems 23 Cumberland Place</td>
<td>0703 334 471</td>
</tr>
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*Prices exclude VAT and all other taxes.*

**CROMEMCO SOFTWARE FOR 6800/2800 SERIES**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
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<tr>
<td>CBO-D-COSMIX (Multi-User/Multi Tasking)</td>
<td>195.00</td>
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<tr>
<td>FOR-D-Fortran-77</td>
<td>395.00</td>
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<tr>
<td>FOR-M-FORTRAN</td>
<td>395.00</td>
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<tr>
<td>ASM-D-ASSEMBLER</td>
<td>395.00</td>
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</tr>
<tr>
<td>STR-D-32K Structured BASIC</td>
<td>395.00</td>
<td></td>
</tr>
<tr>
<td>CDD-D-COBOL Compiler</td>
<td>395.00</td>
<td></td>
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<tr>
<td>Note: All 6800 Series Languages (Suffix D) require 64K Memory.</td>
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**CROMEMCO OPERATING SYSTEMS**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
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<tbody>
<tr>
<td>CROMIX Multi User/Multi Tasking</td>
<td>395.00</td>
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*Note: All 6800 Series Languages (Suffix D) require 64K Memory.*

**XITAN SYSTEMS**

<table>
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<tr>
<th>City</th>
<th>Address</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOUTHAMPTON</td>
<td>Also at XITAN Systems 23 Cumberland Place</td>
<td>0703 334 471</td>
</tr>
</tbody>
</table>
Could you run Tomorrow’s Office—Today?

You must have considered microcomputers as a solution to some of your business problems.

Why not run the office on one?

Stage One Software has developed a program which will do just that: allowing you to carry out all your filing, correspondence, report writing, diary updating and basic financial work in the same way as you have always run your office routines.

But using the Administrator on the Commodore microcomputer your filing is automatic. Retrieval, even of vaguely remembered records, is fast and accurate.

And unlike some other office database management programs, Administrator allows you to control it in English via the screen. You do not need specialist programming knowledge to tailor Administrator to your precise requirements.

Use the Administrator to run your mailing lists in conjunction with a word-processing link; for invoicing; personnel records; stock control; valuations; analyses; control reports on projects; and even for narrative files where each record needs to hold a large amount of written information.

Administrator really scores here.

It is able to accept any length of narrative text on any of its records. You have no space limits other than the capacity of your disk storage equipment.

Try that on a comparable system and see how far you get.

We know your business is unique. You or your predecessors set up the systems in one particular way. Administrator will accept that way. You tell it what you want. You set up the system.

When you have astonished yourself by finding out how clever the Administrator is you will probably think of improvements in your own system. So Administrator allows you to amend the system which you originally set up, so that, for example, you can add one item of information to all previously stored records which in turn will allow you to extract more informative management reports.

Administrator is flexible.

It is also mathematically inclined and can total your analytical columns, provide grand totals and make comparisons of targets and performance to provide you with the selective information you specify.

Dates can also be compared. Your aged debtors will be printed out, plus the reminders you require each day to keep your projects on target.

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

We can’t tell you all about the system in one advertisement. Fill in the coupon below and we will arrange a demonstration for you by one of the dealers in our nationwide network.

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Tel. No. Ext.

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TEL: 0202 735656

STAGE ONE COMPUTERS

commodore

STAGE ONE COMPUTERS

commodore

STAGE ONE COMPUTERS

commodore
Why buy British?

Britain has a unique opportunity to establish itself alongside the United States and Japan as a major producer of microcomputers and microcomputer software. In particular, the UK has a tremendous advantage in this field when looking at the markets of the remainder of Western Europe. The continental people have begun to look to Britain for innovative and competitive computer products. Also, it is obviously much easier for them to communicate with this country rather than California or Japan. The recent Compex Exhibition held in London underlines the importance of the UK to the European market.

It is not easy to analyse the reasons for this situation arising. Obviously, the fact that we are an English-speaking country has had significant influence since the industry has been led from its early days by the Americans. Next, we do appear a naturally ingenious people. The number of inventions generated from within these islands is out of proportion to the population when compared to some of our other trading partners. Regrettably however, these opportunities slipped through our hands and were developed elsewhere. Finally, there has been a very strong hobby electronics market and this has possibly been the most important single influence since so many microcomputer companies owe their origins to the dedicated enthusiast.

There is a wide range of machines available from British manufacturers. In most cases, the products are very competitive and, for this reason, should not be difficult for the potential customer to find a British-made solution for his particular requirement. However, I believe that this attitude should be extended and that the Government, local authorities and other bodies should do their utmost to ensure that they buy British and they should try to influence other people to buy British. For instance, there seems little benefit to anyone if a Government body actively or passively promotes overseas' manufactured equipment. Unfortunately, this is the case. What everybody should remember is that buying British means generating jobs here.

Few people realise that for some strange reason, the Government of this country and its EEC partners have rigged import duties to the disadvantage of the UK manufacturer. Manufactured computer systems attract duty of between 6-7%. Many of the components needed to build computer systems are only manufactured overseas and in particular, the 17% duty on semi-conductors gives the importers virtually a 10% edge on their domestic rivals. Whilst I acknowledge the fact that it would be difficult to force through changes rapidly, there must be a way of giving temporary relief to our industry. The Government have the authority to waive duty in certain instances on an ad hoc basis and this could be considered. It really makes no sense for the tax payer's money to be spent on foreign products or the import duty paid by manufacturers on their component supplies.

If all prospective microcomputer customers gave very careful consideration to the UK manufacturers' machines instead of imported ones, the sheer volume of business alone would provide the profits that are needed to pay for the large R&D programmes we all have to sustain. Successful development mean lower prices and even more competition for our foreign counterparts. I believe that the manufacturers in this country have proven that they have the capability of manufacturing and designing the equipment which the market place wants. What we need now is recognition and support.

**MULTIBOARD**

**GM813 — CPU/64K RAM Board**
- 4MHz Z80A CPU
- 64K Dynamic RAM
- RS232 Serial Interface
- Two 8-Bit I/O Ports
- 1200 Baud Cassette Interface
- Extended and Page Addressing Modes

**GM811 — CPU Board**
- 4MHz Z80A CPU
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- Two 8-bit Input/Output Ports
- 8-bit Input Port
- RS232 Serial Interface
- 1200 Baud CUTS Cassette Interface

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- Disk Controller Board
- Single/double density
- Single/double sided
- 8" or 5.25" Drives

**GM802**
- 64K Dynamic RAM Board
**GM803**
- EPROM/ROM Board
**GM816**
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**MP826**
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**PLUTO**
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- Numerical key pad
- 12" Monitor Included

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Total support for Gemini & nascom Products

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Based around the successful Nascom 2 computer, this new system can be built up into a complete disk based system. Supplied built and tested complete with PSU, Nas-Sys 3 and Nas-Graph.

**48K System**

- £631.35 (£549 + VAT)
- £115 (£100 + VAT)
- NASCOM 2 KIT
  - £258.75 (£225 + VAT)
- Built & Tested
  - £327.75 (£285 + VAT)

**Disk System for Gemini & nascom**

GM825 Disk Drive Unit – The GM825 floppy disk housing is supplied with either one or two 5.25" single sided, double density, 66PI high capacity Micropolis 1015F5 disk drives. These provide 400K bytes of formatted storage per drive. (Gemini QDSS format). The CPIM2.2 package available supports on-screen editing with either the normal Nascom or Gemini IVC screen, parallel or serial printers and auto single-double density selection. An optional alternative to CPIM is available for Nascom owners wishing to support existing software. Called POLYDOS 4, it includes an editor and assembler and extends the Nascom BASIC to include disk commands.

- Single Drive System
  - GM825-1T
    - £402.50 (£350 + VAT)
- Dual Drive System
  - GM825-2T
    - £661.25 (£575 + VAT)
- CP/M 2.2 Package (GM809 for Gemini)
  - £103.50 (inc. VAT)
- CP/M 2.2 Package (GM813) for Nascom
  - £115.00 (inc. VAT)

**SOFTWARE**

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**Gemini Software**

- GEM PEN Text Editor
  - £51.75 inc. VAT
- GEM ZAP Assembler
  - £51.75 inc. VAT
- GEM DEBUG Debugging Utility
  - £34.50 inc. VAT
- WORDSTAR Word Processor
  - £247.75 inc. VAT
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**At last—a Winchester Drive for your Gemini/nascom System!**

GM835 Winchester Drive Sub-system:
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- Industry Standard SASI Interface
- Integral Controller and power supply

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**VIZ:APl** is a high level language system. It can be used to develop small programs faster and large programs in limited memory. The language can be enhanced almost indefinitely and the user's own operators and functions can be built up.

- £293.25 (inc. VAT)

A wide range of software for Nascom also available.

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* Advanced Graphics
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Epson MX100 Type III £509.95 inc. VAT
NEC 8023A £389.95 inc. VAT
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* Twin 280A Microprocessors
* 64K Dynamic RAM
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* 160 x 75 pixel graphics
* Programmable character generator
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* RS232 serial printer interface
* Centronics parallel printer interface
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* CP/M 2.2
* Extensive in-built expansion capability
* Modular design for reliability and ease of maintenance

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BRISTOL
Target Electronics Ltd., 16 Cherry Lane, Tel: (0272) 421 196

COLCHESTER
Empire Electronics Ltd., 58 East Street, Tel: (0206) 855926

EGHAM, SURREY
Electravalue Ltd., 28 St. Judes Road, Englefield Green, Tel: (0783) 3603

IPSWICH
MDW (Electronics), 47/49 Woodbridge Road East, Tel: (0473) 78295

LEEDS
Bits and P.C.'s Computer Products Ltd., Leeds Computer Centre, 60/62 Merton Centre, Tel: (0532) 45877

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Henry's Radio, 404 Edgware Road, Tel: 01-402 6822

LONDON SW11
OFF Records, Computer House, 58 Battersea Rise, Clapham Junction, Tel: 01-223 7730

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for TRS80 and Genies

Premier’s WORD4WORD word processing program has been a best-seller since the day of its release. It’s author David, has now produced his latest masterpiece which exceeds even W4W’s incredibly high standards, TURBO.

TURBO will compile any standard TRS80/GENIE disk BASIC program. It will cope with any TRS Disk BASIC command, including full random and sequential file access. TURBO recognises and compiles almost all TRS/GENIE BASIC words (with several very minor exceptions), except for a few immediate mode words such as LIST, SYSTEM, DELETE, etc, which shouldn’t be in your program anyway! It can handle all usual programming techniques (jumping out of incomplete FOR. NEXT loops, for example), and, more importantly, all disk file words.

TURBO compiles the entire BASIC program — it does not “avoid” difficult parts of the program and leave the user with several routines to access from the remaining BASIC (as some so-called ‘compilers’ do). Nearly all your BASIC programs will compile WITHOUT ANY ALTERATION WHATSOEVER, to give R fantastic improvement in running time. Graphics will now appear instantly to screen! TURBO contains its own ‘garbage collection’ routine, making its ability to manipulate strings for sorts, etc, very impressive.

Many BASIC compilers require that you go through the program first and alter parts they are unable to interpret. With TURBO, the only changes you are likely to have to make is to move DEFINT, DEFSTR, and DIM statements to the beginning of your program — not very difficult!!!

TURBO will compile all BASIC programs using double precision arithmetic — many comparable compilers cannot even do single precision arithmetic — TURBO can!!!

Operation of TURBO is simple: type in its filename, the filename of the BASIC program, then sit and watch as it rapidly lists through your program. Compiling as it goes along. If TURBO finds something it cannot interpret (syntax errors in your coding, illegal use of BASIC words, etc), compiling halts and an error message is generated under the line in question. As well as being an excellent compiler, TURBO can also be used to check for correct syntax through an entire BASIC program in seconds!

TURBO is flexible. Options allow direct spooling from disk (thus saving memory space), memory protection for machine code programs, and integration of the run-time package with the compiled program. A special VARS facility allows you to print out variable values during a halt in the compiled program — invaluable for debugging!!

TURBO is available NOW at a special introductory price of £59.95 inc VAT (+95p P&P). It requires at least one disk drive, and a minimum 32K RAM. An application form is below.

Please send me TURBO as soon as possible!

NAME
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Machine (TRS80 Model I or III or GENIE), and DOS used

I enclose £60.90 CREDIT CARD/CHEQUE no Signed

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OLIVETTI M20 16-BIT MICRO
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- Business
- Education
- Science

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Software

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APPLE II BUSINESS SYSTEM
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- 12" Green Monitor
- Disk Drive with Controller

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- (Expandable to 768K)
- Internal Disk Drive
- BASIC, PASCAL
- COBOL, FORTRAN

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The Jupiter Ace personal computer runs in FORTH, an easily understood language, typically four times as compact and ten times as fast as BASIC. Before the Ace all personal computers used BASIC and FORTH was only available to a privileged few.

The Jupiter Ace also features a full-size moving-key keyboard, high-resolution graphics, sound, floating point arithmetic, a fast and reliable cassette interface and 3K of RAM.

If you own a personal computer you will be aware of the limitations of BASIC. You know how slowly your programs run and how quickly your computer's memory gets filled. The Jupiter Ace is your answer.

If you already know FORTH, the Jupiter Ace closely follows the FORTH 79 standard with extensions for floating point, sound and cassette. It has a unique and remarkable editor that allows you to list and alter words that have been previously compiled into the dictionary. This avoids the need to store screens of source, allowing the dictionary itself to be saved on cassette. Comprehensive error checking removes the worry of accidentally crashing your programs.

All inclusive price
For £89.95 you receive your Jupiter Ace, a mains adaptor, all the leads needed to connect to most cassette recorders and T.V.s (colour or black and white), a software catalogue and a manual. The manual is a complete introduction to the world of personal computing and a course in FORTH programming on the Ace. Even if you are a complete newcomer to computers, the manual will guide you step by step from first principles to confident programming. The price includes postage, packing and V.A.T. The Jupiter Ace is backed by a full 12 month warranty.

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Plug-on parallel printer interface.
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Plug-on 16K Memory Expansion
For around £30.00 you will increase the memory of your Jupiter Ace to 19K giving you instant access to enormous amounts of information.

Software
A catalogue will be sent with every machine, and includes, initially, programs for education and entertainment.

FORTH Finishes First!
Speed Comparison Chart showing times in seconds to perform one thousand operations.

<table>
<thead>
<tr>
<th>Type of Operation</th>
<th>Jupiter Ace</th>
<th>BBC Micro</th>
<th>Vic 20</th>
<th>Spectrum</th>
<th>ZX81</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empty loop</td>
<td>0.12</td>
<td>0.67</td>
<td>1.3</td>
<td>4.2</td>
<td>17.7</td>
</tr>
<tr>
<td>Print a number</td>
<td>7.5</td>
<td>13.5</td>
<td>2.6</td>
<td>19</td>
<td>430</td>
</tr>
<tr>
<td>Print a character</td>
<td>0.62</td>
<td>1.3</td>
<td>3.1</td>
<td>7.5</td>
<td>24</td>
</tr>
<tr>
<td>Add two numbers</td>
<td>0.45</td>
<td>1.4</td>
<td>5.5</td>
<td>7.5</td>
<td>28</td>
</tr>
<tr>
<td>Multiply two numbers</td>
<td>0.9</td>
<td>1.6</td>
<td>6.5</td>
<td>7.5</td>
<td>32</td>
</tr>
</tbody>
</table>

Because of the difficulty in devising exactly equivalent programs, these measurements should only be taken as a guide.
Designed by Jupiter Cantab
Computer Designers Steven Vickers and Richard Altwasser played a major role in creating the ZX Spectrum and then formed Jupiter Cantab to develop advanced ideas in personal computing. The Ace is the result, another all-British computer to lead the world.

Technical Information

Hardware
Z80A running at 3.25 MHz.
8K bytes ROM
5K bytes RAM

Keyboard
- 40 Moving-key keyboard with auto repeat on every key and Caps Lock.

Screen
Memory mapped 32 column x 24 line flicker-free display with upper and lower case ascii character set.

Graphics
Chunky graphics (64 x 46 pixels) may be plotted, unplotted or over-plotted (XOR operation). Also, the entire character set (128 characters and their video inverses) may be redefined allowing intricate shapes to be drawn with a resolution equivalent to 256 x 192 pixels.

Control Structures
IF-ELSE-THEN, DO-LOOP, DO-+LOOP, BEGIN-WHILE-REPEAT, BEGIN-UNTIL, all may be mixed and nested to any depth.

Cassette
Programs and data in the compact dictionary format may be saved, verified, loaded and merged. Blocks of memory can be saved, verified, loaded and relocated. All tape files are named. Running at 1500 baud, the Ace will connect to most portable tape recorders.

Expansion Port
Contains D.C. power rails and full Z80 Address, data and control signals. May be used to connect extra memory and other peripherals. IN and OUT words allow port-based peripherals to be addressed.

Data Structures
Integer, Floating point and String data may be held as constants, variables or arrays with multiple dimensions and mixed data types. There are no restrictions on names.

Sound
Internal loudspeaker may be programmed to operate over the entire audio spectrum.

Programming in FORTH

FORTH programs are constructed without line-numbers, as words which are defined in terms of other words that already exist. Consider the following definition of the word STARS. Comments are in parentheses and have no action.

```
: STARS          (* starts word definition)  
    ; 3 asterisks   (* print 3 asterisks)  
    200 100 BEEP  (* play a note for  
        100 mSecs)  

      The semi colon at the end finishes the  
      word definition. Now, whenever you say    
      STARS the computer will print out 3    
      asterisks and sound a short tone. (Notice    
      how the word BEEP comes after the    
      numbers it uses, 200 and 100. This    
      characteristic occurs throughout FORTH so    
      that you write, for instance, 28 76 + instead    
      of 28 + 76.)  
      The Jupiter Ace already has 140 FORTH    
      words defined in ROM.
```

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In Laboratories For monitoring and controlling experiments, the Jupiter Ace has many advantages. The language is perfect, even the Jodrell Bank Radio Telescope is controlled in FORTH. The Ace expansion port enables it to be interfaced to almost anything, and the built in quartz timer allows experiments to run all weekend.

At Home The Jupiter Ace is powerful enough to play games as complex as Chess and with sound and high resolution graphics, action games written in FORTH will stretch your reaction speeds to their limits.

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<td>BASIC Compiler</td>
<td>Compile your BASIC-80 programs for speed and protection</td>
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<td>FORTRAN-80</td>
<td>Fortran compiler to ANSI X3.9 1966 except COMPLEX data</td>
<td>210.00*</td>
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<tr>
<td>COBOL-80</td>
<td>The COBOL compiler for microcomputers. (BASIC, FORTRAN and COBOL compilers include MACRO-80, LINK loader, Library manager and CREF utilities)</td>
<td>310.00*</td>
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### MISC

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<tr>
<td>CBASIC-2</td>
<td>COMPILER SYSTEMS widely used compiler/interpreter for BASIC</td>
<td>94.00</td>
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<tr>
<td>CB-80</td>
<td>CBASIC compatible compiler</td>
<td>310.00</td>
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<td>PASCAL/M</td>
<td>SORCIM's PASCAL</td>
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<tr>
<td>SUPERCALC</td>
<td>SORCIM's spread sheet and modelling system</td>
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<td>MILESTONE</td>
<td>Project Management and Scheduling from Organic Software</td>
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<tr>
<td>dBASE II</td>
<td>Relational Database Management from Ashton Tate</td>
<td>380.00</td>
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<tr>
<td>dUTIL</td>
<td>Programming aid for dBASE II</td>
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<tr>
<td>MICROSTAT</td>
<td>Statistical program library from ECOSSOFT for (and needed) BASIC-80</td>
<td>150.00</td>
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<tr>
<td>PLI-80</td>
<td>Digital Research PLI Compiler</td>
<td>310.00</td>
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<tr>
<td>BT-80</td>
<td>Record Retrieval for PLI-80</td>
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<tr>
<td>MAC</td>
<td>Digital Research 8080 Macro Assembler</td>
<td>57.00</td>
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<tr>
<td>SID</td>
<td>8080 Symbolic Debugger</td>
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<td>ZSID</td>
<td>Z80 Symbolic Debugger</td>
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<td>DESPOOL</td>
<td>File Print Spooler for CP/M</td>
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<td>TEX</td>
<td>Tex editor</td>
<td>63.00</td>
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<tr>
<td>SPELLINDER</td>
<td>Lexisoft's Wordprocessing and Office Management System</td>
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<td>PRO PASCAL</td>
<td>Z80 True Pascal Compiler</td>
<td>190.00</td>
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The last three months should have taught prospective buyers one lesson: never put off buying a system just because there may be a better one just round the corner.

First, there is always a better one just round the corner, and if you wait until you are round it there will be an even better one round the next corner. And all the people who bought before are going to be that much in front of you on their way to becoming experts.

Second, the corner takes a long time to get round. The Oric, a machine which appeared in these columns so long ago that we have had time to publish a retraction of our silly price (actually £169) is promised for the middle of December — in time for Christmas.

Whether this proves to be true or whether instead the magic custom-built ULAs chips turn out to need one or two refinements (it has happened to other people) hardly matters. Either way, you will be lucky to get your sticky hands on one, because demand will follow custom and be too much for supply.

There are machines like the Commodore 64, which also should be here by now. It's mid-November as I write and I have yet to get hold of a European production version of that (very nice) machine. Commodore offered PCW a US standard machine for a Benchtest, but we felt we should wait for a proper version.

Last year I got very excited about the Z80 add-on to the BBC Micro, due around March 1982. Best estimate (unless you want to buy the Torc add-on, around £800) is for March 1983.

Acorn also promised to have an Electron ready for the big Compeg computer show. The Electron, people first said, would be available before the end of the year, and would make fools of all those who bought Sinclair Spectrums (Spectras*).

In the business machine world, things are no better. Commodore is safe from having deceived the world into thinking that 500 and 700 series 'Porsche' machines would be available in September — but the only reason they failed to deceive the world is that nobody was stupid enough to believe them in May.

Corvus showed the Concept (through Keen Computers) in early summer (at the Apple show, of all places). So far, we haven't received one to review, but probably will have by the time you read this.

The star of last year's Las Vegas Comdex show — apart from Chuck Peddle and the Sirius 1 (or Victor 9000 — same beast) was the Fortune 16:32. You just might be able to get one now — and then again, you may find it difficult to make the journey to the nearest dealer — there aren't exactly hundreds of them. But that's quite appropriate, really, since there aren't exactly thousands of machines ready for them to sell.

The Digital Equipment people got quite shirty with us for failing to mention the launch of their Rainbow and Professional machines when they were announced in spring. We were a bit embarrassed ourselves. But even though our review (courtesy of David Ahl) appeared two issues ago, you still can't find any UK users.

And of course everybody knows that there are still no IBM Personal Computers for UK users more than a year after they started being provided to US users. Some people have gone bust waiting. (Microcomputerland, for example.)

Apple is now very close to announcing the Mini-II, offering less silicon than the II and very little else with the network-based 68000 machine even further off. If you had decided you liked the sound of that particular dream machine when first you heard of it, you might have been waiting two years in vain by now — and there is more waiting to do.

If you feel like reading more about this, write it yourself — there's plenty of material. Just look through back issues, and write down the new machine announcements of the past 12 months.

Even the machines which are in full production, like the Dragon or BBC Micro, have been available only to the few for most of their lives.

And the VIC 20 was supposed to be dead now — it isn't, it's going to carry on being made 'for the foreseeable future' according to Jack Tramiel. He's the boss of CBM and when he says 'the foreseeable future', he means it. (One should perhaps add that Commodore works in three-month cycles, and, while he may mean it, what he actually means is 'until February, anyway'.)

There are also the add-ons — the Sinclair 'disks' (or 'Interchangeable Storage Medium' as Clive would say), for example — which are always 'around the corner' too.

Actually, I've taken some care to list everything which I have some reason to believe will be in the shops come February. All of it is late now, and will be desperately late if it still isn't around in February.

The moral of the sermon is: if you want to buy, buy what is in the shops on the day you have the money, not what looks like it's going to be great next month.

At the moment, the 'toys' in the shops include the BBC Micro, the VIC-20, the Texas Instruments 99/4A, the Sinclair ZX81, the Spectrum, the Dragon, and the Atari. Precious little else is available, and some of that lot is hard to get hold of.

The 'business machines' in the shops are things like boring old Superbrains, boring old Osbornes, boring old Apples, boring old PETs and boring old Signets, plus the occasional interesting machine like the Sirius.

By all means read this section of PCW, and make an intelligent study of what's on the horizon. Being well-informed about the future can help tremendously in making decisions about the present.

As long as you don't forget that the horizon is not here, and the future is not now.

Going Dutch

In Amsterdam, there was recently a show called Comdex Europe, where top US industry pundit Adam Osborne had hoped to address an attentive audience of the most powerful European corporate tradesmen.

Instead, he found himself telling a largely empty hall containing his chief computer designer, Lee Felsenstein (and a few colleagues) that 'designing the hardware is easy — to succeed in this business, you have to provide other things like software support'.

Lee took this tactlessness in good part, since it is his opinion that the 30-odd imitation Osbornes prove that the hardware isn't all that easy. He may be able to get timing signals out of the system to make sure that every chip operates in perfect synchronisation.

This printer can print both up and down: 'when mounted vertically, the printhead can be made to emerge downwards, with the last printed line at the top (data mode) or upwards, with the last line lowest (text mode') — according to Able Systems Limited.

It took me a couple of minutes to work out that what it actually does is to print either left to right, normally, or right to left, upside down. You think about it.

Details on Northwich (0506) 48689.

Guy Kewney delivers his monthly package of micronews.
From the picture, you might deduce that this isn’t a VIC with only 20 characters per line, but the Commodore 64, which has 40. You would be wrong: it’s a VIC with an add-on Stack product which gives 40 or even 80 columns. The only drawback I can see is that it costs £115, which just happens to be the lowest price I have heard of for the VIC itself. But if you already have a VIC, it sounds like worth having.

Details about Vicsoft, the VIC users’ club, or from Stack at 290 Derby Road, Bootle, Liverpool L20 8LN.

Print problems solved

The best-selling word processing package for personal machines is Wordstar, and the best-selling personal printer is the Epson. It comes as quite a surprise, then, to find out that there are no commercial versions of Wordstar which can drive the Epson properly.

Even more of a surprise was the discovery that experts who can advise on how to link the two are equally few and far between, and, until last month (November, if you are reading this January edition in December!), authorities on Wordstar itself didn’t include its inventor, MicroPro. MicroPro has now arrived in the UK. At press time (during the Compec exhibition) nobody was properly installed in their new version.

version 7 is the sort of Unix which most people have on offer or else a version of Version 7 which they have written themselves.

Bell Labs, however, invented Unix, and is currently selling System III of the operating system. Oddly enough, that is a later version (Version 7 is Version Seven of System II).

Just to confuse everybody, Bell has produced System 4 as well and Berkeley University has produced 4.2, which is appearing on various systems. It’s supposed to be a secret, but on a machine called the Sun, at Compec in London last month, 4.2 appeared on the screen with the suggestion that it would be on sale in March through Tim Keen. Even more secret, System Five is near to readiness.

Having established which version (or system) you may be talking about, the next thing is to establish whether that version (or system) is actually running. Here, you’re on your own, because the number of people in this country who really can tell whether Unix is working properly is very limited.

No, this is not an attempt to answer the question in a couple of paragraphs, just to warn you that you really do need an impartial expert when choosing a system with Unix. And to add that Bleasdale is contactable on 01-828 6661, since he has just announced a Sun-based system with Version 7.

Which Unix?

People wanting big power in a personal processing system usually end up listening to a salesman talking about Unix, because Unix is generally agreed (by the people who build bigger micros) to be suitable for big systems.

The trouble with Unix is that there is Unix and there is also Unix, and then there is a group of things like Xenix and Onyx and Uniflex.

British operating system expert Eddie Bleasdale has got himself into a bit of a stew about it all, since he sells a system with Unix and reckons that it is the only ‘real’ system with ‘real’ Unix — something which he can think if he likes but which his competitors get steamrolled up about if he says it.

Bleasdale sells one system based on the Z8000 and another based on the 68000 — the numbers refer to the central processing chips inside the systems. Lined up as his rivals nowadays is a longish list, starting with Fortune 32:16, Wicat, Victory (a new one) and Onyx.

The trouble is knowing what we are all talking about. Unix.
THE GENIUS YOU CAN TAKE TO BREAKFAST.

Now, at last, real portable computer power. The new Sharp PC 1500 pocket computer. A pocket-sized genius that will travel with you to conferences, seminars and business breakfasts.

The PC 1500 has the capacity and BASIC language usage that is very nearly that of the desk-size Personal Computer. When fitted with the optional 4-colour graphic printer, it is one of the most powerful pocket computers on earth.

Chores can be handled swiftly and accurately any time of day, wherever you happen to be. Estimates, records and charts of sales, billings and other important data can be re-programmed, calculated and summoned at the touch of a button. It can even play blackjack, analyse your biorhythms or give you a beeped reminder of a scheduled meeting.

Large memory capacity, up to 11.5K bytes. 4-colour print-out. Six user-programmable keys.

The incredible new PC 1500. A revolution in pocket computers.

From Sharp. Where great ideas come to life.

SPECIFICATIONS PC 1500

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Number of calculations</td>
<td>10 digits (mantissa) + 2 digits (exponent)</td>
</tr>
<tr>
<td>Program language</td>
<td>BASIC</td>
</tr>
<tr>
<td>CPU</td>
<td>C-MOS 8-bit CPU</td>
</tr>
<tr>
<td>Capacity</td>
<td>ROM: 16K bytes</td>
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<tr>
<td></td>
<td>RAM: 3.5K bytes expandable to 11.5K bytes</td>
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<tr>
<td>Memory protection</td>
<td>C-MOS battery back-up</td>
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<tr>
<td>Display</td>
<td>7 x 156 dots mini-graphic display</td>
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<td></td>
<td>(English upper- and lower-case letters, numbers,</td>
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<td>special signs, etc.)</td>
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CE 150 Colour Graphic Printer/Cassette interface (Optional)

- **Power source**: Built-in rechargeable battery
- **Printing digits**: Standard 18 digits (36, 18, 12, 9, 7.6, 5, 4 digits selectable)
- **Printing system**: X-Y axis plotter system
- **Printing mode**: Graph/Text switchables
- **Character sizes**: 9 different sizes from 1.2 x 0.8 mm to 7.6 x 9.8 mm (from 1/16" x 1/32" to 7/16" x 9/32")
- **Printing colours**: Red, blue, green, black
- **Printing directions**: Right, left, up, down
- **Minimum step width**: 0.2 mm (1/64")

**Cassette Interface**

- Up to two cassette tape recorders can be connected

CE 151 Memory Module (Optional)

- Capacity: 4K-byte C-MOS RAM

CE 156 Memory Module (Optional)

- Capacity: 8K-byte C-MOS RAM

CE 153 Software Board (Optional)

- 140 key soft-touch definable keyboard

CE 152 Cassette Recorder (Optional)

- Audio cassette recorder to match PC1500

CE 159 Battery Back-Up Memory Module (Optional)

- Capacity: 8K-bytes, will retain memory contents when removed from PC1500.

CE 158 RS 232 Interface

- RS 232C Interface also incorporating Centronics parallel interface
**BASIC LANGUAGE SPECIFICATIONS**

**PC 1500**

**Commands**
- RUN, NEW, LIST, CONT, TR ON, TR OFF, LOCK, UNLOCK, STATUS, MEM
- INPUT, PRINT, GPRINT, CURSOR, GCURSOR, PAUSE, USING, WAIT, CLS, IF ... THEN, STOP, GOTO, ON ... GOTO, GOSUB, ON ... GOSUB, RETURN, ON ERROR GOTO, FOR ... TO ... STEP, NEXT, END, DIM, LET, REM, DATA, READ, RESTORE, BEEP, READ, ARUN, CLEAR, RANDOM, DEGREE, Radian, GRAD, BEEP ON, BEEP OFF

**Statements**
- INPUT#, PRINT#, CHAIN, RMT ON, RMT OFF

**Functions**
- SIN, COS, TAN, ASN ACS, ATN, LN, LOG, EXP, DEG, DMS, RND, SOR (\(^{\sim}\)), SGN, ABS, INT, PI (\(\pi\)), LEFTS, RIGHTS, MIDS, ASC, VAL, LEN, CHR$, STR$, POINT

**Variables**
- A \(-Z\), AZ \(-23\), two-letter variables possible, two-dimensional arrays applicable

**Operations**
- \(+, -, *, /, (,), >, <, >=, <=, <>, =, \),
- AND, OR, NOT, 
- INKEYS, TIME, ;

**Others**

**CE 150 Printer**

**Commands**
- LLIST, TEST

**Statements**
- LPRINT, TAB, I, ROTATE, COLOR, GCURSOR, SORG, LINE, RUNE, CSIZE, TEXT, GRAPH, LCURSOR

**Cassette Interface**

**Commands**
- CSAVE, CLOAD, CLOAD?, MERGE

**Statements**
- INPUT#, PRINT#, CHAIN, RMT ON, RMT OFF
London offices at 31 Dover Street, but by now you should be able to contact Kristi La Bianca, director of MicroPro UK, at that address.

Incidentally, the new Epson printers (the Mark III) are much cleverer than the ones most of us have bought. They can do things like tiny tiny little super-script and sub-script letters, like emphasised print, like double-width letters, like 132 letters per column.

The old Epsons could do some of these things but not very well. If they did double-width characters, it had to be a whole line at a time, so if they were required to do two lines of double-width characters, you had to reset the thing each line.

Now here’s an interesting thing: the difference between the old Epsons and the new ones is simply the memory chips inside them. Take your old Epson Mark 2 to a dealer, pay him £25, he will put the new chips in — and Shazam! a Mark III Epson.

For some reason, Epson isn’t publicising this fact too heavily.

Bravery

It takes a brave man to announce Ethernet for a microsystem, since Ethernet is widely agreed to be neither fully operational, nor cheap. Two brave hardware companies, then: Altos, which had Ethernet on show in Amstrad recently, and a company called 3COM.

The 3COM system is going to be built around the IBM Personal Computers (when we have them) to provide a line of products that will connect several users into a network. That way they can share big disks, expensive ‘tape spoolers’, and messages.

Anybody fancying trying the experiment can contact the company’s agent, Ambar Components, on (0296) 34141 at Gatehouse Road, Aylesbury, Bucks, HP19 3ED.

Dithering

Osborne in the US is still dithering about how or when it will announce 80-column displays for current users. Logic appears (but only appears) to be on its side. It has judged its customers to see how many of them will buy the 80-column display option if they make it available and the customers mostly say they don’t need it.

This is hardly surprising, since it is about as clever a question as asking a convention of one-eyed cinema enthusiasts if the club films should be shot in 3-D. Naturally, everybody who wants an 80-column display (a lot of people) decided not to buy an Osborne in the first place.

Osborne should pull the people who nearly bought one, and didn’t.

Free micros!

You presumably want to know how the world’s first hard-disk portable computer ended up being sold through Rymans office shops? Read on.

Rymans used to sell an American-built overpriced system called Dynabyte, imported by Metrotech. Then Rymans and Metrotech and Dynabyte all split up.

Rymans has thought a bit about this and has returned to the market with a British product range — the extraordinary Andromeda family from ITCS in Staines.

This is the family of ‘free’ microcomputers which has attracted both controversy (‘he can’t do that’) and enthusiasm (“we’ve done £2.5 million worth of business in less than six weeks from startup”) because the machines are not only free, but come complete with some cheap software.

The idea is simple enough: ITCS will lend a machine suitable for running the software it sells and maintain it for a reasonable fee, for three years.

All the machines (over 20 different combinations from six basic designs, including an Osborne-like portable) run CP/M on an identical central processor.

The difference between the systems is the size of the keyboard, the size of the screen, the density of the disks, and so on.

The systems have now been enhanced with the launch of what proprietor David Lewis-Pryce reckons is the ‘first winchester-disk portable’ in the world.

This is no light-weight: the basic Zita portable requires you to lift 36lb weight and the hard disk version is even heavier. However it does pack away into a single case, small enough to put in front of you on the tube, and compact enough to hold in one hand long enough to push open the door with the other.

Its advantages over the Osborne — apart from its UK origins — are the bigger screen (nine inches) with 80 columns display and much bigger disk capacity. It can be cheaper, too, but not for the same amount of software.

Franchising arrives

First British Computerland store — no, not the old Byte Shop group, but the new US-based ComputerLand group, has opened in Southampton.

It is an expensive store. First, the group had to pay Comart group close to £70,000 for the name, after several years’ wait and legal proceedings.

Second, the chain is a franchise, not a corporate-owned one. You can start up a ComputerLand store if you pay enough. In the case of the Southampton store, the Sperrings Group is spending £2 million and still use that money to open 11 different ComputerLand stores in ‘selected southern and Midland locations’. Some of that money goes on stock but some goes straight to ComputerLand to finance central services — and central profits, too.

At press time, that store was the only one we knew for sure would get the DEC range of Rainbow and Professional models — one day. Details from the energetic publicity agents, Rayner, on (0703) 332829.

Directory

A directory of microcomputer software has been compiled by staff from Sunderland Polytechnic.

It has taken them a year to put it all together — not just lists of program names but details of what system the program runs on (and how big it must be) and who sells it and what the dealer’s address is.

Copies are available from the Department of Mathematics and Computer Studies, Sunderland Polytechnic. Cost is £3.00 and cheques should be made out to the Borough of Sunderland. I can’t vouch for it, however, since by press time I still hadn’t seen a copy.

Good news

Two bits of good news from Welsh manufacturer Dragon Data, which produces the Dragon 32.

First, the company is not going ‘down the tubes’ with the failure of Mettoy (which at press time seemed to me to be likely) because it has been bought out.

Second, the designers are planning to release reasonably priced disk drives early next year and also predict that the problems with display on many colour televisions will be overcome before February.

The machine is tremendously successful: from the launch in August to mid-November, it sold 12,000 units. Predictions were that, by Christmas, twice as many would become the proud possessions of home users.

This makes it very hard not to recommend the machine as a serious choice. The power of its internal processor is comparable to (or greater than) some ‘16-bit’ chips.

Financially, the company now has the backing of Prutech, the venture capital arm of the Pru. There is also some money from the Welsh Development Agency, rounding off a busy month for that body (it also sank a quarter of a million pounds into Torch, when that company bought Arfon). Arfon, for those who don’t have VIC 20s, is the company which sells a case for the VIC which expands memory and allows several other add-ons to be plugged in simultaneously.

False impressions

Hardly a day goes by, you may think, without some newspaper or journal showing a picture of some disabled human being helped by a computer. Surely, you say, it is ridiculous to suggest that this sort of thing needs more publicity — every time some picture editor wants to run a ‘technology’ story with a ‘human touch’ out comes the automatic Braille reader, or the talking wheel-chair. But the impression is false.

The British Medical Association...
The Critics Don't....

"Cardbox is your familiar, tried and trusted card index...with most of the features you have always wanted on your manual card index but couldn't have, because of the limitations of pieces of card."

"Cardbox...succeeds extremely well. Its facilities for indexing and searching are good and very fast...the user image of the screen displays and the documentation are in the main excellent."

Personal Computer World, August 1982

"The interesting thing...is the display...Cardbox enables you to draw a form on the screen complete with headings."

"Cardbox is an excellent database manager...its versatility...and its ease of operation make it a useful program for home or business."

InfoWorld, September 13, 1982

Anyone can use Cardbox. It's a simple yet powerful electronic card indexing system. Easy to learn and easy to use, Cardbox is bringing real computer power to hundreds of new users.

Put yourself in a user's shoes:

- You wouldn't have to change your present working methods or think in computer terms. Cardbox talks to you in plain English.
- If you can do it with a card index you can do it better with Cardbox thanks to its sophisticated automatic cross-indexing.
- Up to 65,500 'cards' can be stored and they can be displayed, printed or passed to other programs in any number of alternative formats.
- Groups of 'cards' can be selected by any word in any field. Your choice can be refined by using up to 99 words in a single search.
- Information is easily added, changed, duplicated or deleted.

These are just a few of the reasons why the top British and American micro journals are convinced Cardbox is the ideal card index for CP/M users.

Cardbox - the ideal card index system for CP/M users

Caxton Software Ltd, 10-14 Bedford St, London WC2E 9HE. Tel: 01-379 6502. Telex: 27950. Ref: 398

Caxton products are available from leading microcomputer suppliers in the UK.

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Please send _____ copies @ £157 + VAT (includes P+P)

A cheque for _______ is enclosed.
Every day we receive up to 50 press releases at PCW. Something like half of these go straight into the trash can because they're nothing to do with micros or because they're plain boring. Occasionally, though, one appears which is either so ludicrously wild in its claims, or so riddled with errors, or so arcane in subject matter that it deserves to be considered for some form of award. We're proud to announce, then, the PCW Press Release of the Year Award for 1982. There have been quite a few contenders during the year but we feel that Mitsubishi Electric Corporation wins hands-down. The prize is the dream of every PR man: a verbatim reprint of the entire press release. So here goes:

Mitsubishi Electric develops pattern recognition software for sorting fish and cucumbers.

Mitsubishi Electric Corporation has developed Melsort pattern recognition software which promises to have wide application in the automated sorting and grading of commodities at the manufacturing and distributing stages. The microcomputer-operated Melsort system can recognise commodities by identifying their images with memorised key diagrammatic features. One application is the fish sorting and grading system developed jointly with Mitsubishi Kakoki Kaisha Ltd. It recognises sardines, herring, anchovies and a variety of mackerel by shape while grading them into three sizes - small, medium and large. The task of fish sorting which used to require skilled human labour is now done automatically, based on information regarding five to 10 selected diagrammatic elements such as length, width, snout shape, etc.

The system typically consists of a supplying unit, lighting unit, line sensor (TV camera), picture processing unit, conveyor and sorter which are controlled from the central control monitor linked to the data processing unit. Fish first go through light to activate the line sensor which transmits diagrammatic information to the picture processing unit for identification and sorting. Fish up to 500mm in length and 150mm in width can be handled at a speed of about 14,400 per hour. Melsort is also used in a cucumber sorting and grading system which Mitsubishi Electric is marketing to save time and labour in this hitherto tedious task. It sorts and grades cucumbers according to thickness, length and curvature and shape, which are appreciated by Japanese customers. The system has gained wide acceptance (in Japan) among agricultural cooperatives in particular.

It's likely that dealers will start to discount the machines even further, an attitude which NEC seems interested in encouraging - or at least in not discouraging.

There's still no sign of the company's 16-bit micro appearing here, even though it has been on sale in Japan for a time. NEC in the UK is still assessing it and does not expect it to be on sale for some months yet.

Peter Rodwell
The 16-bit Dot — portable but pricey.

The 16-bit Dot is 8088-based to allow it to run MS-DOS software but comes with an optional 280 add-on to allow users access to CP/M-80 packages too. The Dot contains up to 704 kbytes of RAM and 24k of user-expandable memory, and one day, it will have software. It has its own Basic, it has programmable ROM and has up to two Sony 3½in disk drives, capacity 278k each. As if this wasn't enough to make it unique already, the Dot also contains a built-in 80-column thermal printer which can print out anything displayed on the screen, including high-resolution graphics. Options include a built-in modem and an 8087 arithmetic processor.

The snag, though, is the price: an estimated £2300 for the basic system, comprising CPU with 32k of RAM, bit-mapped graphics, keyboard, a single disk drive and two expansion slots. Manufacturer Computer Devices Inc maintains, however, that it's not competing at the Osborne end of the market; the machine is intended mainly for desk-top use, it says, where its main advantage is the small amount of space it occupies. More from Computer Devices' European office at 108, Place des Moines, 91000 Evry, France, tel: (6) 079 0077.

Peter Rodwell

Legal matters

Atari says it is suing Commodore for ripping off the Pac-Man game, and selling it as Jelly Monsters. Commodore says that Atari has lost a similar lawsuit in Hong Kong, and as a result has withdrawn from this one. Atari says no, it hasn't withdrawn, it has just 'stood over its application for a temporary injunction, but obtained an order for a speedy trial'. Commodore says it will be pressing for costs.

When we know more, we'll tell you. I can't help feeling a touch ironical about the wording of Atari's press release, however.

The release itself refers to the 'substantial commitment to the development and marketing of new and original software which is very true and valid — and says that it will "continue to enforce its rights against those who would seek to misappropriate the fruits of Atari's labours," which is a matter for the courts to settle.

The irony of this case is the fact that Pac-Man is not a program which Atari wrote. It happens to be one they bought from a Japanese company.

Hand-held hand-outs

A possible £100 million is to go to London's shy or proud and needy under a new scheme based on hand-held micros. The micros will be used by welfare visitors on their rounds to spot eligibility for welfare benefits. A possible £100 million currently goes unclaimed in London. The Greater London Council (GLC) is budgeting around £300,000 for a system based on devices like the Tandy, Sharp, Newbrain and Epson.

The scheme, expected to be underway next spring, will reach people who would never dream of asking for any financial assistance,' says the GLC. 'Every day thousands of people are being means-tested for specific things, but the task of calculating their eligibility for any welfare benefit is very complicated. The new system will prompt welfare visitors to ask a series of questions leading to an automatic on-the-spot assessment of eligibility. Precisely which machine will be used has yet to be decided, but it will have to include a small display and printer. A parallel project involves communicating via existing terminals in Citizens Advice Bureaux to a central database at the GLC for textual information on legal advice about welfare benefits.

June Bird

Final act in Sirius drama

Sirius superstar Chuck Peddle flew into London in November for a lightning press conference to explain the mystery surrounding the rumoured takeover of his company, Sirius Technology, by the US Victor organisation. The sequence of rumours went something like this: first, it was whispered that Sirius had taken over Victor. Then UK Victor 9000 distributors DRG issued a press release claiming that Victor had taken over Sirius and from now on we'd only see the Victor name on the company's products. ACT, the British distributors for the Sirius 1, seemed as much in the dark as anyone — and nobody could get any information at all from Sirius in the States. Confusion was compounded at Compex Europe in Amsterdam where the large Victor stand was populated with Sirius-style machines with a Victor label in which the 'o' in Victor was composed of the Sirius logo!

Here, then, is the (abbreviated)
The more observant of our readers may have noticed something different about this month's PCW. What we've done is to change over to phototypesetting, in the form of a brand-new, computerised Itek machine. Our dear old IBM golfball machines have been put out to pasture on a much less onerous task of setting Private Eye.

This doesn't mean, of course, that we'll now see fewer errors in PCW—it's just that they'll be high technology errors. Pic shows our typesetter, the glamorous Ms June Hambell, trying to get Space Invaders running on the Itek.

official story from Chuck Peddle. Back in October 1980 he and a colleague decided to go into microcomputer manufacture. They did a deal with Victor Business Products (an offshoot of the Walter Kidde organisation in the US) under which Chuck's company, Sirius Technology Systems, would manufacture the machine we know as the Sirius 1, and Victor—a well-established office equipment company specialising in desk-top calculators but looking for a macro to add to its range—would market it throughout the US and abroad through its subsidiary companies. Victor would have the machine exclusively in America but Sirius remained free to market it under its own name elsewhere. In return, Victor injected a large amount of capital in Sirius.

For various reasons the Sirius machine got off the ground in Europe (through ACT, which still sells more of them than anyone else) before the Victor version was out in the States. With the Sirius selling well in Europe, Victor surprised us all by launching its own name elsewhere. In return, Sirius Systems lost the court case (despite desperately buying up a small, long-established but bankrupt company called Sirius to try to establish prior use) and had to find itself a new name. As it was taking over the Victor Business Systems empire anyway, 'Victor' seemed an obvious choice so Victor it became, with a new logo incorporating the old Sirius logo.

However, there's a final twist. Although the new Victor company can't use the Sirius name in the US, it can elsewhere and, as the machine is firmly established in Europe as the Sirius, that's how it will continue to be known over here. But established distributors and dealers of the Victor 9000 will also continue to sell that machine, although don't expect Sirius and Victor people to be any friendlier just because of the takeover. And don't expect them to indulge in a price war, either. That will be very firmly stamped on by the new Victor company.

Peter Rodwell

Novel printer

Olivetti has found a new way to become newsworthy—by producing a new printer with a completely new way of printing. It involves shooting black sparks at white paper.

Most printers hit a piece of paper with an inky ribbon, pressed onto it either by a lump of metal in the shape of a letter, or else with sharp needles which repeatedly slam into it.

Some printers use the needle method but instead of hitting the paper in the right place, they burn the paper. To work properly, this method needs heat-sensitive paper. Don't leave it in the sun after printing...

Olivetti has hit upon the idea of using a graphite electrode and instead of writing on the paper (as with a pencil) it electifies it. A spark flies between electrode and paper and a particle of carbon flies with it, onto the paper. The idea is exciting enough and, at £400 plus VAT (£14 more than the Epson), the price isn't badly wrong.

Olivetti claims that the printer has fewer moving parts, which is true enough, but omits the fact that it only has one electrode. So where your impact matrix (those needles) with seven or nine moving parts has to travel down a line of print once, the carbon head has to travel seven (or so) times. It has to shake about a bit. The drawback is that the carbon used in the printer is all too clearly carbon.

There is a printer which uses laser techniques, which is so fast that it does carbon copies by printing the same page twice and you don't notice the difference. 'Every copy a top copy,' somebody said once. The Olivetti has every copy a carbon copy.

One of the first companies to adopt the new printer is Acorn. Olivetti is on 01-785 6666.

List service

You have just finished writing that immortal Spectrum program, which is not only going to make you rich but also famous. You plug in your ZX printer, LLIST it and then send it in to PCW. You pop the silver paper into the letter-box and it pops straight out again, with a little note saying: 'This letterbox is not programmed to receive any more ZX printer listings for PCW because the line of unread listings (mostly unreadable) now stretches back from Evelyn House to here. Don't panic! Send the cassette to LE Listings, 1 Leshwin Road, N16, with £2, and they will print it out on plain paper (missing out only the underscore, user-definable graphics and block graphics).

Stephen Adams, who runs the service, also sells various adaptors to make the ZX81 look like a Spectrum and vice versa, so that people can plug in their own peripherals to the new machine. Like all people who understand the ZX back connector, Adams speaks a language almost totally impenetrable to me: I suggest you contact him direct for details of what he sells. It all seems pretty cheap.

Assorted op-systems

Anybody planning to sell you an imitation IBM Personal Computer with MS-DOS, the operating system which Microsoft produced for IBM, can plan on paying a mere $19 per copy, providing they plan to sell more than 5000 machines. Microsoft has announced new prices to go with its new version of the operating system, which is expected 'soon'.

MS-DOS 2.0 "offers a number of new and enhanced features," the company says.

User friendliness is provided by a 'visual shell, and help facility'—that's to say, a menu of common commands and an explanation of them if you panic and type a question mark.

The new software should run a bit faster, too, because Microsoft has taken a little of the computer's main memory over and uses it to store data coming off disk. The assumption is that you are very likely, having read one sector, to want the next, so MS-DOS 2.0 reads in the whole track and your second access comes direct from memory.

Most interesting, however, is the sign of a response to Digital Research's Concurrent CP/M-86. So far, DR has offered this on the IBM PC and very few other systems. There are several reasons for the slowness of the response: first and foremost, people don't understand what it is.

Once you have understood that Concurrent CP/M-86 lets you switch happily between Supercalc and Wordstar and your electronic mail system without loading and unloading files, you tend to want it. At that point, you find that it
The hard disk in front of the Apple is actually a disk and tape system. When you start to worry about the disk crashing and tearing your data into a finely separated stream of oxide, you read it all off onto the tape, and store the tape in a cupboard somewhere.

The difference between this one and other types of tape dump is that this one checks the data as it goes out — it has a tape read head behind the tape write head, and makes sure that what was written is what it wrote. If not, it marks it dud, and repeats the block.

You get it from Hal Computers, on Barnborough (0252) 517171.

takes up an extra 91 kbytes on the Sirius 1.

So there is no panic for Microsoft in producing its multi-tasking system, which (it adds mysteriously) is written in 'C'.

The only reason there is any mystery about this, is that 'C' is what Unix is written in and, of course, Microsoft does have a Unix-type operating system called Xenix. Microsoft now has a European office: details on 04427 75091.

Where's the action?

There is an 'adventure' type game for women, if they have a ZX81. It is called 'Love' and I haven't the nerve to try it out. All the action happens at a 'Zany Houseparty' and I just can't face another.

Normally, it is nice to see people advertise in PCW: on this occasion, however, it is necessary. John Noyce has written a superbly grovelling letter, with my address most efficiently printed on the top in the space where such things should be found.

But until he adds his own address, just above that, we won't know where to send our £5.95, will we?

Another 'portable'

Somebody at MicroAPL with a sense of humour has decided to put a handle on that company's enormous, specialised, expensive personal minicomputer and describe this as a 'challenge to Osborne'.

Osborne, I assume, is a manufacturer of computers which are rather more expensive and specialised than Osborne CP/M micros. They are presumably grovelling in their teak-lined boardroom.

Not that the Scorpion isn't an impressive-looking machine. And, at the price, it even seems quite reasonable value for what it is.

It is just that with a 16-bit 68000 super-chip inside, the highly specialised APL language for programming in, no packaged software and a price tag of £6000 (plus VAT) or more, it does seem to be in a difference world from Osborne. Even if it does come in a box with a handle. We can presumably expect a Porsche with pedals and a chain as a 'rival to the bicycle' any day now. Details on 01-834 2687.

Apple picks up

Apple has done pretty well in the last six months as it prepares to sell off the last of the Apple II machines and launch the smaller version with fewer chips, the Revision E version.

By bringing down the price of a disk system, the company has had its best quarter ever, winding up at the end of its financial year with a 74 percent net increase in sales. That's a very great deal more than was on the cards in June. Apple's worst month ever, before the coupon offer.

In the UK, the boss, Peter Cobb, is convinced that somebody else has suffered. 'We want to know whose lunch we've eaten,' was the way he put it, to the trade paper MicroScope.

Some manufacturers at the upper price end of the micro market (competing with minicomputers) did have a lean time, but they aren't really competing with Apple directly.

It seems likely that Apple did well because many new machines were announced, and were very effective in whetting buyers' appetites — but didn't appear.

Commodore certainly isn't the company to suffer — though its PET range didn't boom — because its VIC has been enormously successful (see story elsewhere). In the third week of November, it reported a total of 20,000 machines shipped in the UK, at prices down to £130 through some chains, and even as little as £115 through some discount warehouses.

Disk deliver

This is going to hurt so grit your teeth: if you want to see what's on a disk, you need a program called Watson.

I warned you.

It costs £35 and it does things like dump memory to a tape, disassemble text, look though disks.

It works with the Inspector, which Vergecourt has already launched. Details on (0268) 728484.

Forth spreading

Oric, one of the many Christmas Bargain machines still not available at the time of writing (but expected in days rather than weeks, of course) has been given an extra programming language. So has the BBC microcomputer.

This one is obviously designed to take some of the wind out of the sales of the Jupiter Ace, which comes with Forth.

Forth is now available, on a free audio cassette, with every full-size Oric — the one costing £169. Or it will be, when the Oric is available.

The BBC Microcomputer gets its Forth from Level 9 Computing in High Wycombe. This isn't free, but, at £15 including a 70-page manual, it can't be exploitation.

Details from Oric on (0990) 27641, and from Level 9 on (0494) 26871.

Another Visicalc improvement is the one which you get from using the Apple III rather than the II — but not everybody with an Apple II is daft enough to want the III.

Vergecourt has produced a big memory board and Visicalc expansion system for Apple II users, which (they say) provides 'a whole series of extra commands which speed up the production of presentation quality management reports. These include', they add, 'many of the long awaited format features found in Visicorp's Visicalc Advanced Version, which is currently only available on the Apple III.' Details here on (0268) 728484.
The good news this month is the birth of a new Town. David (or myself — neither of us can remember which) sent some guidelines to Peter Stone of Wolverhampton recently. He’s just written back to say that his (or their) Town started in October at the Polytechnic in Wolverhampton. They meet on Friday evenings during term time from 6pm until 9pm in the Computing and Maths department, so that’s where you’ll find them if you’re in Wolverhampton and you feel like paying them a visit.

There’s plenty of hardware there and technically knowledgeable people on hand to provide help and advice. The computers are: 16 TRS-80s running disk systems, a PET, a BBC model B and an RML 380Z.

On top of all that hardware CT Wolverhampton provides a self-teaching Basic course and a large room for those who want to add their own micros to the already quite impressive list. Anyone who wants to know more should contact either Peter Stone or Mal P Streatfield during "normal working hours" at the Computing & Maths Dept., the Polytechnic, Wulfruna Street, Wolverhampton WV1 1LY. The phone number is Wolverhampton 27371 ext 145. We wish them all the best for the 'Town and other wise and hope to bring you more news on what they’re up to in future.

CT Worcester has a new 'manager', as Tony Cartmell has stood down but will be helping out whenever he can. The new man-on-the-spot is Clive Watson — he’s also manager of the local Tandy store, where the 'Town will now be based.

They’ve had a bit of a break recently, but should have started up again by the time you read this. The emphasis has tended to be on TRS-80s, mostly because that’s what’s in the shop — but they hold an open house for people with other micros.

Clive Watson’s put forward a really interesting idea which should be given a bit of fresh air. This is a regular session on making and testing modems, acoustic couplers and other communications devices and, when the products of such labours have been thoroughly tested, linking up with other CTs. This is very much a future proposal and not one that is just about to come to fruition. Who knows — perhaps there’ll be a CTUK! bulletin board in operation one of these days. Any volunteers?

Anyone in Worcester wanting to contact Clive and hear more about his 'Town can reach him on Worcester (0905) 28985 or write to him at the Tandy Store, 8 St Nicholas Street, Worcester.

Pam Pollicott of ComputerTown Ruislip recently appeared in print. She’s assistant librarian at Ruislip Library and she wrote about Ruislip’s ComputerDay and about local ‘Towns in general in the Service Point, the journal of the branch and mobile libraries group of the Library Association (phew!).

That’s good publicity for CTUK! on the library front because the day was a great success and this is self-evident in what Pam says: "With winter closing in and our library appearing like an isolated island, a ComputerDay is a fitting celebration of something which is helping to make the library a place where people want to come. And, if people are coming to see what’s there, they’ll probably find a friendly face and perhaps a school after hours. The aim is to make computers enjoyable and non-threatening and, because Computer Towns might be found anywhere — in a church hall, a library or perhaps a school after hours. The aim is to make computers enjoyable and non-threatening and, because Computer Town is entirely non-commercial, overt axe-grinding of any sort is banned. Guidelines are available for those interested in setting up their own 'Towns: Write to CTUK!, 7 Collins Drive, Eastcote, Middlesex HA4 9EL or 17 St George’s Road, London NW11 0LU. Remember to enclose an A4 SAE for your reply. Please don’t telephone PCW for information as CTUK! is entirely a spare-time activity.

The hunt is over and our man has been found. Congratulations to Stan Higgins from Malvern in Worcestershire who was the first person to ring in with the correct answer. Despite our mammoth efforts to ensure that all copies of the December issue arrived at the same time, some subscription copies slipped the net and arrived early. So we have decided to run a compensatory competition for all those of you who rang in and left the correct answer on the Ansaphone before Friday 26 November. Details of this will be sent to you by post shortly. And for all of you who want to know, here are the correct answers:-

**Puzzle 1 (September)**: 66266 and 8

**Puzzle 2 (October)**: 358926471 and 2

**Puzzle 3 (November)**: 44744 and 7

N (Nineteen digit number): 66266358926471414744
N°: 2909090844869903112884951885
0594873447749210782707676382784
The three single digit answers appear in N° where underlined. Reading to the left from that place, the next 35 digits form the key to the cipher. Decrypt by writing the alphabet, space, and the digits 0 to 9 in a circle. Each digit of the key is an anticlockwise displacement of the cipher digit. This gives the plain text-

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INVASION LAUNCHED IN TOKYO

Peter Rodwell reports on the new products at this year's Tokyo Data Show.

Expectations that the Japanese would do with computers what they've already done with motorcycles, cameras, hi-fi's and watches have been rife for several years. The fact that, so far, we haven't seen our micro industry going the way our motor-cycle and hi-fi industries went has encouraged not a little complacency in some quarters: many people seem to think there's something different about computers which will prevent the Japanese from flooding us with shiploads of low-cost micros.

Meanwhile, oblivious to this difference, the Japanese are mass-producing computers on nearly the same scale as they do audio equipment, TVs, etc, and are preparing to flood us with shiploads (or, more probably, plane loads) of them. October's Tokyo Data Show — roughly the Japanese equivalent of Compec in content but larger — gave a good preview of the latest Japanese machines, most of which are already selling well in Japan and many of which will be reaching our shores over the next few months (in fact one or two have already been seen in Europe).

The outstanding trend at the show was for 16-bit micros, most of them at least software-compatible with the IBM Personal Computer and some hardware-compatible as well. The 'mainstream' trend was for 8088 and 8086-based machines, typically with at least 128K of RAM, good quality keyboard and medium-to-high resolution graphics displays.

Although, in a certain sense, the new wave of Japanese machines are much of a sameness and scarcely innovative, two features about them all struck me as particularly interesting: as we have long since grown to expect from Japanese products, they are all superbly made, with minute attention to detail and rigorous quality control, and they nearly all retail in Japan at prices which are typically between a half and two-thirds the price we expect to pay for such machines in Europe.

New 16-bit micros

Nearly all the well-known names launched 16-bit machines, with the notable exceptions of Sharp and Casio. NEC seemed to offer best value for money with its PC-9800, which starts at 298,000 yen, say £650. For this you get a system based on NEC's equivalent of the 8086 with 128 kbytes of RAM (expandable to 640 kbytes) and a bumper 96k of ROM containing N88-Basic and the system monitor. The display gives 25 lines of 80 characters in text mode and three pages of 640 x 400 dots or six pages or 640 x 200 dots monochrome graphics. Colour graphics are also available — 640 x 400 dots in eight colours. The PC-9800 runs both CP/M-86 and MS-DOS.

National (Matsushita) launched a micro — ludicrously named the Mybrain 3000 — which is very similar to the NEC in many respects: 640 x 400 dot resolution in eight colours, MS-DOS and CP/M-86, but 8088 instead of 8086. It comes with 96k of RAM as standard (expandable to 224k), 16k ROM and 32k of video RAM. The machine sells for 332,700 yen (£1100) for a monochrome display and a single 3½in, 160k disk to 865,700 (£1900) for the model with twin 8in 1.2Mb disks. I particularly liked the machine's keyboard, which felt good and is a rather sexy twin-tone job: white for the main keys, olive green for the control and function keys.

Definitely outside the mainstream is Chuo Electronics, which rather bravely opted for the Zilog Z8001 CPU and Unix as the basis for a pretty smart business system housed in an all-in-one box and with a 20 Mbyte hard disk as an optional extra.

Sord launched two interesting...
new systems. Well, actually, the M343 16-bitter wasn't totally new but was making its first big appearance in public. And very nice it is too, with full colour, high resolution graphics and 256k RAM (expandable to 768k) and twin floppy disks. However, it's certainly not cheap (by Japanese standards): 1,300,000 yen or about £2800.

Toshiba caused a big stir with the Pasopia 16 — a neat, 8088-based machine running MSDOS — version 1 was on show but version 2 is promised for production machines. The machine comes as a 'mainframe' box with two built-in double-sided, double-density disk drives and separate keyboard. The basic version comes with 192 kbytes of RAM, expandable to 512k. Basic video display is 80 x 25 lines of text using just 4k of video RAM but this, too, can be expanded to four pages of 640 x 500 dot graphics in 16 colours, using a massive 512 kbytes (yes, half a megabyte) of video RAM! The Pasopia starts at 398,000 yen (£870) and Toshiba is planning a 100,000-unit production run over the next three years.

8-bit micros

Although the 16-bit machines grabbed a lot of attention, the 8-bit world is by no means dead, the Tokyo show reassured me that my private conviction about the 16-bit world is by no means dead; it's grabbing a lot of attention, the 8-bit micros of video RAM! The Pasopia starts at 398,000 yen (£870) and Toshiba is planning a 100,000-unit production run over the next three years.

8-bit machines is true: there's a lot of useful software around for these machines and their performance is certainly adequate for many business applications. Thus there's still a place for them and what's happening is that — as I suspected — we're either getting more for our money, or paying less or, in some cases, both.

Take, for example, Sharp's new MZ-3500. It's a smart-looking beast which departs from Sharp's usual all-in-one configuration by coming in the 'standard' (for everyone else, nearly) three-box layout: keyboard, screen and 'mainframe' housing the disks and electronics. Inside are two Z80s (one for processing, one for I/O) plus a separate dedicated processor for the keyboard. The entry level machine has 64k of RAM, internally expandable to 128k and there's provision for taking this to 256k with an external add-on. Its display system seems a typical piece of Sharp complexity (or ingenuity?): three kbytes of character video RAM, 2k for kanji (Chinese) characters and 96k of graphics RAM. And there's more: the machine has provision for up to 32 kbytes of program ROM (presumably a Basic interpreter and some sort of operating system) and an incredible megabyte of kanji generator ROM, which probably won't be in much demand if/when the machine goes on sale here! How those poor little Z80s cope with all this, heaven knows, but the graphics demo at the show looked acceptably quick and slick. Starting price in Japan is 320,000 yen, say £700.

Sharp also showed its MZ-2000, a very similar machine to the MZ-80B in specification and selling for 218,000 yen (£470). And the company also introduced its PC-1251, a tiny hand-held machine with Basic, very similar to the PC-1211 but considerably smaller — doubtless Dick 'Hand-held' Pountain will be telling you more about this in the next month or so.

The Sharp machine which I liked best was the MZ-700, a small home-hobby machine with 64k of RAM and a 280, with colour TV output and sound, and software-compatible with the MZ-80K/A machines. You can upgrade the machine to a larger version of the incredibly neat four-colour plotter used in the PC-1500 and add a tape recorder as well. Both of these slot into the main unit and the result is a very useful, neat little system indeed. Japanese prices are £170 for the basic unit and £279 with plotter and recorder.

Epson launched its HX-20 portable (see Benchtest in last month's PCW) and a range of peripherals which included a rather nice acoustic coupler, a 5¼in disk drive and a TV interface. Epson was also doing interesting things with its range of printers — but see the 'Peripherals' section below. In addition, Epson showed a very neat 8-bit desk-top machine which can interface to an HX-20 for up- and down-loading and generally communicating. We should be seeing this machine in Britain sometime in '83.

Back on the Sord stand, a 12-deep crowd was jammed around a couple of tables showing the Sord M5, a tiny games machine in the Sinclair Spectrum mould (although Sord prefers to describe it as being suitable for 'studies, household accounts, playing intellectual games and for data processing and correspondence'). This all strikes me as a little ambitious but it's a very nice machine with excellent colour graphics (including sprites on 16 planes) and a good range of peripherals including 'joypads' (actually sort of flattened games paddles). Inside you get a rather
TOKYO

measly 4k of user RAM, 8k of ROM and a handy 16k of video RAM. Software mostly games, as far as I could see — comes in the form of plug-in 16k ROM cartridges and, apart from the joyruds, you can interface the M5 to printers and to other Sord machines. The basic price of the M5 in Japan is £105, which places it a little awkwardly in the market in Europe: its graphics are far superior to the Spectrum but the latter — on paper at least — still looks better value for money, allowing for the fact that the Sord will probably sell for around £150 or so in this country.

NEC and Toshiba both came up with hand-held machines, of which the NEC looked the better buy, with a nicer keyboard and an LCD display of two lines of 40 characters, both upper and lower case. It has 20k of ROM, expandable to 32k externally, and 8k of RAM, externally expandable to 16k. Best news is that it’s software-compatible with NEC’s PC-8011 desk-top micro, but it’s not cheap at £130. The Toshiba hand-held has a single-line display of only 24 characters and, it seemed, was less powerful and versatile than the NEC while selling at almost the same price — £120.

Finally in this section, there’s Casio’s 8-bit desk top machine, on which I have virtually no information other than it seems to run CP/M and I found it on sale in Tokyo computer shops for £600 or so for the basic unit.

Peripherals

Epson proved that printers can be as exciting as computers by showing an ink-jet printer with a very high quality printout indeed. Not exhibited at the show, but demonstrated privately at Epson’s headquarters, was a four-colour ink-jet printer with a really impressive output, unfortunately, Epson still has a few problems to iron out (mainly with the jets getting clogged with ink, the universal problem with these printers) and nobody was able to say when the machine would be on sale or how much it would cost. Nothing to do with computers (yet) but at the same time I got to see Seiko’s wristwatch TV, which uses an LCD display just over an inch diagonally. Actually, ‘wristwatch TV’ is a slight misnomer as the tuner and batteries are housed in a separate unit, about the size and shape of a Sony Walkman, and you run a wire down your sleeve to plug into the watch. Yes, it does function as a watch too, using a smaller display above the screen. The picture quality wasn’t too good and the Seiko people reckoned that, although they will be marketing it in Japan this Christmas for about £250, a better version should be on its way next year.

Epson did, however, show its four-colour dot matrix printer, an MX100-sized device which, while being very good, wasn’t quite the same as the ink-jet machine. Over on Canon stand, they were into lasers in a big way and had several ‘desk-top’ laser printers eating up paper at a frightening speed. ’Desk-top’ here seemed to mean ‘the same size as a desk top’ rather than something you’d actually stick on your desk and still have room to eat your sandwiches. The smallest laser printer was about the size of a medium-sized photocopier, in fact.

Elsewhere, we had a plethora of disk drives — hard and floppy, including the Hitachi micro floppy but excluding the Sony variety; oddly, Sony had only a medium-sized stand devoted exclusively to Tektronix graphics displays but not even a hint of a micro to be seen.

There were several companies exhibiting video disks as high-density, low-cost-per-bit computer storage media. The fact that you can’t erase and overwrite them was regarded as important by many of the technical people manning these stands: if a single disk can hold two gigabytes or so and costs a fraction of the price of a hard disk pack, so the theory goes, you will just afford to keep on writing stuff to it instead of overwriting. If the disk ever does fill up (and it takes a lot of typing to fill two gigabytes) then you just transfer the latest copy of your data to a new disk and throw the old one away.

Pricing

In general, computers in Japan seem to retail at between 50 and 100 per cent of British prices. (But so do cars and hi-fis and lots of other things except — annoyingly — cameras.) I should stress that the prices I’ve quoted here are Japanese retail prices and if and when these machines appear here, they’ll be some what more expensive — but not much. Most people at the show were talking about a 30 to 50 percent price markup on Japanese retail prices, and most seemed certain that by mid-1983 Europe would be receiving its first of the assault from the Japanese micro makers, spearheaded by 16-bit desktop machines of slightly better than IBM PC spec selling at under £2000.

How much under depends on several factors, including the quantity being shipped here and how much the importers/distributors think they can slap on to retail. In general, with the shining example of the British micro invasion has passed; the British company exhibited in Tokyo, but they are either good or bad, and if and when these machines are Japanese retail prices, and most seemed certain that by mid-1983 Europe would be receiving its first of the assault from the Japanese micro makers, spearheaded by 16-bit desktop machines of slightly better than IBM PC spec selling at under £2000.

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Recently I had to return a mains filter to the suppliers (Display Electronics) because it was not what was expected, although it may have matched the ad.

After 14 weeks' delay, four phone calls and various excuses, I received a credit note, the first admission of the safety-retumed item, which showed that, as expected, I had paid postage both ways but also approximately 10 percent 'handling charge'. As the 14 weeks delay convinced me I would not buy there again, I succeeded in obtaining a cash refund.

Unusually one other occasion have I needed to return goods — to Lasky's and they returned my money full, including postage to Lasky's and they returned my item, which showed that, for the purpose for which it has been acknowledged of the safety of the item, I feel the 'handling charge' is a liberty. Is it common practice?

W. George, Harlow, Essex

The Sale of Goods Act states that if an article is not suitable for the purpose for which it has been sold, the buyer is entitled to a full refund — not a credit note, not a partial refund with 'handling charges' deducted, but a full refund.

However, there are limitations to this. If the equipment you received matched what was advertised, then I fear you are at fault for ordering something which wasn't what you required; caveat emptor still applies in these cases and Display Electronics would then have been under no obligation to give you a refund. In this case, the deduction of a 'handling charge', for dealing with your mistake is reasonable — after all, they have to pay somebody to do the paperwork. Taking 14 weeks to respond is not good enough but is, unfortunately, par for the course.

On a general note, the micro industry as a whole seems to consider itself magically exempt from the Sale of Goods Act. I experienced this a couple of years ago when a large supplier sold me some faulty equipment. Getting my money back cost me £90 in solicitor's bills and the cheque only arrived on the day before we were due in court. If you do buy goods which don't perform as advertised, you are covered by the Sale of Goods Act. It doesn't matter whether you're buying by mail order or over the counter and the 'as advertised' bit includes what the salesman tells you verbally (although he can always deny having said that, so get it in writing if a lot of money is involved). But always read adverts very carefully and check that you're certain that the advertised goods are exactly what you want before you send off your money. — Ed.

Quick Beeb

I have just received my BBC Computer, When I Model B in three weeks and five days. Is this a record?

D.A.P. Mitchell, Northolt, Middx

No — it's a computer. — Ed.

Cheap C

I was interested to read in November's 'Braindump' references to the C programming language. Yes it is a nice language but compilers do not start at £400! True, a complete implementation of C under Unix will cost around that figure but there are a number of versions (with some of the more esoteric features missing, admittedly) available for much less. I have a BD Software C compiler (available from Lifeboat) which cost £60. The main omission from this is that floating point is not directly implemented, although there is a package of routines which goes some way to alleviating the problem. Otherwise, it's a lovely piece of software.

Robin Jones, Folkestone, Kent

Beeb characters

I read with interest Mr Whitworth's letter (October PCW) on my character generator for the BBC Computer (July PCW) and I would like to thank him for his criticism.

Three weeks after my friend received his Model A in February we both saw the usefulness of a character generator. The program was written in the first week of ownership and at the time there was only the Provisional Guide to refer to (as far as I know).

In answer to the question about the use of Mode 6, it was the only mode in which we could display the characters defined and fit the program in on a Model A. I didn't use the cursor keys for the simple reason that the Provisional Guide didn't tell me how to and it was rather low on my priorities (getting it working was my main priority). The COLOUR query is simple to answer: I wasn't sure of the use of COLOUR at the time and, looking back, I don't know why I did that either!

After seeing the program printed out on paper I must say that I'm not too impressed with its general structure and can think of various improvements (using *SPOOL for saving the characters, for instance).

Finally, my thanks to Mr Whitworth and Mr Clayton ("IT's Workshop' October PCW).

Apologies to all those who typed it in and were screaming 'inefficient idiot' while doing so.

Mark Howlett, Braintree, Essex

Book bood

The recent article on Ada by Mike Parr contained a serious omission.

In the list of books recommended as further reading be omitted the bestseller on the subject — Programming in Ada by John Barnes, published by Addison-Wesley at £9.95. Would you kindly bring this fact to the attention of your readers?

Peter Hoenigsberg, University Director, Addison-Wesley Publishers Ltd.

Pressure group

In his article, "Expanda-Beeb" Paul Beverley referred to the use of the promised "second processor" with the BBC Micro. He said, "... Acorn suggests there will be capacity for 60K RAM on both the 6502 and the Z80 board.'

I regret to inform you that he was, at best, misinformed and at worst misled. I am informed by Acorn that the 6502 second processor will have less than 30K of user-RAM as it will have to cross-load both the MOS and the language ROMs. I understand that the position will be slightly better for the Z80 board as it will have an on-board interpreter.

I have not been able to get a straight answer to the question of how user-RAM is affected by additional language ROMs in the host processor. You may be able to fare better.

Personally, I am sick of the reluctance of Acorn to face up to its responsibilities, particularly as regards the OS 0,1 MOS ROM that is fitted to my machine. Had I known that I would be expected to pay extra for a machine that performs in accordance with its published specification, I would have been extremely wary. Had I known that the machine would not be expandable in the manner publicised, I would definitely have not purchased. May I suggest that other users who feel similarly contact me with a view to some concerted effort to change Acorn's attitude.

Richard Bean, 81 Hilmy Green, Linslade, Leighton Buzzard, Beds LU7 7QA

Info source

I would like to bring to the attention of your readers an organisation which could be of value to many of them.

I was recently involved in an attempt to attract financial support for some ideas which I felt to be of commercial value, and which proved to be somewhat frustrating experience. Over the years I have often felt the need for a central information service which is able to match the needs of inventors, industry and finance, and during my investigations I found that such a system does actually exist. It is a fairly new company, but it is already showing signs of its potential, and I think it is deserving of our support.

Its computerised network matches ideas, skills, resources and financial support in such a way that it is able to cater for a variety of different needs, whether an amateur inventor, a large manufacturer or an investor looking for wider areas of commerce. I believe it to be an impressive use of computer data systems which I whole-heartedly endorse.

Membership fees are extremely reasonable, and I would suggest...
COMMUNICATIONS

that anyone who is interested in putting ideas into action get in touch with them as I did. They are extremely helpful about sending information about their service to anyone who contacts them.

The company is IREX, Snow House, 103 Southwark Street, London SE1 0JF. The telephone number is 01-633 0424. Michael Harris, London E2

Tapebox tip

A quick tip for owners of Sinclair Spectrum machines.

Being small and relatively flat I find there is a tendency to stack things on top of it. I’m not certain that this is entirely a good thing so I started looking for a suitable case.

My eyes lit on a Sony U-Matic cassette case of the square, ‘opens-like-a-book’ variety. Provided that you install the Spectr-um with the back of the machine towards the inside of the box, the machine fits like a glove. You now have a neat rectangular container that will stack flat or will fit in a book case if needed.

I realise that not many people will have access to such cases but it is more than likely that some of the specialist audio-visual aids people or even your local video shop may be able to provide an empty library case at a reasonable cost.

For those who don’t know, the U-Matic is a sort of higher quality cassette case. The tape compartment has an amazing list of add-on facilities which are not actively being supported. Where are the colour programmes for the new colour board? Where are the disk programs? Where are the programs that take advantage of the huge add-on memory that is available? Why, for example, are there more home computer manufacturers that software to be sold with these pro-ducts? A few duplicated sheets of suitable routines is not good enough.

I realise that the original surge in software sales is no longer there but I would have thought that steady sales would continue especially if stimulated with new software. Presumably the thou-sands of Atom machines are still out there. I have not seen any good software for home computers. This may apply to other machines such as the Sharp MZ280K, Nascom, ZX80, ZX81 and others.

I hope that if you pulpish this letter it will encourage some re-sponse from the software houses if only in defence. If the software industry is to be a success, then support of new machines I see that this young industry will be badly damaged when computer owners in general realise that they will be continually under pressure to buy a new machine. Imagine the situation in the hi-fi market if all new records could only be played on new equipment straight from the factory.

John Ferguson, Chelmsford, Essex

P for Pathetic?

I was interested to read the Benchmark article ‘The Ultimate Test’ in the January [PCW]. It confirms my view that ‘P is anything but Perfect’ due to its being excruciatingly slow. I use a UK-produced Pascal compiler called PRO Pascal written by Prospero Software which just beats the best of the compilers (of any language on an 8-bit machine) listed in the original Byte article. The 10 itera-tions time on a 4MHz Z80 system for the standard Pascal version of the published benchmark was just less than the 14 seconds of the Byte best. Using non-standard fea-tures the time is 121.7 seconds. This is more than 20 times as fast as the UCSD p-code version run-ning on a similar machine accord-ing to Byte while the such as Times version is nearly 20 times faster than the version using only stan-dard Pascal cited in the PCW article.

The faults with p-code are shared nearly equally between the compilation and the interpretation of it on the host machine as can be seen by considering the times given in the original article for the Pascal Microgine which has p-code as its machine code. It is 4.5 times as slow as the best (5-bit machine) listed even though it is nominally a 16-bit machine. This indicates that the compilation to p-code itself is a source of inefficiency as no interpretation is involved in this case.

I accept that the UCSD oper-at-ing system is a pleasure to use but heaven preserve us from their compilers. It appears not common that the portability provided by p-code is dearly bought and the only beneficiaries are Softech.

One further point may be gained from the original article in that it provides a time for Z80 assembly language implementation of the benchmark which is only 1.7 times as fast as the PRO Pas-cal indicating that there is little room for further improvement with the Z80.

Timings for PRO Pascal were obtained on two Apple systems and they were confirmed by Pros-pero Software (with whom I have no other relationship that that of a well pleased customer) on a 4MHz system. The first used a Microsoft Softcard. (The Z80 runs at 2.041 MHz with this card) and an Axlon Ramdisk. The Axlon was configured as a single 32Kb drive allowing an automatic compile and link for the PRO-Pascal sys-tem. Drive time is negligible with this arrangement.

The second used an Appli-Card with the Z80 running at 6MHz which of course gave me times half as fast again which I scaled down for comparisons. As I am not yet able to link the Appli-Card system to the Axlon due to all too typical manual problems, I used Apple drives. It appears to me that a moderately enhanced Apple II and a good compiler of standard Pascal (probably with the addition of an overlaying lin-ker) provides a setup that is hard to beat.

John Crookes, Univ of Lancaster, Lancaster

Cheaper clock

I read with interest your article ‘Clock it to me’; October/November 1982 but then I looked at the price of £36 just for the parts minus battery. I take it, therefore, that Bruce Marriott is not aware of the clock-calender card for the Apple II (soon to be released for the BBC) it is rumoured made by Namal Associates in Cambridge.

The card uses the now well established MC 146818 from Motorola. The card was briefly men-tioned by Mr Marriott which is second sourced by Hitachi and has the following features:

1) Day light savings, eg, it automatically corrects for British Summer Time.
2) Alarm function which will cause an interruption to the CPU when an alarm time occurs.
3) Has a full year counter to 99 years.
4) Can work in BCD or Binary.
5) Has a square wave output which can be used as a very accurate programmable function generator.
6) Has 12 or 24 hour format.

This board sells for around the £70 mark which is much less than the £149 quoted by Mr Marriott for the standard Apple board. The Namal board also contains a bat-tery as standard and a £4 (2732) operating system on the card! A kit of parts (although not sold yet) has been quoted at being around the £40 mark, which makes Mr Marriott’s £36 look a bit expensive.

Mr Marriott also said that the M550532 is rather difficult to get hold of. For the interests of the experimenter, the 146818 is readily available from: Namal Components, Radio Resistor (part of the electrocomponents group, ever heard of RS?) and the Hitachi version is available from Impulse Electronics and probably ITT Meridian.

May I also take this oppor-tunity to draw to your attention the clock calendar board using the 51714 which is sold by Com-putech Systems for £80. I agree with Mr Marriott about this chip and this makes the Computech board very suspect.

Never mind, maybe Mr Marriott’s article was a long time getting to print and the prices have dropped since it was written.

For further information, contact the following:

Radio Resistor Co, St Martin’s Way, Letchfield Estate, Cambridge Road, Bedford.
Impulse Electronics Ltd, Crousdale House, Caterham, Surrey.
ITT Meridian, West Road, Harlow, Essex.
DN Anderson, Cambridge.

PCW 111
Dick Olney investigates games for the ZX Spectrum

When David Tebbutt Benchtested the ZX Spectrum in June 1982 he proclaimed it the best value for money around and, despite the flurry of price drops in home computers over the past few months, there’s no doubt that this low-cost colour computer still deserves that title. Like the ZX81 the Spectrum is not particularly impressive to look at, being only slightly bigger than its predecessor but offering a more substantial button keyboard. Since no joysticks are currently available, this keyboard is used for all the games, and works quite well despite the rubbery texture.

I used a 48k machine which (as I’m sure nearly everybody in the western world is aware!) costs £175 including VAT. Many of the games will run on a 16k machine (£125 if you didn’t know) so I’ve marked those that need the full 48k. I’ve covered a wide selection of software including some of Sinclair’s own label Psion and ICL games. As yet there is not much of a selection of games around for the machine, with a sizeable portion of it being old favourites. The Spectrum itself impressed me, although few of the games I saw seemed to make very good use of the facilities it offers. To be fair I may have jumped the gun, and I will be interested to see if enough good games software becomes available to make it worth giving this machine a second look. I do know that Psion is planning a flight simulator and a sequel to Hungry Horace (see review), both of which should be available by the time you read this, but unfortunately neither were ready for review at the time of writing.

Sinclair label games are available on mail order through the usual channels and Quicksilva and Bug-Byte games are on general sale. Simon Hessel Software can be found at 15 Lytham Court, Cardwell Crescent, Sunninghill, Berks, and Impact Software at 70 Redford Avenue, Edinburgh.

Games 1: Hungry Horace
Supplier: Sinclair - Psion
Price: £5.95

Question — when is a Pacman derivative not a Pacman rip-off? Answer — when it’s Hungry Horace. Yes folks, with a stroke of genius Psion has managed to produce a game which should satisfy the most painful Pacman craving, yet march proudly and ‘I’ and ‘Z’ keys for up/down, ‘7’ and ‘9’ keys for left/right. This arrangement works very well, making the game a joy to play.

The park is divided into four sections, each of which consists of a ‘maze’ of paths, bridges and tunnels. In each section there is a one-way gate to the next frame through which you can move at any time. Horace is chased by between one and three park keepers, who will throw him out of the park if they catch him (quite right too!). Occasionally one of them will drop his lunch of a cherry or a strawberry, which Horace may eat to supplement his flower gobbling. If he is caught three times the game ends.

To help Hungry Horace on his campaign of destruction there is one alarm bell situated in each section of the park. When this is rung the park keepers panic (their hair stands on end) and Horace can throw them out of the park, though only for a few seconds. The game, of course, gets progressively harder (though not faster) mainly due to an increased awareness of Hungry Horace’s presence among the keepers. Indeed, because of the layout, in some places it can get almost impossible to continue since the keepers make an immediate beeline for you, which is very frustrating.

This game is destined to be a big success among Spectrum users of all ages. The graphics are excellent, and there are some interesting, if rather limited, sound effects. The noise when Horace gets caught could, with a lot of imagination, sound like a gruff ‘get out of here!’ shouted by an angry export officer amongst the keepers. Indeed, because of the layout, in some places it can get almost impossible to continue since the keepers make an immediate beeline for you, which is very frustrating.

Games 2: Martian Knock Out
Supplier: Sinclair - ICL
Price: £4.95

What on earth do these people think they are doing? It was understandable when games were in their infancy for Sinclair to produce their trivial games packages for the ZX81, whose potential in this respect was limited, anyway, but now that they have a full colour graphics 16k machine such behaviour is inexcusable. Each tape contains a selection of very poor programs, any of which should put the new user off video games for life. Let me explain.

Games 1 starts with ‘Martian Knock Out’. You are presented with a huddle of green lines and circles in the top right hand corner representing the Martian fleet, and a simple ‘missile launcher’ which moves around the bottom left. The idea is to key in the velocity of your missile (a number between 10 and 60) so that it will hit the maximum number of enemy spacecraft. After each launch the program re-positions your base whilst the attacking fleet remain static. A game consists of 15 missiles.

Second on the agenda is ‘Racetrack’. The track is marked by a multi-coloured boundary which uses standard Sinclair graphics symbols. It races up the screen (there are nine speeds to choose from) while, using the ‘5’ and ‘8’ keys, you attempt to steer a little car through it — the car incidentally is not the same horizontal level. This is a fairly standard idea, and would be quite fun to play except the moving track soon starts to hurt the eyes and make them water.

The third game on Games 1 is called ‘Labyrinth’ and is a simple maze game. Using the cursor keys you move an ‘o’ into a maze inhabited by three astersisks (which move across the entrances) with a view to reaching the dollar sign in the centre without being caught. You have a limited number of moves determined by your ‘water supply’. The astersisk guards only move when you do and if you patrol a predefined corridor. This is probably the best game on the tape, but it is hardly mind-boggling.

The fourth and final game on this tape is ‘Skittles’. The bowling lane appears at the top of the screen with a square (!) block of thirty skittles on the left and your ball (the square) on the right. You position the ball vertically using the ‘5’ and ‘8’ cursor keys and bowl it with ‘0’. Not the most stimulating of tasks I think you’ll agree.

The tapes continue in this vein. Pastimes 2 has a reasonable ‘Mastermind’ program called ‘Secret Code’, in which the player can allow the computer between four and eight valid numbers; a strange game called ‘Mindboggling’, which presents you with 16 random letters with the idea that players compete to see who can make the maximum words; a version of the well known cub scout game ‘Kim’ in which 20 random characters are displayed, one is removed when ‘Enter’ is pressed, and you must guess which one it was; and, finally, a magic square program which acts just like the fairground novelties except that you decide the final pattern.
Games 3 and 4 contain much the same sort of stuff as Games 1, so don't be misled by names like 'Journey into Danger' and 'Escape from Jupiter'. None of these tapes even gives a taste of the Spectrum's capabilities, though you can list them, which might be a useful exercise to help you understand some fundamental programming techniques (why not just list them in the Basic manual or use them as part of a teaching course?). This sort of thing only encourages those Philistines who see home computers as a passing fad with no real usefulness or lasting qualities. Using a machine like the Spectrum for such programs is like warming your feet with a nuclear reactor – both Sinclair and ICL should be ashamed of themselves.

As versions of Startrek go, this one can best be described as barely adequate. The presentation is entirely standard with no extra sophistications and none of the interjected comments from Mr. Spock or Scotty that experienced Trekkers have come to expect. No use is made of the Spectrum's graphics or colour facilities any the more than the original Startrek, and for Spectrum owners unfamiliar with the game it could well prove to be a good buy.

In one of the rooms you'll come across a trader, from whom you can purchase any number of weapons, elixirs or spells – depending on your current wealth. It is essential to find this room, since many of the monsters can only be killed by weapons available exclusively from the trader. There are some other interesting rooms, but on the whole the game involves searching as much of the maze as possible, collecting useful artefacts and avoiding monsters (unless well-armed) with too few clues as to the whereabouts of the elusive Grail. Unlike many adventures this one reconfigures the room on each run, which means its attraction may prove more lasting. On the other hand, the massive size of the maze cannot disguise the lack of complexity. Certainly you'll need to learn which weapons are effective on the various monsters, but on the whole the thrill is in the way of real brain teasers. You could almost certainly get your fiver's worth out of this game, but I'm sure that most experienced adventurers would find it a little dull.

This must be one of the most extensive and complex management games I've seen, with two discrete sections, both of which would take a lot of time and effort to master. In the first section you must prove your financial acumen by turning £10,000 into £100,000 in 26 turns (weeks) and thus become the beneficiary of Great Uncle Arbuthnott's inheritance. Each turn comprises three sections. First you can invest in the stock market by buying shares in any of six major industries, for which current prices are displayed. Next you may make a similar investment in the metal market, and again there are six choices. When these two sections have been completed all stock and metal prices are updated with an analysis of your gains and losses.

Your turn culminates in an opportunity to gamble on the horses or at blackjack. The horse race includes five horses, and you are allowed to back any number of them. Sometimes the odds will make it worthwhile backing four of the horses and thus be almost certain to come out winning, but if you win too much it will be stolen by your dishonest cousins. The race itself is run before your eyes and in one of several simple graphics frames in the game. The blackjack (pontoon) is less interesting than the races, and the program rarely churns out a winner, making it easy to lose a lot of money, although you do
only get the chance to play one hand. I’m assured that experienced players find this first part easy, but I failed to get the hang of it even when provided with a few handy hints. The whole thing seems interminably slow, and with your capital—though easy to lose—making only small increases each turn. If, however, you do manage to make the hundred grand (or find the right statement to GOTO) you’ll receive the inheritance, which turns out to be a soft drinks factory.

Having found the secret formula (a simple task involving only patience) you set off to the Bango Island to buy Bango fruits—more graphics—and you must negotiate the cheapest price for this vital ingredient. This concluded, you set about managing the factory in an attempt to make your million.

Running the soft drinks factory involves three main decisions—the weekly production, number of advertising entries placed and the selling price of your product. To help you with this you are given a market forecast at the beginning of each turn. This should enable you to build up stock for an excellent market forecast, then advertise extensively and hence sell all your stock at maximum price. As your capital builds up you may be hit by strikes, frauds and advertising rate increases, and you will eventually be given the chance to extend the factory for greater production capability.

The second part of the game is faster moving than the first, but will still often involve long waits for 'excellent' weeks to come along before you seem to make much headway. The game is well presented throughout with a colourful menu format.

There is no doubt that this is a must for management game enthusiasts with plenty of patience, but less determined players may find their interest waning after a short time. If you do like this sort of thing and need something to while away the cold winter nights this is one of the best games in terms of value for money that you’ll find.

Presentation: Complexity: Addictive quality: Value for money:

Game: Great Britain Limited (48k only) Supplier: Simon Hessel Software Price: £5.95

I’m assured that the 16k ZX81 version of this is number 10 in the ZX software library Top 20 (out of 200 titles). It’s a colourful and sophisticated management game that gives you the chance to play at being Prime Minister of our sceptred isle. The idea, of course, is to stay in power for as long as possible, which means ending each five-year term in as popular a state as possible among your decidedly fickle electorate.

To start the game you key in your name (or any other suitable title) and then choose which party you represent—Labour, Conservative, Liberal or Social Democrat. This is not a decision to be taken lightly—I found for instance that a Labour government always started on a much worse footing than the rest, particularly Tory. When the preliminaries have been completed you are presented with a rundown of the current state of affairs.

Although Simon Hessel does stress that this is a game and not a simulation, plenty of variables are taken into consideration—flation and unemployment being the key elements. Each year begins with these two factors being updated along with the exchange rate, your popularity rating and the balance of the national account; their movement depending on your performance in the previous year. There are three ways in which you can control these figures.

Firstly you must set the levels of income tax, corporation tax and VAT, and also of excise duties on tobacco, alcohol and petrol. These will not only determine your total income at the end of the year, but will also have significant effects on unemployment, inflation, and your popularity rating.

Next you must set the levels of social benefits, including child allowance, pensions and unemployment benefits. The populace are particularly sensitive to any of these, especially pensions falling behind inflation, so great care must be taken.

The game is not entirely unlike a type of computer pinball, except that instead of a ball bouncing around the screen there is ‘Sid the silly space invader’. You use the ‘n’ and ‘m’ keys to place a ‘/’ or ‘\’ in front of Sid and hence change his direction by 90 degrees. These deflectors flip over when Sid hits them so that a ‘\’ turns into a ‘/’ and vice versa. The idea, therefore, is to control Sid’s movement so as to bounce him onto a prescribed target, while avoiding the various obstructions placed in his path.

There are nine levels of play, with an increasing number of hazards. Black boxes are merely barriers which Sid bounces off harmlessly, whilst red boxes represent deadly land mines. At the higher levels bunches of coloured deflectors appear, behaving just like those which you place yourself, and these serve to add to the general confusion. The most lethal hazard pitted against you is the laser beam. This fires between two tiny markers at the top and bottom of the screen (the markers are set up afresh just before each blast) and will disintegrate Sid if it hits him. Finally the most difficult frames includes ‘Grud the Droid’ who races Sid to the target. If he reaches it first, or if Sid bounces into him, a life is lost.

Each game consists of four lives, and you are given the choice of which level to start on. To complete a level you must hit ten targets (they only appear once at a time) and the layout remains the same except for the position of these targets. If you place too many deflectors it can become almost impossible to control Sid, and for this reason placing deflectors without hitting a target invokes one of the most endearing features of the game; a giant llama strolls across the screen, clearing it completely, and the game is then reset as if you had just begun that level.

Although this is probably one of the most original arcade type games I’ve seen on the Spectrum, the limited controls and tediously slow action (it is after all in ZX Basic) make it rather difficult. Nevertheless, good value for money and a refreshing change from the endless Invaders-Asteroids-Pacman derivatives.

Presentation: Use of graphics: Addictive quality: Value for money:

Game: Superdeflex (48k only) Supplier: Llamasoft Price: £4.95

The first of Jeff Minter’s offerings for the Spectrum (I’m assured that there are others on the way), Superdeflex starts its loading procedure with the warning that anybody making an illicit copy will be ‘hung, drawn and quartered’. His worries are not ungrounded, but unlike most of the other games I looked at, the ‘Break’ key is not disenabled during this program, making listing or copying the program a simple operation.

The idea, of course, is to stay in power for as long as possible, which means ending each five-year term in as popular a state as possible among your decidedly fickle electorate. To start the game you key in your name (or any other suitable title) and then choose which party you represent—Labour, Conservative, Liberal or Social Democrat. This is not a decision to be taken lightly—I found for instance that a Labour government always started on a much worse footing than the rest, particularly Tory. When the preliminaries have been completed you are presented with a rundown of the current state of affairs.

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Presentation: Use of graphics: Addictive quality: Value for money:
She needs ‘Superscript’!

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‘Superscript’ transforms your Commodore computer into a true Word Processor, enabling your secretary to turn out high quality letters, mailshots, quotations, etc., faster and easier than ever before.

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Superscript and Superspell run on the 2001, 3016/32, 4016/32, 8032 and 8096 Commodore computers, 2040, 3040, 4040 and 8050 disk drives, all Commodore printers and a wide range of letter quality printers.
This month sees the start of a regular new chess column. Tony Harrington kicks off with a look at the latest dedicated chess computer from SciSys.

THE NEW CHAMPIONS

This is the start of a regular monthly column on computer chess. I will be concentrating, at least for the first few months, on dedicated computers — the kind you can go into a games shop and buy for anything from £35 to £400 — and the companies that make them.

Computer chess is still new enough for a question like "Who is Fidelity?" (or SciSys, or Hegener and Glazer) — to name but three of the leading suppliers of dedicated chess computers — to need an answer. More importantly, computer chess, by its very nature, involves a fairly unique meeting point between the separate areas of business, computers and chess. So this question gives one an ideal way of tackling all three areas simultaneously.

This doesn't mean that the technical issues — like how you go about programming your own personal computer to play chess — will be entirely neglected. But for the first few months we'll be looking at what is around and how the machines available perform. Computer chess tournaments are becoming increasingly frequent and we'll be keeping an eye on the results of such competitions. There will also be a games section, where in future issues annotations will be done by international master David Levy.

Levy is well known in chess playing circles for his bet a decade ago that no computer would be produced for ten years that would be able to beat him. He was right, but he himself admits that the time is approaching when the gap between experienced players like himself and computers will close. As a founder and director of Intelligent Software which specialises in writing chess programs himself and a different programmer.)

SciSys is about to introduce a sensor-board machine in its range, but this machine has a different development history called its sensor-board machine in your hand. (SciSys, incidentally, has a sensor-board machine in its range, but this machine has a different development history called its sensor-board machine in your hand. (SciSys, incidentally, has a different development history called its sensor-board machine in your hand. (SciSys, incidentally, has a different development history called its sensor-board machine in your hand. (SciSys, incidentally, has a different development history called its sensor-board machine in your hand. (SciSys, incidentally, has a different development history called its sensor-board machine in your hand. (SciSys, incidentally, has a different development history called its sensor-board machine in your hand. (SciSys, incidentally, has a different development history called its sensor-board machine in your hand. 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However, the computer chess boom is now well under way. Many (which has its own office). Chess computers are now big business, and Page estimates that the UK office turnover this year is around two million dollars. I do not have anything to do except concentrate on the game as it unfolds on the board. As a teaching device, it is hard to beat. I've played dozens of games on it and it's a marvellous way of finding out where you or the computer lost the initiative, or went astray in the opening, middle-game or end-game. Another advantage of the LCD display is that it enables a range of comments and a two-player analysis to be displayed. (A ply, for the uninstructed, is a single move by one player.) What the analysis entails can be seen by looking at the demonstration game, where we play the Mark V against the Mark VI, and give the analyses provided by both after each move. For those who feel that all these advantages don't outweigh the disadvantage of not having a physical, solid chessboard to play on, SciSys is about to introduce a sensor-board which can be added to the Mark VI. It is not

1 e4 d5
2 Nc3 Nf6
3 Bb5 c6
4 Bd3 Bg4
5 Nf3 ... (Mk.5; b6d7, o-o +001)
   ... e5 (Mk.6; e4d5,c6d6 +001)
6 0-0 ... (Mk.5; b6d7,e4d5 +001)
   ... Nxd4 (Mk.5; c6d4,e5d4 +003)
7 Nxe4 ... (Mk.5; d5e4,d8e8 -000)
   ... dxe4 (Mk.6; d3e4,f7f5 +000)
8 Bxe4 ... (Mk.5; f7f5,e4d3 -012)
   ... f5 (Mk.6; e4d3,e5e4 +015)
9 Bxf5 ... (Mk.5; g4f4, f3e5 +011)
   ... BxB (Mk.6; f3e5,b6d7 +007)
10 Nxe5 ... (Mk.5; b6d7,d2d4 -011)
   ... Be7 (Mk.6; d1f3,g7g6 +010)
11 d4 ... (Mk.5; b6d7,e5c4 -011)
   ... 0-0 (Mk.6; f1e1,b8d8 +013)
12 Bc3 ... (Mk.5; b8d7,e5c4 -012)
   ... Nd7 (Mk.6; e5d7,b8d8 +010)

For many chess players the absence of a 'real' chess board is a disadvantage, not an advantage. They like the familiarity of board and pieces and the illusion that one is playing a "normal" game. I like the display, not least because I combine chess with TV watching and the LCD display means I don't have to worry about chess pieces falling off the board if it tilts out of kilter while my attention's on the screen rather than the game.

More seriously, the LCD display comes into its own if one considers the replay feature. Here again, the comparison is with sensor board machines. Many sensor board machines have a replay function, but it is fairly tedious and involves the player following an endless series of LEDs lighting up square after square, replaying the move sequences.

The LCD board on the other hand simply provides a movie-like rerun of the game. The player doesn't have anything to do except concentrate on the game as it unfolds on the board. As a teaching device, it is hard to beat. I've played dozens of games on it and it's a marvellous way of finding out where you or the computer lost the initiative, or went astray in the opening, middle-game or end-game.
13 Nc4 ... (Mk.5: d8c7, d1e2 -011)
... Oc7 (Mk.6: f1e1, a8e8 +011)
14 Od2 ... (Mk.5: a8e8, a1e1 -012)
... Be6 (Mk.6: d2c3, d8e8 +013)
15 Oa5 ... (Mk.5: c7a5, c4a5 -011)
... b6 (Mk.6: a5c3, a8e8 +010)
16 Oc3 ... (Mk.5: a8e8, c4d2 -012)
... Rf5 (Mk.6: f1e8, a8e8 +010)
17 h3 ... (Mk.5: a8f8, c4d2 -012)
... Ra8 (Mk.6: f1e1, d8e8 +013)
18 g4 ... (Mk.5: f5c4, c4d5 -011)
... Rf3! (Mk.6: g12g, e6d5 +018)
19 Ne5 ... (Mk.5: d7e5, d4e5 -012)
... Nxe5 (Mk.6: d4e5, f3h3 +016)
20 dxex5 ... (Mk.5: f3h3, f1e1 -021)
21 B4 ... (Mk.5: g8h8, c3d4 -016)
22 Rb1 ... (Mk.5: g12g, b4a4 +040)
23 Kf1 ... (Mk.5: g1f1, e6a2 +050)
25 Kd2 ... (Mk.5: g1f1, h3h1 +059)
24 Ke1 ... (Mk.5: h3h1, e1d2 -063)
... Rh1+ (Mk.6: e1d2, c7d7 +098)
26 Qd3 ... (Mk.5: c4d3, b1h1 -103)
27 Bxk (Mk.6: b1h1, d3e4 +087)
28 Ke2 ... (Mk.5: e4h1, a1h1 -103)
29 Rxk ... (Mk.6: a1h1, d7f5 +100)
30 Rd1 ... (Mk.5: e7b4, d1c2 -104)
... Kg2 (Mk.6: e6g1, f4e1 +010)
31 c3 ... (Mk.5: f5c2, d1d2 -112)
32 Rb6+ ... (Mk.6: b2d8, d1d8 -112)
33 R2d3 ... (Mk.6: d6g7, g8f7 +018)
... Bxh3 (Mk.5: d8f7, g8e7 +113)
34 Rd8 ... (Mk.5: c6d5, c8d8 -129)
... Ra4 (Mk.6: b2d8, e5c3 +132)
35 Rd2 ... (Mk.5: c6d5, f2c3 -129)
... Bc3 (Mk.6: d2d8, a4a2 +142)
36 Rd6 ... (Mk.5: a2a2, e2f1 -140)
... Rxh2 (Mk.6: e3d2, a2d2 +149)
37 Bd2 ... (Mk.5: c3d2, d6d2 -195)
... Bxh2 (Mk.6: d6d2, f5e4 +206)
38 Kf1 ... (Mk.5: f5h3, f1e2 -225)
... Bd4 (Mk.6: d6d7, f5d7 +223)
39 Rd7 ... (Mk.5: f7e6, d7d2 -236)
... 0Xr (Mk.6: f6g6, D&G +999)
40 Kg2 ... (Mk.5: f7e6, Forced Move)
... Qg4+ (Mk.6: Comment; Forced Move)
41 Kh1 ... (Mk.5: Comment; Forced Move)
... Qh3+ (Mk.6: Comment; forced Move in 1)
42 Kg1 ... (Mk.5: Comment; Forced Move)
... Ra1 Checkmate.
Robin Webster investigates the 'expert system', which offers advice plus an intelligible explanation of its decisions.

Normally, if you ask the question 'why' too many times you'll get a slap around the face - expert systems, though, are much more polite.

Whatever the field of expertise in which an expert system is supposed to operate, it can, on demand, provide the user with a justification of any conclusion it comes to.

It has to do with the following premise: human experts use sets of knowledge-based rules to solve problems — discover these rules, code them up in a form that can be understood by a computer, and you have a machine that can act as a consultant — or at least as an intelligent reference tool.

But whereas the human consultant cannot always explain why he/she made a particular decision, the expert system can be asked to explain itself in a form intelligible to humans. Generally, this will be achieved by having the system display or print out the selection of rules it used in making a particular decision. Sometimes it is also valuable to ask it for the rules it considered, but rejected, during a session.

The trend is to predict that one day there will be hand-held expert systems which can be used in the office or home to work out tax or accounting problems or to care for your car or houseplants.

Right now, that's not feasible — although there are some micro-expert systems running on machines such as the Sirius, IBM Personal Computer and the Sage II (the second part of this article will look at a couple of packages in detail).

Application areas can be large or small, trivial or dramatic.

On the large and dramatic side there is one US-developed system called Prospector, which is designed to be of use in geological exploration. Last year, Prospector came into the limelight because it made a prediction that stopped more than a few geologists in their tracks.

Prospector was given the same field study data about an area in Washington State as that used by experts employed by a mining company and came up with the conclusion that there were deposits of a metal ore called molybdenum over an extended region. The geologists disagreed and said the molybdenum was present in a much more restricted area.

Lenat wouldn't give full details of the Dart project for Stanford, 'What is the expected behaviour of the system and why is it expected?'

'To achieve this goal, we have a knowledge-base in which we write down assertions about the structure of the machine — very high level assertions such as what the CPU does. Once we have that design model built in, we make a set of rules that access it and take a fault as input.'

'If I ask a computer how it is expected to work I want to get an answer somewhat like the answer I would get from the designer of that system,' said Mike Genesereth, who is participating in the Dart project for Stanford.

Another implication of this work is that it becomes feasible to develop intelligent operating system interfaces, as Genesereth explains.

'We are finding that as computers become more and more complicated they become more difficult to use, so, apart from the Dart project, we are working on ways in which to proceed under the name Xmos to systems. The idea is to have what we are calling an "intelligent agent" in each machine, one that knows about its machine and how to achieve a user's goals.'

Heurisko is a fairly recent expert system developed by Doug Lenat, another Stanford man who regularly consults on expert systems for Rand and Xerox.

The system is based on an earlier expert system that I developed called AM,' he said. 'AM was designed to take fundamental mathematical ideas and go off by itself to see if it could discover new rules. It really worked quite well for a time, but it began to get interested in really trivial things and wouldn't let go — it essentially ran out of steam. With Heurisko I've made some changes so that this kind of thing can't happen.

'About six months ago Heurisko came up with a discovery that looked promising in terms of 3D chip design. Just as the fundamental device in 2D chips is the gate, which handles one function at a time, wouldn't let go — it essentially ran out of steam. With Heurisko I've made some changes so that this kind of thing can't happen.'

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in six months. It is said to be no larger than a conventional 2D gate, but since it is somehow able to compute both the AND/OR functions simultaneously (one presumes not on the same piece of data) less devices are needed per chip, and 3D chips should prove to be very compact if they are ever produced commercially.

Apart from such practical pursuits, Lenat has also used Heurisko to help make him something of a war-game champion. For the last two years, he has entered and won the Trillion Credit Squadron competition organised in the US by the Game Designers Workshop.

Essentially, competitors must design a fleet of sea and spacegoing ships that are invincible. The rules for the game run to several books published by the organisers. Each fleet designer has a theoretical limit of a Trillion Credits to fund his work.

Lenat has applied Heurisko's technique — ie taking a given design and "mutating" it in all manner of ways — to the war-game.

"The resolution of any confrontation between fleets can be worked out fairly easily," said Lenat, "but the rules of design are very, very detailed. For example, there are maybe 100 to 200 ships of all types in the fleet and any design must take account of 100 or so different parameters. For example, if you want to increase the power of a particular engine, you have to be aware that it will be more expensive and that you may have to strengthen many other related parts of the ship. Or maybe you want to have thicker armour plating than usual — this will obviously increase the weight and result in a slower, less manoeuvrable ship."

After hundreds of hours of computer resource time, Lenat managed to give Heurisko the rules of the game in a form it could use. For many nights he simply set the system loose on design work and came in the next morning to look at the results.

"The key thing is that Heurisko is able to mutate a design by making a large collection of small changes to a ship and then assessing the quality of that new design," he said. "I've won the competition for the last two years and hope to do so again in 1983, but it is probably going to get harder. It is becoming clearer that more and more computer science people are getting involved, and expert system techniques are ideal for this environment."
Your hands will sweat. Your heart may pound. Your oxygen might run out. And you’re still...
At seventy fathoms the only light comes from your Sonar, steadily tracking the advancing enemy fleet.

Suddenly they're above, dropping depth charges. You could dive. But how close is the sea bed? You could attack. But how many torpedos are left? And your oxygen. Isn't it dangerously low?

'Submarine Commander' is one of 21 challenging new home computer games from THORN EMI, for use with Atari 400/800 or Commodore VIC 20. Like our 'Jumbo Jet Pilot' it's more a real-life simulator than a game.

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And whilst budding Beethovens play the 'VIC Music Composer,' would-be Chancellors can work on their budgets with 'Home Financial Management.' We also have educational puzzles for children that will puzzle adults at higher skill levels.

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FORTH BENCHMARKS

PCW already has a set of Benchmark programs for the Basic and Pascal languages. As FORTH is becoming more widespread on personal computers Dick Pountain has produced an equivalent Benchmark set, the first results of which are printed here.

It seems likely that during 1983 FORTH will finally emerge from the shadows and take its place as a major microcomputer language. The evidence for this assertion is not hard to find: during 1982 FORTH systems at reasonable prices have become available for most of the popular micros. While the Jupiter Ace reviewed in this issue, makes the language available to beginners for less than the price of many software systems. The number of professional level FORTH systems under CP/M is now quite bewildering. At the West Coast Faire last year there were more FORTH systems than Pascal products on display. IBM has commissioned and sold FORTH developed software for its PC while Atari's arcade games are now developed in a graphics FORTH.

This is not the place to go into how FORTH works (see PCW Dec 1981 or Brodie's magnificent book Starting FORTH). Nor am I going to oversell FORTH as the universal panacea for programming problems as has, unfortunately, been done so often before.

After a year of working in FORTH I have formed a somewhat more realistic opinion of its capabilities and shortcomings; suffice it to say that I remain impressed enough to use it whenever appropriate for serious programming tasks and to offer these Benchmarks for evaluating FORTH systems.

FORTH is definitely not a suitable replacement for Basic as a beginner's language, or more than an AC Cobra is a suitable car for learner drivers. Logo is a much better bet to take on this role. One myth which circulates about FORTH is that the code is always unreadable; the truth is that it can be as readable as you want to make it. Forth is not only interactive; it is more interactive than any other language in existence. How else can you sit at a terminal and work in any number base you desire at a keystroke, dump blocks of memory, mix Assembler in with your high level code, manipulate any object from a bit up to an array or file without ever leaving the system? And it's structured, too. One myth which circulates about FORTH is that the code is always unreadable; the truth is that it can be as readable as you want to make it. The commenting facilities in FORTH are unlimited and since you decide word names (up to 31 characters on my system) it is your responsibility to make them intelligible. One day soon I intend to publish in PCW a fairly heavyweight piece of FORTH code which I have produced which is certainly as readable as Pascal.

Anyway, on to the Benchmarks. Since FORTH is an extensible language it presents some problems in choosing the level at which to write Benchmark programs. In order to produce programs which stand a chance of running on all systems it is necessary to restrict the functions tested to the 'core' words which are mainly control constructs or stack manipulation words. I have not tested any lower, byte level, words as these tend to be almost 'naked' machine instructions and one ends up Benchmarking the processor not the implementation. Similarly high level structures like strings and arrays are excluded because they are not implemented on many systems. Floating point extensions are becoming more widespread and could be a candidate for future addition.

Even having decided to stick to core words there were problems over standards. There are two major variants of the FORTH core, the FORTH Inc version and the FORTH 79 Standard plus lots of 'eccentric' versions such as Transforth and Stackworks FORTH. The differences are usually only a matter of names, there are equivalent words in most systems but they may be called by different names. I have chosen (with one exception) to go for FORTH 79 Standard words in these programs as this gives compatibility with most FORTH systems. The fact that my own system is 79 Standard of course didn't influence me at all.

The exception I mentioned is the word SPI which removes all the contents of the data stack. This isn't required in the standard though it is in fact implemented in a lot of 79 systems. The reason it's required is as follows. PCW's other Benchmarks, the Basic and Pascal, are analytical in the sense that by subtracting the timings of successive tests one can isolate the time due to a given instruction (not completely true for the arithmetic functions). We feel that this is a desirable feature which is why we haven't adopted catch-all tests such as Eratosthenes Sieve. (For a full account of Benchmarks see PCW Nov.)

FORTH is so fast that most of the programs test 100,000 iterations (and that is barely sufficient for 'magnifier'). No FORTH system in the world can hold 100,000 items on its stack and so the stack has to be cleared if we are to get a direct timing for any word which leaves a result on the stack. Hence SPI is required. I have deliberately placed it in 'magnifier' which is meant to be subtracted from the other timings as a constant overhead (thanks to Chris Sadler's Pascal BMs for the idea). If you want to run the BMs on your system and don't have SPI or an equivalent, you must write one; it hardly matters whether it's in machine code or high-level as it's part of the overhead. I had to write SPI for two of the systems timed here, PicoFORTH and GraFORTH. PicoFORTH keeps the stack pointer in a processor register, the definition in 8080 code is:

```
CODE (SPI) P POP SPHL NEXT JMP
```

The word S0, which is present in most systems is a variable holding the address of the stack base; many systems also have SP which fetches the address of the stack top.

GraFORTH uses RAM locations and has the unForthlike PEEK and POKE so:

```
: SP 7680 156 POKEW ;
```

---

**Block 8001**

```
0 ( PCW FORTH Benchmarks - Dick Pountain 10th Nov 1982)
1
2 FORTH DEFINITIONS DECIMAL
3
4 1: magnifier : S' 10001 1 DO
5     SPI LOOP , "E" ;
6
7 1 do-loop : S' 10001 1 DO
8     11 I DO LOOP
9     SPI LOOP , "E" ;
10
11 1: literal : S' 10001 1 DO
12     11 I DO 9 LOOP
13     SPI LOOP , "E" ;
14
15
```

**Block 8002**

```
0 ( Benchmarks 2)
1
2 VARIABLE V
3
4 1: variable : S' 10001 1 DO
5     11 I DO V LOOP
6     SPI LOOP , "E" ;
7
8 1: literal-store : S' 10001 1 DO
9     11 I DO 9 V LOOP
10     SPI LOOP , "E" ;
11
12 1: variable-fetch : S' 10001 1 DO
13     11 I DO V LOOP
14     SPI LOOP , "E" ;
15
```

---
The heart of this office of the future is the powerful new "double density" Osborne 1 portable computer with 64k memory, two 200k disc drives and built-in monitor. The Osborne is linked to an Olivetti Praxis 30 11cps daisy-wheel printer/typewriter for printing your work superbly. In addition you get software (sold elsewhere for up to £800) to make your office of the future into a word-processor or a financial planner. And as a special bonus we add the exciting new UCSD Pascal.

Your Osborne and Praxis are a remarkable combination. The machines are so portable you can carry them both home instead of working late. Plug them together slip the Wordstar/Mailmerge disc into the drive and you have a word-processor with twice the capacity of earlier Osbornes. Change discs for Supercalc and you have the power of a dozen clerks for your budgets. Then Osborne types your work perfectly on Praxis.

O-COMPUTERS
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Telephone: 01-828 9000
does the trick here.

Some readers may wonder why TEST > and TEST < are both included. When I was checking out different candidates I discovered that on my system (xForth 1.2) a > test is 50% slower than a < test, because it is defined at high level using <. I thought this was useful knowledge as by choosing appropriate logic it is possible to save time, and so included both in the BMs.

I deliberately haven’t included any timings for compilation as this is so I/O dependent; there would be no basis for comparison between disk and cassette based systems for example.

What of the systems timed here? Z-80 FORTH is a product of Laboratory Microsystems in Los Angeles and has established itself as one of the best CP/M systems available. It is based on figFORTH 1.1 recorded for the Z80. It features a first class screen editor, floating point extensions, and a true Z80 assembler and it has the ability to generate a new system for any RAM size of host with any required extensions included. All the high level source code is included and it uses a CP/M-compatible file format to store screens.

xForth is a British product from AIM Research of Cambridge, and also runs under CP/M. It has a 79 Standard kernel with lots of very advanced extensions. In particular, it has facilities for modular programming with local variables, run-time conditionals and conditional assembly (8080 assembler), and full CP/M file handling capabilities which can access, for instance, Wordstar files. Floating point and sequential files (with pipes and spooling) are available as extras. It has an even better screen editor than Z-80 FORTH which includes a global search-and-replace and user configurable control codes.

PicoFORTH is a ‘Kosher’ product from FORTH Inc, itself, distributed in the UK by Computer Solutions of Chertsey. Meant as an introduction to FORTH programming rather than as a professional system, it’s a smallish single-user subset of their multi-user system. An 8080 assembler is provided but only the original FORTH line editor which is rather spartan compared to the editors on the other systems tested. Although it boots from CP/M it does not use CP/M compatible files but ‘pure’ FORTH blocks. This means you cannot, for instance, copy files with PIP nor interface with CP/M via system calls.

GraFORTH is a special graphics language, based on FORTH, for the Apple II; it is written by Paul Batt of Applewriter fame (notoriety?). It provides some very nice features for animated 3D graphics and music synthesizing. The demo programs impressed everyone who saw them, even given the limited resolution of Apple graphics. It is possible to draw a wire-frame picture using turtle graphics and then animate it by scaling, rotation and translation without any more drawing at all. As a FORTH system it is rather eccentric with numerous willful deviations from FORTH practice which make it hard to come to or go from this to a ‘standard’ system. For instance, variables are handled in a Basic-like assignment statement eg, L1 + -> L and put their value rather than address on the stack when called (which is why I have no timing for ‘variable’). The editor is based on the Apple Basic editor using the same ESC codes and line numbers; it is quite nice to use. No floating point or assembler is included. Unusually GraFORTH is directly threadable – ie, it compiles 6502 code rather than pointers into its headers; the effect on the time for ‘dictionary-search’ is very noticeable.

Working FORTH is a teaching system from Mountain View Press of California based on standard fig-FORTH. Like picoFORTH, this is a ‘pure’ system which doesn’t use CP/M files. It has a large number of screens of teaching-machine type instruction which have the nice feature that the student can come into FORTH and do exercises and then easily start at the point he/she left off (or indeed repeat a lesson). The quality of the teaching is high, if perhaps rather forbidding the total novice; it would be better to know Basic and best to know some Assembler before approaching it. It represents terrific value for money, though, because you get a full FORTH system with assembler and editor (an enhanced line editor) which will keep you happy long after you finish the teaching course. They even give you the assembler source for the kernel on disk. The documentation is very rudimentary, however, as most of it is meant to be on the screen.

At the last minute before hitting the press I received a copy of Kuma Computers’ FORTH for the Sirius 1. This is a fig-1.1 based system written in genuine 8088 code, and as you will see from the timings it is indeed quicker than a 4MHz Z80 version except in the odd case of ‘increment’ (maybe in high-level?). It seems, at cur-sonarity acquaintance, to be a nice implementation, with a simple but effective screen editor. It goes well beyond the 79 Standard with a large part of the Reference Word-set included. It comes with
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<table>
<thead>
<tr>
<th>System</th>
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<th>xForth v 1.2</th>
<th>Working Forth v 2.5</th>
<th>picoFORTH</th>
<th>GraFORTH</th>
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**FORTH BENCHMARKS**

Floating point but no assembler, and does not have full CP/M86 file compatibility though you can read a CP/M86 file into RAM at a chosen address using a routine called READFILE. It has a reasonable manual and user guide which is short on low-level information, however.

What is my overall impression of the products? As far as speed is concerned the Z80 systems were not far apart as you can see from the table. The 6502 system was slower overall than I would have expected. My money is already on the table as I am an xForth licence holder (and extremely happy with it). Z-80 FORTH runs it pretty close and is now on sale in this country, I believe. The ability to work on CP/M files from either of these is of inestimable value to me; I can write utilities such as word count programs to work on Wordstar or Cardbox files without having to buy a CP/M Basic or resort to assembler. These two also have excellent documentation which allows you to probe as deep as you will into the system.

I hope that any Forth using readers will run the Benchmarks and send in their timings so that I can print updates on an annual basis as Chris does with the Pascal. Please specify what processor and clock-rate if you do this. Any suggestions for improvements or modifications will also be welcome.

**Addresses of suppliers**

AIM Research, 20 Montague Road, Cambridge - xForth.
Laboratory Microsystems, 4147 Beethoven St., Los Angeles, CA. 90066 - Z-80 FORTH.

Mountain View Press Inc., PO Box 4656, Mountain View, CA 94040 - Working Forth.
Computer Solutions Ltd, Treway House, Hanworth Lane, Chertsey, Surrey - picoFORTH.
Insoft, 10175 Barbur Blvd, Suite 202B, Portland, Oregon, OR 97219 - GraFORTH.
Kuma Computer Ltd., 11 York Road, Maidenhead, Berks - Kuma FORTH.

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At last there has appeared on the market a small computer which does not use Basic as its principal language — and about time, too, as many people will no doubt think.

There is no doubt that Basic is a good too, as many people will no doubt think. Its principal language — and about time, very small computer which does not use Basic as its principal language.

It has long been touted as a possible alternative to Basic for very small systems because of its compactness and high speed of execution; but although Forth is now available for many machines no one up until now has taken the plunge and produced a machine for the mass market which has Forth as its main — and indeed its only — language.

This ground-breaking machine is the Jupiter Ace and it comes as a surprise to those of us who have been waiting for a Forth machine: for a start it is a much smaller machine than I would have anticipated, priced to put it in direct competition with the Sinclairs, Acorns and other giants of the mass market; and secondly it uses the Z80 which, excellent chip though it may be in other ways, is less suitable for a Forth machine than say a 6809. However, the Ace is certainly an interesting machine with many features to recommend it both to absolute beginners and Forth enthusiasts.

Hardware

The Ace has the look of a ZX80 about it: a small white plastic case measuring 210cm by 190cm and a rubber keyboard, each key having a number of symbols on it. The Sinclair background of the designers shows through in a number of other ways too. There are two edge connectors at the back of the case, one of which looks just like a Sinclair interface but isn’t quite; in fact the same signals appear on this connector as do on a ZX81 or Spectrum but they are not quite in the same order so you cannot plug in extra memory and the printer straight away: however, an adaptor between the two would be easy enough to make and doubtless one will be appearing soon. There are four sockets around the side of the case: one jack socket for the power which comes from a separate power supply with an integral mains plug, one phono socket for the UHF output to normal television and two for connection to a cassette recorder.

All leads are supplied — the power lead and the tele connector are the same size and length, but the cassette leads are a bit short and use only jack plugs instead of the more common DIN plugs. The sockets are labelled on the underside which means that anybody (like me) who gets worried about plugging the power supply into the wrong socket has to keep turning the machine upside down. The underneath also holds the interesting observation ‘No user serviceable parts inside’. The user is clearly not intended to venture inside this machine, for the case is held together by a sort of plastic rivet which needs the application of pincers to remove.

The insides of the Ace are very much as you might expect: there is a single board, the front half of which is taken up by the keyboard. The rubber sheet which forms the keyboard lies loose on the board, and when a key is pressed the part of the rubber under the key moves down to make a contact on the board. It may be simple but it is hardly elegant. I have been told that the design has been improved to overcome the tipping problem, but it still does not impress me very much. I think I would prefer to pay the extra and get a machine with a proper keyboard. The Z80 processor sits at the back left hand side of the board with 8K of ROM in two chips next to it, and the loudspeaker. The rest of the board is taken up with discrete logic TTL; no ULAs and so hopefully no delays! The design again is reminiscent of the ZX80. The board itself is not of the highest quality but it looks well put together, it will need to be strong because the case itself is quite flimsy.

There is no on/off switch — the power plug being simply removed and inserted to perform this function. When the plug is inserted and the television tuned in then you are rewarded by a black screen with a small rectangular cursor at the bottom left hand corner, a refreshing change from the usual blowing of horns (and own trumpets) so beloved of many manufacturers.

A good approach to any new Forth system is to get it to ‘VLIST’ all the words in the dictionary, which breaks the ice by filling the screen with characters, it worked normally on the Ace.

The first noticeable thing about actually using the Ace is that the keyboard could take a lot of getting used to; each key needs a firm push in the centre otherwise it is liable to tip sideways and not make contact. There are both lower and upper case letters available, and the next key also has a symbol on them; there is a normal shift key on the lower left hand side which gives upper case letters but also gives some control functions when used on the top row of numeric keys. For example, shift-0 is to delete the previous character, shift-9 switches to graphics mode, shift-5 to 8 are the four cursor controls, shift-4 inverts the video, shift-2 is CAPS LOCK and shift-1 deletes an entire line.

The second shift key on the right hand side is labelled ‘symbol shift’ and is used to obtain the mathematical and punctuation symbols on most keys. All keys are the same size except for the space which is double sized and in the extreme bottom right hand corner: shift space acts as a BREAK in most circumstances. The display is black and white giving 24 lines each of 32 characters. It is not a particularly good display (but reasonable for this price of machine), having no proper descenders on lower case letters, for example. All commands are entered on the bottom line of the display, and on pressing return they are moved to the next available line at the top of the screen and then executed. Ace Forth does not distinguish between upper and lower case for commands, all words being converted to upper case before incorporation into the dictionary, though they are distinguished in anything that is not a dictionary name — ie, string input.

Software

The list of words produced by the VLIST command shows a fairly normal Forth basic dictionary with one or two omissions and one or two additions to the 79-Standard. The one major departure from any other Forth system I have ever used is...
the way of entering and editing source code. Normal Forth systems are 'screens' which are 1K blocks of memory normally held on disk and transferred into a buffer when needed: a vocabulary of editor commands is used to manipulate text on these screens while they are in memory—for example to write Forth code which can be saved on the disk or loaded into the dictionary. A sort of virtual memory is used, where the system will decide whether a given screen is in memory, and fetch it from disk if it is not. This has always been a difficulty with cassette-based Forth systems; how to duplicate this system? It has normally been resolved by the use of a number of buffers in RAM as a pseudo-disk whose contents could be written to or read from tape.

The Ace uses a different technique entirely; incorporated into the basic dictionary are three words LIST, EDIT and REDEFINE which use a powerful decompiler to edit source code. Forth definitions are entered at the keyboard and entered into the dictionary immediately; this can be done on most Forth systems but that new definition is not normally accessible any more except to execute it or forget it. The Ace, however, can access any word that has been defined in this direct way; LIST will list the definition of the word on the screen. EDIT will make it available for editing using the cursor keys. As soon as enter is pressed the new definition is added to the top of the dictionary. This of course leaves you with an extra copy of your word but the use of the command REDEFINE causes the new copy to be put back to the previous position in the dictionary with the rest of the dictionary being adjusted accordingly.

The same edit mode is entered if there is an error in a word definition. An interesting side effect of this form of editing is that it is possible to make forward definitions, using words that have not yet been defined; the trick is to use an arbitrary predefined word in place of the yet-to-be-defined word. Later, when you have defined this word properly, you can return to the higher level word which is meant to use it and insert it in the appropriate place. REDEFINE will now move this high level word back, pointing forward for one of its components.

The problem of saving to tape is overcome in two ways: the entire RAM dictionary (that is, excluding the predefined words in ROM) can be saved to tape using the SAVE command, and these tapes can then be loaded using the LOAD command to be added onto the dictionary. There is also a VERIFY command to check the contents of a tape against the contents of memory. The second way of saving data is by the BSAVE, BLOAD and BVERIFY commands which save, load and check a block of memory between two addresses on the stack. This could be particularly useful for saving screen pictures from the memory mapped screen. I tried recording and playing back on two standard cassette recorders; one gave no trouble at all, the other gave a few problems but it’s one I’ve had trouble with before. The standard of recording seems quite adequate and fast at 1200 baud.

The rest of the supplied dictionary is fairly standard (see the accompanying table of words for a more comprehensive comparison with 79-Standard Forth) but there are some more interesting features.

There is a floating point facility supplied, which should placate many Forth critics. Words F+, F-, F*, F/ F, FNNEGATE, INT and FNNEGATE allow a full range of floating point calculations to be done to 6-digit precision and the normal Forth double numbers are available as well. There are words VIS and INVIS which can cause the screen to blank out and reappear and (another relic of the ZX80?) the words FAST and SLOW to control the speed of execution. FAST does not mean any error checking procedures (such as stack busy) so programs run appreciably quicker, but of course this should not be used until the program is known to be working properly in the SLOW mode.

There is a limited sound generation facility using an internal speaker, and the word BEEP is provided to control this. It takes two parameters off the stack to specify pitch (period in units of 8 microseconds) and duration in milliseconds. There is a table in the manual giving appropriate pitch values for various notes. The sound produced is rather weak but it could produce reasonable sound effects for games. The other major provision is a graphics facility provided by the word PLOT. The resolution is 64 pixels across by 46 down, which is hardly high by today’s standards but the graphics are generally easy to use; it is quite painless and a good exercise to define your own words to draw lines or shapes, and the speed of execution, even in slow mode, is very good as you would expect from Forth. Animation is straightforward and it is possible to get a higher resolution if defining a character generator which is RAM-based. Some examples of how to do this are given in the manual.

One other noteworthy difference between Ace Forth and 79-Standard is the provision of two constructions DEFINER ....DOES> and COMPILER....RUNS> to replace the normal DEFINE....DOES> construction to define new defining and compiling words. They work in the same way, though, and so anyone who is familiar with Forth or who is using a book such as Storing Forth should find no difficulty.

CODE definitions are provided to produce faster execution for hex instructions (or decimal or any other base) as no assembler is included, which is fairly unusual for a Forth system. Given the extensible nature of Forth, however, once the user has become a reasonably competent programmer they should soon be able to produce an ASSEMBLER vocabulary if desired. The way that this Forth system works is another interesting departure from the norm. Most Z80 Forth systems use the machine stack for the data stack and arrange the return stack by other means, but Ace Forth does
the opposite. Indeed the data stack is not in a fixed position at all but remains at 12 bytes up from the current top of the dictionary, the ROM part of the dictionary occupying the bottom 8 k on the memory map. It is therefore used as a system variable at the top of available memory and grows downwards, the dictionary and data stack growing up to meet it. The 3 k or so of space that is available for this is available in large, most usable things you would not expect because of the compact nature of Forth, but it is not exactly huge and you are going to run out of space fairly soon; there is not sufficient space to store all the Benchmarks at the same time, for example. This organisation does, however, mean that the system can immediately take advantage of extra memory simply by initialising the return stack at the highest available memory.

The version of Forth implemented on the Ace, in summary, is a good version which incorporates all the desirable features of a standard Forth dictionary with additions to make full use of the features of the machines; some useful words which are omitted can easily be added if the need arises.

Documentation
The manual is impressive; written by Steven Vickers, one of the two designers, it sets out to be both a user's manual and a self-instruction course in Forth. It does not quite succeed but it does as good a job as most other manuals for machines in this class. It has 181 pages with illustrative examples of the use of all the words in the dictionary, and reference sections including details of the memory map and locations for all the system variables, so all features of the machine are available to the user. A section of the manual explains how to write code definitions (words defined in machine code for extra speed). The manual is written in a fairly light-hearted manner, so that anyone intelligent enough to want a costume in the first place should be able to make sense of it. An illustration of the style is this quote from the section on loading programs from tape: 'Let us suppose that your tape has an interesting program called DVL; it runs a game in which you are menaced by hundreds of vehicle licence application forms falling out of the sky, and you have to destroy the enclosed vehicle registration documents.' Clearly the author has had a recent unfortunate experience.

Benchmarks
The Benchmark timings given below were taken using the Benchmark programs discussed elsewhere in this issue. They were taken in SLOW and FAST modes. The word SP which is an essential element of these benchmarks is not available in Ace Forth, so I have defined it as SP: HERE 12 + 15419;

Where HERE 12 + calculates the bottom of the stack at 12 bytes up from the next dictionary space and 15419 is the address of the system variable SPARE (not available as a Forth word) which holds the next free space of the stack. The timing of 'magnum' is subtracted from other figures to compensate for the time taken by SP! which, would, of course, have been much quicker if defined as CODE.

Conclusions
The Jupiter Ace is a cheap computer at £89.95, and externally it looks cheap. It does not have colour and with the price of colour machines dropping fast this could turn out to be a big disadvantage. It has as yet no peripherals, though Sinclair ones can be adapted and Jupiter themselves will shortly be bringing out a parallel Centronics interface. There is no software around either as yet but hopefully this will change soon especially if a large number of machines are sold; it could even bring about a boom in Forth software which could be run on a variety of machines. It is a bit difficult to imagine what the market for this machine will be, a lot of people may be put off by the Forth language itself with its use of Reverse Polish notation (calculators which use this system have never been particularly popular except in the scientific community). However, there are real benefits to be had from this machine as opposed to many of its competitors; programs will run appreciably faster than their equivalents on a Basic machine; anyone who is prepared to persevere with Forth will find it a rewarding experience which will lead to a quicker program development time, and more reliable programs as well as a better understanding of the operation of the machine; and simple Basic interpreters written in Forth as well as a lot of other interesting software are available through the Forth Interest Group. The Jupiter Ace is a very interesting machine; I would not like to predict whether or not it will be a sales success but it deserves to be. It uses a very good version of the Forth language and has a reasonably clear and detailed manual.

The Jupiter Ace is available only through mail order at present from Jupiter Cantab Ltd, 22 Foxhollow, Bar Hill, Cambridge CB3 8EP. The price including power supply and leads is £89.95.

Benchmark timings
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<td>test&lt;</td>
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<td>12</td>
<td>while-loop</td>
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<td>until-loop</td>
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<td>14</td>
<td>dict-search</td>
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<tr>
<td>15</td>
<td>arithmetic</td>
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</tbody>
</table>

See also "Forth Benchmarks elsewhere in this issue."

Fig 1 Table of Forth words used by the Jupiter Ace

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
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<tbody>
<tr>
<td>DO</td>
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<td>DROP</td>
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<td>INPLACE</td>
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<tr>
<td>ELSE</td>
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<td>BEGIN</td>
<td>END</td>
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<tr>
<td>END</td>
<td>END</td>
</tr>
<tr>
<td>TIME</td>
<td>TIME</td>
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<td>JAVELIN</td>
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<td>JUPITER</td>
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</tr>
<tr>
<td>ACE</td>
<td>ACE</td>
</tr>
</tbody>
</table>

The following 78-Standard words do not appear in Ace Forth: *, +, -, TRAILING, 79-STANDARD, >IN, >IN, CMOVE, COMPILE, COUNT, DEPTH, EXPECT, PRINT, FILL, KEY, MOVE, NOT, STATE, [CLOSE], SP;.

The following words are extra to 79 Standard Forth: ASCII, AT, BEEP, CALL, CLS, FAST, IN, INKEY, INVIS, LINE, OUT, PLOT, RETYPE, SLOW, VIS.

Technical specifications
Processor: Z80 3.25Mhz
ROM: 8k
RAM: 3k
Keyboard: Rubber keys, 40 keys with auto-repeat and caps lock
Mass storage: Domestic cassette recorder, 1200 baud
Screen: TV (black and white), 32x24 characters, 64x64 dots in graphics
Sound: Internal speaker
Ports: Expansion port contains power rails, address, data and control lines.
Language: Ace Forth

PCW 131
Photography. Now, there's a subject to contemplate. Like playing a guitar, it is something that is easy to do in a simple fashion, but it is almost impossible to become a master.

The world and his uncle has spent many joyous hours taking full-colour photographs of Aunt Ethel's knees (neatly exorcising thereby the part of Aunt Ethel that has always afforded a delicate set of ear-drums). Pocket Instamatics can be seen distorting the careful tailoring of every other suit seen walking down Oxford Street. The other every-other-suit is only not being distorted because the Instamatic is in someone's hand, taking a glorious, full-colour shot of the top half of the right-hand corner of Selfridges.

Yet, if it is done properly, photography can capture a mood or emotion—a nuance of the pain or happiness felt by a subject, an insight into the horror of war and the joy of laughter. A master with a camera can see and capture what most of us miss until the photograph gave us the time and space to observe.

So many things can be photographed it is hard to know where to start sometimes. Should the camera be pointed at people—old people that smile, young ladies that work the Page 3 circuit—or should it be pointed at the inanimate things of our world: cars, mountains, computers, telephones, data, plates of chips or...?

Data?
Yes, indeed, why not photograph data? In fact it is becoming eminently sensible to photograph data instead of carrying out all this silly nonsense about encoding it in magnetic flux.

In a few years time, and almost certainly before the end of this decade, it is reckoned that the majority of data storage in small systems will be photographic rather than magnetic. Who says so? Well, actually it's a Mr Bill Martin, who works for Control Data, planning that company's product and marketing strategy in storage peripherals. As an important sideline, of course, this means observing what IBM gets up to. He has to watch this particular company because of its pre-eminent position in the computer business. Where IBM leads the others have to follow, and be damned quick about it. In fact they usually try to out-guess the Blue Giant, at least in terms of the general outline or configuration of an upcoming product.

This means that Bill Martin is well aware of not only the IBM marketplace, but also the technologies involved in all aspects of data storage. He is a wizz at magnetic storage techniques such as disks and tapes, and fully understands their advantages and disadvantages. He is also a reasonable wizz at photography and its implications.

To be fair, the photography in question is not the same as yer actual David Bailey (or Editor Rodwell, for that matter). No, what this particular photography refers to is the optical disc.

This has enormous potential in the small computer systems market because of its truly staggering storage potential. Its use will require a rethink on how users store their data, and on the economics of storage, vis-a-vis existing techniques. It will also bring about an important development for the large numbers of first time users that will continue to make up the majority of the personal computer market for years to come. The development is that, for the first time, they will not be able to lose their data...ever.

First, however, some facts. Bill Martin is predicting that by the mid to late 'eighties, there will be optical disc storage systems available for small computers. He sees this marketplace being developed, quite possibly by IBM, before the mainframe market, if only because with applications like word processing and small business accounting the market itself is well defined.

The storage system will not be cheap to start with, probably around $10,000. It will
appear firstly therefore on the bigger 'professional' systems. It would use a standard optical disc that is written to and read from by laser. Each of these would cost around $10.

This is where the fun starts. The capacity of each disc will be around 2,000 megabytes per side. Sounds a lot, doesn't it? Sit and think about it for a while. Modern minifloppies pack around a megabyte per disc. A mini-winnie crams maybe 50 megabytes. Each side of an optical disc will be the equivalent of a string of 80 mini-winnies. But the disc can be turned over and the other side can be used. This means that for around $10,010, 4,000 megabytes of storage will be available.

That starts to make nonsense of current data storage economics. For example, a mini-floppy storing 1 megabyte, and costing some $500, provide 2,500 bytes of on-line store for each dollar spent. The optical disc, though more expensive, will provide a staggering 20,000 bytes of on-line storage per dollar spent.

The change in the economics of data storage will bring with it changes in the way that storage is used. The relative cost, and more importantly the inconvenience, of magnetic disk storage means that it is against the user's interests to be profligate with storage as it's possible to be. Should a disc ever become full (and that would take some doing) then all the user has to do is turn it over and start again. Should that side become full, well then, just spend $10 on another one.

If you let this attitude to data storage sink in, its implications become clearer. Optical disc systems no longer are seen as being just 'backup' systems for archival use. It matters not that you can't erase data. In fact you shouldn't want to (in most cases anyway). Even in really modern applications like word processing, where storage like it's going out of fashion, there is really no need to erase or overwrite files. It is an advantage not to have to.

As Bill Martin points out, the optical disc automatically produces father/son file structures, and gives an automatic 'audit trail' of those files. Because a file cannot be erased it can never be lost or erased accidentally. Any amendment or addition to a file will just produce another, latest, version of it. The original will still exist.

This has important implications for a variety of applications, of both textual and numeric types. The daily grind of backing up files will no longer always be necessary for the back-ups will already exist. The inherent father/son structure for creating files would seem to match the requirements of the accounting/data processing areas to a tee. It would also fit many of the requirements of the word or text processing environment.

Unfortunately, the one drawback of the early use of optical discs is going to be the cost. The hardware will cost considerably more than a domestic disc player because it will have to incorporate a 'write' as well as 'read' capability. In time, of course, the price will drop, and so will the price of the discs. Then the systems could prove to be unbeatable in terms of price and performance, instead of performance alone. At that time, maybe the magnetic era could come to a close.

And remember, all this refers to using optical discs in a predominantly conventional data processing manner, storing data as '1's and '0's. Even here it would seem to stand up well against magnetic media in all but initial purchase price. But this does not include the many other tricks that optical discs are capable of - the interleaving of data and audio/visual material, for example. There just have to be thousands of applications for that trick that no one has yet thought about. Try thinking - that's what Clive Sinclair did.
THE SINCLAIR SPECTRUM IN FOCUS
by M.R. Harrison, Software Sciences Ltd.
Supplements the Sinclair operating manual, and provides answers to some of the questions posed but left unanswered in the manual. The book is designed for readers of all ages, and those with either no previous computer experience or others who require more assistance in operating the ZX Spectrum computer system.

0905104 28 5 approx. 160pp Dec’82 £6.25

Z80 INSTANT PROGRAMS
by J. Hopton
The first edition of this book, which was approved by Nascom Microcomputers Limited, was a sell-out. It has now been completely revised with the following features: all of the programs now work under the NAS-SYS monitor, which is the monitor for both NASCOM-I and NASCOM-2 machines; all of the programs are now listed with mnemonic, as well as pure machine codes; all the programs start after address 0080, to fit the Nascom systems and terminated well before OFFF, allowing ample space for the stack.

0905104 19 6 198pp Nov’82 £7.50

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Advanced Microcomputer Applications
by E.A. Flinn; A.E. Hill and R.D. Tomlinson, all of University of Salford
For a number of years the authors have been running a series of highly successful and proven courses at Salford on the PET/CBM computers for a wide spectrum of audiences. This book is a distillation of the experiences gained on these courses.

0905104 23 4 198pp Nov’82 (paper only) £7.50

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by M. Banahan and A. Rutter, Department of Computer Science, University of Bradford

0905104 21 8 approx. 160pp Nov’82 £6.50

HART’S DICTIONARY OF BASIC
by W.A. Hart

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Torch The World Beater

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Torch is a dual-processor machine with a massive 800K of floppy disc storage (expandable up to 10 or 21 Mb with the hard disc option).
Torch runs a CP/N operating system giving all the normal business software — accounting, budgeting spread-sheets, PAYE, stock control are all readily available and the high resolution colour graphics make the most of them.

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Cambridge-based Torch Computers has produced a very interesting machine which combines the ability to run standard software products with high resolution colour graphics and in-built communications capabilities. My first impression was one of surprise, since I hadn't really expected to evaluate a machine with such features for some little time yet.

Owned by the Climar Group, Torch is a young and very aggressive company, determined to secure a niche for itself in the world markets. With American and Canadian offices and exhibits at the NCC in Houston and Comdex in Amsterdam, Torch evidently means business — and I wish it every success.

At the time of this review, Torch had got most of the hardware sorted out but there were still some serious gaps in the promised software offerings. Fortunately, its operating system (CPN) is compatible with CP/M and, providing that you can get it on Torch format disks, a wealth of software is available.

**Hardware**

My first impression of the machine was that it was very plain, if not downright ugly. The welded sheet metal construction has led to a very rectangular design which makes the machine appear a lot larger than it really is. In fact, it is just about the same size as a Superbrain but without the curves. I understand from Torch that an injection moulded casing is being designed which should make it look a lot better as well as reducing the weight somewhat. On my bathroom scales, the Torch came near to 14 kilos!

The main unit comprises the screen, disk drives and processors while the keyboard is separate and attached to the main unit by a coiled black lead. The screen is a good quality monitor made by NEC and the disk drives vary. The first review machine had Tandon drives, one of which gave me trouble. The second machine had Mitsubishi drives which behaved perfectly. The review machine contained a 6502 processor and a Z80 processor. Future 'super-Torches' will run a Motorola 68000 processor as well as the two current processors. The 6502 processor board is, in fact, the one which drives the BBC machine.

The screen is a high resolution, colour monitor which can handle eight different...
Detachable keyboard.

Twin disks are standard.

Built-in editing pad.

I/O includes direct-connect modem.
THE TORCH

resolution/colour combinations — see Figure 1 for the details. You'll notice that up to 16 colour modes are available. Eight of these relate to plain colours, while the others refer to flashing colours. Although yellow/blue flashing would appear to be the same as blue/yellow flashing, the separate modes are useful since if each is being used at the same time one would be displaying blue while the other displays yellow. Whichever way you look at it, I think the sales literature is naughty when it refers to '16 colours'. See Figure 2 for the details. All this activity is handled at present by the BBC board inside the Torch.

Individual pixels may be given a different colour to their adjacent neighbours to give the illusion of further colours such as orange. I think that the screen characteristics are very good. They will certainly cope with the vast majority of applications over the next few years. I did notice, when I was programming, that it would accept logical screen addresses up to a resolution of 1280 x 1024 which probably bodes well for future screen developments.

The Torch has a very comprehensive keyboard comprising the normal keys, a row of 14 user-definable keys, a numeric keypad and a word processing function keypad. The dished and textured keytops give the keyboard a very pleasant feel. Upper and lower case letters may be used and the keys automatically repeat after a short while. I didn't bother to time it since it can be varied by the user anyway. The only things that bothered me were that some of the symbol keys were in unexpected positions and the numeric keypad didn't contain the Prestel "#" and "*" keys. Fashion-conscious ladies who like using detachable keyboards on their laps may find the cold steel casing a little unpleasant. I did, and I wasn't wearing a miniskirt! (Liar — Ed.)

The keyboard contains a number of editing keys — one set operates on the current line while another set allows you to move a 'shadow' cursor to a different line so that relevant parts of the other line could be embodied in the current line. Does that make sense? It overcomes CP/M's inability to allow cursor movement to previous screen lines. I found it very useful anyway, and a pleasant change from having to retype CP/M commands whenever I made a trivial mistake.

Setting up the user-definable keys is a doddle. You simply type the word KEY followed by its number and contents. <cr> can be included using the stretched-out colon (:) followed by M. Use <cr> to finish the entry and the new function is attached to the key. I found this particularly useful when initialising and copying disks since it is so easy to mess up these commands. This is the sort of command I encoded:

FORMAT B: M:COPY A: TO B:

Each Torch is supplied with two 400k disk drives or a single 400k drive coupled with a hard disk of either 10 or 21 Mb capacity. As I...
the information on the computer screen. This would be useful for exhibitions and talks, for example. I tried it on a portable black and white TV and there appeared to be no problem. One of the options available is to adjust the white balance of the screen. I have no idea what this means or how it works, but I did find it quite nice.

[Table]

<table>
<thead>
<tr>
<th>Mode</th>
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<tr>
<td>2</td>
<td>5</td>
<td>6</td>
<td>20x32</td>
</tr>
</tbody>
</table>

Fig 1 Screen modes

said earlier, one of the Tandon drives gave me trouble whereas the Mitsubishi drives were fine. Whether this is a reflection on the drives or not, I have no idea. I understand that Tandon drives are used in a lot of other microcomputers so perhaps something caused the trouble. In fact, you're not familiar with disk drive capacities then you should know that 40K is quite respectable. It is roughly equivalent to 100 A4 typewritten pages. The disks are double sided single density with 80 tracks per side.

A number of connections to the outside world are provided at the back of the Torch. A DIN socket is used for plugging in a cassette player. Incidentally, this is the only way of saving programs written in the built-in BBC Basic. It gave completely trouble-free operation when I used it with a Sanjoy Slim 3G recorder. An RS432 port allowed me to connect up to another computer (a Superbrain) and, by connecting the 'Ready to Send' and 'Clear to Send' pins to each other, I was able to fool the Torch into exchanging files with the Superbrain. In fact I took a CP/M program (Cardbox) and its associated data files from the Superbrain and got them running successfully on the Torch. I'm sure that I could have attached my printer too, but I didn't fathom out the appropriate connections. A Centronics interface is provided for those who need parallel connections.

An external UHF monitor socket allows you to connect a display screen which echoes PCW 139

Software

Like so many computer manufacturers, Torch managed to get its hardware out much quicker than its software. One product, called Executive Aid, is claimed to comprise three elements: a card indexing system, a word processor and a diary system. Only one of these three was available at the time of review. A Torchlite program was supplied which allowed me to access and exchange files with other computers. After succeeding only occasionally, I called Torch and mentioned my inconsistent results and they informed me that there was no CRC (a checking system) in the Torchlite program and it was about to be replaced by Torchmail which would be better. I understand that Torchlite is useless and I'm rather dreading my next 'phone bill since I was hooked up to Prestel for some months and I'm quite sure that Torch deliberately chose this selection of three letters when there are over 16,000 other three-letter combinations to choose from CPN, by the way stands for Control Program Nucleus. Since it is in ROM, it doesn't intrude too much on the memory associated with the Z80. In fact 63k is available for application programs. The screen memory (20k) is on the base board so graphics do not interfere with memory available for program memory.

As if to confuse the public further, Torch has called the console command processor (CCP in CP/M) CCCP, which stands for Cambridge Console Command Processor. I suppose all the confusion occurred or it is to stop people like me saying 'Oh no, another new operating system?' In fact I wouldn't say that. Providing people give a perfect emulation of existing operating systems then I think the user wins both ways. He can run popular software while taking advantage of the additional facilities offered by the new system. The people who are mad are those who don't realize that CP/M is rubbish and then introduce their own operating system which bears no resemblance to any other operating system, living or dead. Oddly enough, they are often companies who don't expect to sell more than a few hundred machines a year and therefore end up charging the earth for something which has to be specially commissioned. At least Torch didn't fall into that trap.

What Torch has done is to produce a machine which is very easy to use because so much useful software is available from the starting point. I would have thought that there was a market for a machine which is more than a few hundred machines a year and therefore the one that is supplied with the machine is ideal for people who are not very familiar with computers. It is simple to use and has a lot of facilities which are not available on other machines. The only thing that I would have liked to see is a bit of money purely in connect time, never mind the other charges associated with it. I can see the day not very far off when instant access to relevant information will become even more important than it is now and that, coupled with things like telesoftware and teleconferencing, will increase Prestel's popularity providing the Source, or something like it, doesn't get in first.
I couldn't use the Telex or Datel facilities which are offered by Torch so I can't pass comment on them. I asked Torch whether UHF broadcasts could be received so I can't pass comment on those which had some effect. Later, Maggie Burton extracted me from the mire by digging the codes out of a BBC book. I'm back to that silly business of Torch not being able to supply BBC manuals. Such a manual at the right time would have shorted this Benchtest by about 10 hours.

My conclusions on documentation are that Torch is doing a conscientious job on its manuals. The lack of a BBC manual or equivalent is likely to prove very frustrating for programmers working in high-level languages. Looking at the outline contents of the Systems Guide I'm not at all confident that it will be the answer.

**Potential**

There's no doubt about it: this is a business machine which can handle most, if not all, current CP/M applications. It goes beyond that, though. The high resolution colour graphics give a potential for presenting statistical information in a far more easily digested way than the common rows of figures. It also allows users to store and view graphic information as well as text and numbers. All that's needed is for the software industry to catch up with this type of machine. Torchnet is the answer. It will be very common in a year or two, but right now it poses a headache for people looking for packaged solutions for their graphic software problems.

The communications facilities are very good and, once again, provided the software is made available this probably gives the Torch its greatest advantage over its competitors at the moment. Torch has seen this and its main effort has been on the communication package mentioned earlier.

So, if you need a machine which can run a wide range of proven software, which has communication facilities and which offers high resolution colour graphics then you should take Torch very seriously indeed.

It's not a pretty machine but functionally it's very good.

**Expansion**

A 68000 based machine is on its way. It will keep the Z80 processor too, so no system investment will be lost. The new machine will run 'DAVROS, an all British operating system developed by Torch'. I found that statement pretty depressing until I went on to read that it will support Unix programs. Once again Torch has recognised what's happening and taken steps to improve things but without putting itself out on a limb. There's talk of Torch taking on APL and the UCSD p-System too. Reading between the lines, Torch seems to believe that the 8086/8088 based systems are a temporary phenomenon destined to take advantage of existing software availability. All I can say about that is that they're not alone. I do believe that Apple has bought quite a large number of 68000 chips too. We shall see.

**Prices**

At first glance the price of the Torch looks high. I think it's important to bear in mind that it has an in-built modem which would cost in the region of £300 if it was bought separately. It has high resolution colour graphics and reasonably high capacity disk drives. Against this, it is currently a 6552/2Z80 based machine and prices of these are dropping like stones. You must decide for yourself what you consider is important to you. If you'd never use graphics or communications in a month of Sundays then perhaps this isn't really your machine.

**Documentation**

Two manuals were supplied with the machine - a user guide and a programmer's reference manual. The user guide is a delight. It is well written and entirely appropriate to the fact that one area I'd have enjoyed playing with. In fact, I'm beginning to wish I'd bought myself a BBC machine. All I managed with music was some very messy shaping and simple tunes through the BBC Basics to an article in good old PCW. At least it worked and it showed great promise. I even programmed some of the user-definable keys to play set tunes. Hardly the thing to do on a business machine, perhaps.

Wordstar, Mailmerge and SuperCalc were supplied and they all worked just fine. A financial accounting package came with the machine but I didn't try it out. I read the documentation and it looked OK. You really need to spend several days at least to get a true feeling for such a package. Cardboard worked just fine on the machine so I don't think anyone will have much trouble implementing CP/M programs on the Torch providing they can configure the screen controls and get the appropriate format disks. MBasic was supplied too and that worked well, both interpreted and compiled. Compiled, of course, was faster than interpreted and, on the whole, Microsoft's Basic ran faster than the BBC version.

You will notice that I only checked a couple of the compiled Basic figures simply to give a comparison; see the Benchmarks timings.

Other languages which are said to be available are Fortran, Pascal, Cobol, BCLP, Algol 80, C, Lisp and Forth.

**Technical specifications**

- **Processors:** Z80A (6 MHz), 6502 (2 MHz)
- **RAM:** Main system: 64k; peripheral processor: 32k
- **ROM:** 4k bootstraps for main system; 32k inc Basic, operating system and comms software for peripheral processor
- **Display:** 12in colour monitor (optional monochrome); 8 text modes, 3 graphics modes, up to 16 colours
- **Keyboard:** Expanded qwerty with cursor control, editing & numeric pads, 16 user-definable keys
- **Disk drives:** Twin double-density, double sided 5in. 400k each
- **Interfaces:** Centronics parallel, RS232 serial, 4 12-bit A/D inputs, modem for comms in Prestel
- **Systems software:** CPN (CP/M compatible) operating system

**Languages:** BBC Basic in ROM

For a full explanation of Benchmark timings, see PCW, Nov 82.

**Conclusion**

For anyone who needs a high resolution colour graphics, communications oriented, CP/M compatible machine, the Torch should be considered among their options. I get the feeling of 'almost ready' on the software and documentation front which is a pity — it spoils otherwise a fairly professional approach. The machine is heavy and not very good looking but it offers an impressive range of capabilities.

**Benchmark timings**

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For a full explanation of Benchmark timings, see PCW, Nov 82.
Horses for courses

From magazines such as your own, and from books, I have learned a lot about hardware, packaging of software, and how a computer operates. However, a gaping hole in my knowledge is languages.

I have used a ZX81, and discovered the extreme disadvantages of Basic. Consequently I would like to upgrade both my language and my hardware.

Which high-level language should I choose from the wide range which includes Pascal, Comal, Fort, Cobol, Logo, Algol, Basic, Pilot, APL, PL1, Fortran, etc.

Are we working towards a 'universal' language, or a series of languages tailored for each application? Will the language we learn tomorrow be out dated in six months' time?

Your magazine is by far the best of those I see at the newsstands, and I thus look forward to some constructive comments — perhaps to a comparison table of the main microcomputer languages?

A L Taylor, Grimbsy.

I fear there would not be room in 'Computer Answers' for the table you envisaged. We do not have the space to give a complete survey of the various versions on microcomputers available. As far as I know, the fastest one is Basic, which is very widely used for commercial data-processing applications on minicomputers (there are also micro versions).

On microcomputers the closest approach to a 'universal' language is in the versions of Basic. Comments and Basic's many detractors, a good implementation of its language copes very well with most programming applications, and is used by professional programmers. The more fairly available versions on microcomputers tend to suffer from poor string and file handling, but this problem is not irretrievably built into the language. The other problem with micro Basic is slow execution, due to the lack of efficient use of compiled versions. A good implementation of Basic, with many operators, long variable names, good string and file handling, and a compiler is an excellent programming tool. Ideally, you should aim for the ability to develop programs using an interpreted version, and then be able to compile the finished, de-bugged program for fast operation. Basic is one of the few languages in which this can be done.

P L McIlmoye

Why CP/M/MSDOS Quite simply this will give you the widest range of high-level language interpreters and compilers commercially available. Don't be put off by rumour at CP/M...it's not nearly as bad as it's painted, and is very powerful. Anyway, it is now possible to get a program which combines the advantages of Unix to CP/M, without adding Unix's major disadvantages.

P L McIlmoye

Computergook

With reference to the answer from P L McIlmoye in the November issue of PCW regarding CP/M, I would have thought that the latter was a sufficiently simple concept for it to be explained in one column of your estimable publication, with references to further reading elsewhere, and without the use of the quite unnecessarily artificial computerspeak, which makes the answer incomprehensible to all but the ardent enthusiast.

J Caroy, Canterbury, Kent

It may surprise you to know that I agree with much of what you say. If only the 'computergook' (it sounds even more pretentious if you don't pronounce the 'k') were mine — then it would be easy to ignore or dismiss it. Unfortunately, it comes from the writers of CP/M, and more particularly, from the writers of the CP/M manuals. I fear it is largely the lack of clarity of the latter which has earned CP/M the bad name it has in some quarters.

As an expert in it, who might not be able elsewhere, and without the use of the quite unnecessarily artificial computerspeak, which makes the answer incomprehensible to all but the ardent enthusiast.

PCW 141

COMPUTER ANSWERS

Send your queries to: Sheridan Williams, 35 St Julian's Road, St Albans, Herts. Please note that Sheridan can no longer answer questions on an individual basis, so please don't send an SAE with your query.

The long way round

How do I get a Basic program to run on my Osborne? The only way I've found is to create the program using Wordstar using the 'non-document' option; call this program "PROG.BAS" and save it with KX. Now put the disk with the Basic compiler and interpreter and type what is underlined: B>A:MBASIC B>SNDFILE

This method works but I'm sure there must be a better way, because I fear that I've lost the advantages of compilation.


There certainly is a simpler way because you are going all around the houses. A lot of people do use Wordstar to edit Basic programs; however there is no need to learn Wordstar to do so. Just type MBASIC and you will enter the Basic interpreter; now you can simply type in your Basic program, line by line. Consult your M Basic manual for instructions on editing. When you have completed it you can test the program with RUN. To save a copy of the program just type SAVE "PROG.BAS". A Once you are totally satisfied that it works correctly then you can use the Basic compiler and compile your program. The speed advantages of a compiler will only be noticeable wherever possible, avoided unnecessary calculations, etc. In a few machines this may be enough, but with the faster ones you will almost certainly have to alter the computer's internal "clock" to match. This may be a matter of altering some jumper settings, or it may mean changing a quartz crystal for another one. The most expensive area is likely to be memory. RAM chips have made Basic! Despite speeds, and the faster ones are usually appreciably more expensive. Thus it is likely that the RAM used in your micro will be just fast enough to cope with the existing processor. You could make the existing memory compatible by using software 'wait states', but then you've lost the speed you changed the processor for! Disk controllers may also be speed-limiting, but as long as your programs do not exceed the disk accesses, you could live with 'wait states' as a solution.

So if you fear you can choose to change from a Z80 to a Z80A, but if you already have a lot of RAM it could be a better way.

P L McIlmoye

Speeding up

Is it possible to convert a Z80-based microcomputer into a Z80A micro by changing a few components? If so, how?

E Kwok, Ballards Lane, London N3 2NT.

As the difference between the Zilog Z80 and Z80A processors is essentially one of speed, the components that may need changing are those which are speed-dependent or speed-limiting. The Z80 can be replaced by a Z80A simply by removing the former, and plugging in (if your processor chip socket is not integral). Unfortunately, a few machines this may be enough, but you will almost certainly have to alter the computer's internal
Memory refreshment

Can you explain how 'bank switching' of memory works? Does the normal Z80 refresh system function over the whole of the bank switched memory? G V Barbier, Tiverton, Devon

In 'bank switching' the RAM memory of the computer is arranged in blocks (or 'banks') of typically 64K, and at any one moment only one bank is connected to the processor's data bus, as 8-bit processors can only address one 8K memory location at a time. The other banks are not connected to data, and if they are dynamic rather than static RAM, refreshment will be needed. This can be done by the main Z80 processor, but it will need refreshing. This can be done by the main Z80 processor, but it will need refreshing. This can be done by the main Z80 processor, but it will need refreshing.

Switching from one bank to another is done under software control, and it is essential that the memory cards used are equipped with an appropriate control line for this purpose. Thus, if you have an S100 machine you cannot necessarily just slot in some more memory cards. You must make sure that the cards are equipped with a bank-switching control line, and that your S100 bus also supports this, and that your operating system software also does so. The newer S100 systems meeting the IEEE S100 spec do support bank-switching. P L McIlmoyle

Random tip

For the past two months I have been trying to write a machine code random number generator for the ZX81 but with little success. Please could you give me some ideas? Andrew Quilley, Gosforth, Newcastle-upon-Tyne.

Try playing around with the machine register K; it does not hold a random number but the computer uses it constantly, hence the value changes continuously. James Walsh

Spectral quirks

At present I am considering purchasing a ZX Spectrum as I already own a 16k ZX81. However I would like to know the answers to a few questions before I do:
(1) Is it true that the Spectrum crashes when a certain number of keys are pressed at once?
(2) Are you limited to only two colours within the 8x8 pixel character square?
(3) I wish to learn machine-code; what facilities do the Spectrum and manual have to help? Also, are there any good books on the subject?
(4) Since the Spectrum has only one user port, how can a printer or joystick, etc. be connected at once?

Steven Garrett, Southwick, Sunderland

(1) I have heard of cases where the pressing of two or more keys causes some strange effects, but I am yet to hear of one actually crashing. The Spectrum does have some weird bugs, many of which I am yet to discover. If you do have any good ones I would be very interested to hear from you.
(2) Yes, this is the same as for most of the new, cheap colour computers - it is done to save memory.
(3) The Spectrum has few actual facilities for machine code and the manual is rather sketchy on the subject, though there are various assemblers and disassemblers available. One of the best is available from ACG Software. At the time of writing there were no really good machine code books available for the Spectrum, though "Interface" may have one ready for the early part of next year.

James Walsh

THE WORKING SPECTRUM

A LIBRARY OF PRACTICAL SUBROUTINES AND PROGRAMS

By David Lawrence

The Working Spectrum is based on a collection of solid, sophisticated programs in areas such as data storage, finance, calculation, graphics, household management and education.

There is also a chapter of utility routines including a Basic renumbering program which can handle GOTOs and GOSUBs.

Each of the programs is explained in detail, line by line. And each of the programs is built up out of general purpose subroutines and modules which, once understood, can form the basis of any other programs you need to write.

Advanced programming techniques spring out of the discussions explaining each subroutine. The result is not only to advance your programming skills but also to leave you with a wide range of practical applications programs which might otherwise only be available to those prepared to buy cassettes or those capable of writing substantial programs for themselves.

Expert or novice — whatever your experience, you will find this the most useful and valuable book for the Spectrum.

(4) The Spectrum has one edge connector rather than one port. The Z80 is capable of communicating with 256 simple on/off applications before it starts using memory space. James Walsh

M/C error

When I was typing in the machine-code program in the October edition to display the number of free bytes on the ZX81, I noticed that there were a number of errors in the listing. For this reason could you please publish a corrected edition?

T J Stanfield, Birmingham

Thank you very much for your letter. I apologise for any inconvenience that these errors may have caused you. So here goes for the corrected version:

10 REM 1234567890123456
29 FOR X=1 TO 16514
30 INPUT A
33,0,0,57,237,91,28,64,167,
45 PRINT X,PEEK X
50 NEXT X
60 PRINT USER 16514
1000 REM THE CODES ARE:
33,0,0,57,237,91,28,64,167,
237,82,68,77,201,
Lines 25 and 90 in the M/C loader program in the same edition should read:
25 LET X=X+1
70 GOTO 25
James Walsh

Please send me a copy of The Working Spectrum.
I enclose a cheque/postal order for £5.95.
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Address:

Signed:

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When I first discovered the Epson MX-80 I believed I had grasped all the reasons for its success. In my view it scored heavily on all fronts — practicality, ease of use, reliability, and cost-effectiveness. On top of all this it battled out bidirectionally and logic-seeking at 80cps, it looked good, and it was portable (it came in a sturdy box with a handle on it).

One morning I received a telephone call from a distressed customer. In desperation he had taken a stop watch to his MX-80. It was only printing at 50 cps! Oh dear, had those ‘awfully nice’ Epson people let me down? Further investigation showed that it was also printing with a jolly nice but non-standard typeface (this however was of no interest to my customer).

I took the printer along to the surgery where I received some sound advice from the chief fitter. . . . ‘When in doubt, read the manual!’ It seemed like a good idea and an hour or so later I was almost overcome with the delights displayed before me (I get excited easily) . . . Print options galore, true superscripts and subscripts, the ability to change line heights, a host of international character sets, and full graphics capability! All this for what price?

Being reasonably versed in the art of Wordstar, it was not long before I was experimenting with the different ways of making the MX-80 sing and dance from within a document file. I have also spent some time heavily involved with the Osborne 1 and decided that the combination of these three world leaders required further investigation.

Let’s start with the MX-80. Figure 1 shows some of the different print options available. If you find one of the options so pleasing that you would like to use it all the time, the best approach is to modify the printer internally. Refer to the section in your Operation Manual entitled ‘Setting the DIP Switches’. Take it slowly and you should find this a simple matter.

It would be nice, however, if you could get the MX-80 to obey your will by selecting the different print options whenever you desire. The way you do this is by sending a sequence of control characters to the printer while it is turned on. The different characters determine the different print options. When you turn the printer off and back on again it resets itself back to normal.

You can send these characters directly from the keyboard of your computer (in this case a Wordstar). Or you can send them from within a program (in this case Wordstar).

**Direct from keyboard**

I suggest this method for experimental purposes initially. Load your Wordstar disk and then return immediately to the operating system by typing X. The CP/M prompt A> is displayed on the screen. Now type ^P and <CR>. The printer should have jumped into action. From now on, everything you type at the keyboard will be sent to the printer. Let’s tell it to print everything in emphasised mode. Type <ESC> E <CR>. Some gibberish will appear on the screen and on the printer — don’t worry about this. Now type ^P and <CR> again. This stops your typing being sent to the printer. Return to Wordstar by typing WS <CR> and away you go!

Anything you now type will appear in emphasised mode. Remember, by turning the printer off you set it back to normal. To select other print options, merely enter the correct sequence of characters instead of <ESC> E above. Table 1 gives the correct sequences to be sent for each different option. To choose one print option while using another, you first have to deselect the one in use. The simplest method is to turn the printer off or send <ESC> @ to initialise the printer.

Try experimenting with some combinations. In particular send the combination <ESC> S ^A <ESC> A ^F. This combination is ideal for those terms and conditions you don’t want anyone to read.

The table also includes the sequence of characters which turns off the paper end detector. With this off you can feed single sheets through without that blasted buzzer sounding and the printer stopping half way down the page.

**Direct from Wordstar**

Of course, the ideal solution for a user of Wordstar and the MX80 would be the ability to select the printer’s options while creating a document. Hence enlarged titles, emphasised subtitles, condensed tables, etc, could all be chosen at will, to enhance the presentation of the text. We have seen how print options are selected and deselected by sending a unique sequence of characters to the MX-80. These sequences can be sent from within Wordstar and the ^P menu provides a true underline instead of dashes and a stronger impression on the paper. The print speed is reduced to 50 cps.

This line demonstrates true superscript printing.

This is the normal default printing mode. Here the MX-80 prints at 80 cps and produces 6 lines per inch. This mode is usually used for fast draft printing.

This is condensed mode which will print up to 132 characters on A4 paper. It’s jolly useful for financial reports.

These are double printed characters. They are different to WordStar ‘PB characters because the printer offsets slightly on the second pass of the head.

This is emphasised printing. It gives an even stronger impression on the paper. The print speed is reduced to 50 cps.

This line demonstrates true superscript printing.

Some enlarged printing

The MX-80 has its own underlining facility. It provides a true underline instead of dashes and you don’t have to fill in the spaces manually!

Most combinations are possible. One of the most interesting is Enlarged/Condensed. It produces 66 columns on A4 paper.

This is a combination of Double Printing and Emphasised. Find the dots in this one!

Fig 1 Some examples of MX-80 print options.
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CP/M; Digital Research DataFlex; Data Access.
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OEM, SYSTEM HOUSE AND DEALER ENQUIRIES INVITED.
The Osborne function key template.

Table 2: Memory addresses for available ASCII options.

<table>
<thead>
<tr>
<th>Option</th>
<th>Memory Address</th>
<th>Memory Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toggles</td>
<td>06CP</td>
<td>D or E</td>
</tr>
<tr>
<td>Y (select)</td>
<td>06AD</td>
<td>D or E</td>
</tr>
<tr>
<td>Y (deselect)</td>
<td>06E2</td>
<td>A or N</td>
</tr>
<tr>
<td>T (select)</td>
<td>06E2</td>
<td>A or N</td>
</tr>
<tr>
<td>T (deselect)</td>
<td>06E2</td>
<td>A or N</td>
</tr>
<tr>
<td>D</td>
<td>06BA</td>
<td>N</td>
</tr>
</tbody>
</table>

Table 3: MX-80 print options with the associated select/deselect HEX sequences.

1: ^FXD^PX
2: ^FSX^IX
3: ^FSX^IX
4: ^FSX^IX
5: ^FXD^PX
6: ^FXD^FX
7: ^FXD^PX
8: ^FXD^FX
9: 070D

Table 4: Osborne function key configuration.

- **^FXD^PX**
- **^FSX^IX**
- **^FSX^IX**
- **^FSX^IX**
- **^FXD^PX**
- **^FXD^FX**
- **^FXD^PX**
- **^FXD^FX**
- **070D**

Options are supposed to do. Just look upon them as sequences of characters being sent to the printer. By changing these sequences, we can decide what the relevant menu options will be. I have decided that the easiest way to do this is by using DDT. For Osborne users, DDT is located on your CP/M utilities diskette. We are about to mess about with the Wordstar program itself. Don't do this on your master diskette. Make a copy.

Before we begin, there are some things we need to be aware of. Wordstar is stored on disk in hex code. One hex character is in fact represented by two normal characters. Hence 1B 00 2D 6C represents four hex characters. Each cell of your 64k memory has a unique address. These addresses are also represented in hex. Typical addresses might be 06DD 0799 and 06CF. DDT gives you the ability to:

1. Load a program into memory, putting each hex character into its own individual cell.
2. Locate and change particular hex characters by telling DDT which cells they are stored in (the unique hex address) and
3. Write the modified program back to disk.

We are now going to change the sequences sent when options Q, W, E, R, A, N, V, T and Y are chosen from the ^P menu. It is important to note that the first six options send only one sequence to the printer whenever they are chosen. Option Y is a toggle. The first time it is used it sends one sequence to select the option. The second time, it sends another sequence which deselects the option. Options V and T are also toggles, but just a trifle more complex. They were originally designed to raise or lower the carriage of the printer half a turn. This gives somewhat compromised superscripts and subscripts. They work in conjunction with each other by sending the same sequences from the same memory addresses — only the opposite way round. V raises the carriage the first time it is chosen, and lowers it the second. Vice versa for T. We now have true superscripts and subscripts on the MX-80. There is no need to merely raise or lower the carriage, and I can't think of any two operations we could usefully combine in this way. We are stuck with only being able to use one of either V or T. The other is redundant.

Table 2 gives the start addresses of the sequences sent when choosing ^P options. Table 3 gives the sequences we need to send to select or deselect the associated MX-80 options. As an example, let's make ^FQ turn on emphasised printing and ^PW turn it off.

Load your CP/M utilities disk (drive A) and your copy of Wordstar in drive B. Type DDT B:WS.COM <CR>. The following message appears on the screen:

```
DDT VERSS 2.2
NEXT PC
3F00 0100
(I don't know what it means either!) Now type SECO <CR> (the address is actually .06C9 but leading zeros can be ignored).
```

The screen will now display what currently resides in this memory address. To change the sequence we first enter the number of hex characters in the new sequence and then the sequence itself. Type 02 <CR> (the number of characters) 1B <CR> 45 <CR> (the sequence). Type X <CR> to finish. The same goes for W. Type S6CE <CR> 02 <CR> 1B <CR> 46 <CR> and X <CR> to finish. A ^C brings us back out of DDT to the CP/M prompt. To overwrite changes on disk type SAVE 62 B:WS.COM. Now load Wordstar in drive A. Prepare and print a document using ^P and ^W somewhere within. Exciting so far?

As we've discovered, the MX-80 is extremely versatile. To use all the options in Table 3 we would have to include 22 different sequences within Wordstar. We can include only 10, so some compromises are called for. Combining the information in Tables 2 and 3 with the above procedure will enable you to allocate the available ^P characters to the options of your choice. I found the decision of what to include and what not to include an extremely difficult one to make. I decided to opt for maximum flexibility, which meant choosing lowest common denominators. These basic choices could be combined to provide even further options with a few more key-strokes. I waved goodbye to superscripts and subscripts, as I would use these least of all.

True MX-80 underline was a must — this is so superior to broken dashes. Line heights I chose to control directly from the keyboard and outside Wordstar. Before printing, either single or triple spacing can be selected. The same applies to configuring the printer for single sheets.

Table 5 shows my final solution. Wordstar also enables you to include an end of print sequence. This is located at memory address 06F8 and is normally used to set the printer back to its normal default values. I left this and used the scientific method (when in doubt, turn the printer off and back on again). Most of my work I prepare ragged right. I don't usually include page numbers. I never use hyphens at the end of a line and I find it useful to be able to produce computer zeros (0). You may also find it useful to use Wordstar with INSERT off. The following are the memory addresses and patches to produce a Wordstar with the necessary defaults.

- **^PO** Condensed ON
- **^PO** Condensed OFF
- **^FE** Enlarged ON
- **^PR** Enlarged OFF
- **^PA** Emphasised ON
- **^PA** Emphasised OFF
- **^PT (select)** Double Strike ON
- **^PT (deselect)** Double strike OFF
- **^PF (select)** Underline ON
- **^PF (deselect)** Underline OFF

Table 5 Allocation of options.
Superfile is another CP/M based data management system, constructed rather differently from most of those I’ve reviewed in this series. Instead of a fixed record structure, in which every record must have the same number of items of the same size even if in a particular record there are empty fields, Superfile uses a storage method which allows records to differ widely in structure within the same file. This is achieved by storing item names — called ‘tags’ in Superfile with the associated value(s) within each record. This flexibility makes it more likely that you will be able to manage with just one file to hold all your data on one application — though for all but a command driven package more specific than is usual in Superfile about which tags you will most often use to retrieve data.

The adding of data items and tags can be achieved easily with this approach, so there is no need to copy a complete file if you simply want to add a data item. Since the records essentially have no structure, the need for copying files to change their structure does not arise either. The storage of tags within files also permits Superfile to use a compressed storage format, in which items with null values need not be stored, and this may save a lot of space (more than enough to make up for the space the tags take in the records) if you have ill-structured records. However, even if this trade-off does work in your favour, you will still need to consider some side-effects of this method of storage — for instance in the display of information from long items.

Superfile is itself simply a package for storing and retrieving data in a straightforward line-by-line format, with no formatting. It is complemented by Superforms, a form design-package, and SuperTab, which allows the generation of formatted printed reports. All three functions are accessed by loading Superfile’s overall control program, and then requesting the particular facility you need. Under this control program you can access all the CP/M commands except SAVE, so you can get directories of files, delete files and so on within Superfile. You can also create files of commands (which may be either Superfile or CP/M commands or a mixture of both) to be executed with a single SUBMIT command, just as in CP/M. This is important, as the command-based access to Superfile, interfaces are provided to Microsoft Basic, to Whitesmith’s C and to assembler; the supplier, Southdata, which is based in London, will write interfaces to other languages on request, I understand free of charge. However, I think a user would need to be an experienced programmer to understand the interfacing process. You would need a program to read in data from outside Superfile, or to make connections between different Superfile data files.

**Data access**

All access to data, whether for reading or writing, is achieved either through the LOOK command or through Superforms. The LOOK command simply displays records by listing them on the screen, one item per line, for more sophisticated formalisation. Normally all tag values are indexed; to index an item, Superfile takes the first word in the item of more than two characters, and reduces it to a three character term consisting of the initial letter and a phonetic representation of the remainder. Thus, in an item consisting of more than one word, you cannot choose to have other words indexed — you must split the item up to get the first word indexed. This will fit. In Superfile this is achieved by the creation of minor indexes, each using only those tags needed for a particular use of the file. If necessary, this minor index file can be given the name of the standard index file, and thus automatically be used by Superfile when accessing data, without explicit instructions. In this mode, Superfile’s method of indexing works very similarly to packages like dBASE II which allows you to have several indexes in use at one time, although the ability to control the size of the memory available for indexing is unusual.

A tag may occur more than once in a record — for instance, if you store personnel records which may include two or three Christian names for each individual, you may use the same tag for each. So a request for people called John would find all those whose name was John whether this was their first, second or third name. This is achieved with one request matching which in most packages require the combination of requests with OR (is XNAME1 equal to John or XNAME2 equal to John, or XNAME3 equal to John?) — which is just as well, as Superfile has no method of ORing requests for matching, and can only combine them with AND. All matching is ‘case-blind’, for instance, a request to match John would also match JOHN.

When data is added to data files, the index is not automatically updated. Updating occurs when the TIDY command is issued; TIDY reorganises the main index and integrates all amended or added information in one operation. This can take some time. If required, TIDY can be used with a minor index instead of as well as the main index. After information has been added, but before a TIDY is done, Superfile accesses new data by reading the file of new data sequentially.

**Constraints**

Superfile can handle files up to the CP/M maximum (currently 8 megabytes). The maximum record size is variable within Superfile; initially it is set at 1024 characters, but this can be changed by the user. A record may contain just one field if you wish, or it may contain up to 150 fields in the version of Superfile normally distributed to users; this limit can be changed by Southdata on request. The number of tags in one file is limited to 250, and this limit cannot be changed.

Data may be alphabetic or numeric in form; there is no special data format, so dates must be stored either as three separate items or in year/month/day order if comparisons are to work properly. Numbers are always stored in character format, but may be defined as integers, money numbers or fixed point numbers of a particular precision, and these definitions used to check data when inputting via the forms package.

**File creation**

The most common way of using Superfile is to have just one file containing all the data, since records do not have to be all of the same format. So, unless this pattern is inappropriate, the user does not need to worry about explicit file creation. To put data in a file, you must first use the LOOK command to set up tags for all those items which you will want to index. You can then simply type in a record using the LOOK command to set up tags for all those items which you will want to index. You can then simply type in a record using the LOOK command, or devise a screen form and fill that in with data. Records may be added, amended or deleted; deleted records may be restored provided you have not yet carried out a TIDY. Since the process, whether using LOOK or a form, is exactly the same for all files, and for simple display, I shall describe it under ‘Display’.

**Displaying data**

The LOOK command expects each new record to be typed in the form ‘tagname=value tagname=value’. Since this involves typng the tag name for each item in each record, you are unlikely to want to use this method for large volumes of data. The alternative is to design a form using the Superforms package. This involves supplying a caption and a data space for
each item; these can be anywhere on the screen. Then you are asked what tag, if any, to associate with each item in turn. You can also indicate a wide variety of options, to be used when the form is displayed either to add records or to access them for updating or reading. These include the ability to restrict the value of a particular item to the elements of a list (for instance, to ensure that days of the week are filled in correctly), to validate an item to ensure that it is within a particular range, and to calculate an item either from constants or from the values of other fields. You can copy from one field to another within a record, and you can specify a 'stay-put' value for a field to be constant across all records.

Items may appear on just one screen line; if an item has more than 80 characters less its caption, then another line can be used for the rest of the item and both lines given the same tag. However, in some circumstances such information may not be retrieved in the order in which it is stored, so you could have line 1 of an item appearing on the form after line 2 when the record is retrieved. This may happen when the user takes the option to store information in the compressed form, which takes up less disk space, but at the fact that items with null values do not have to be stored.

You may have as many different forms as you wish. These are single-recorders. Since a form may display a subset of the items in the records in the file, you can use one form for editing data and another for display. You can also use different forms for particular purposes — for instance using a form without confidential salary information for display to someone who is updating an employee's record. Selections

Selection

The simplest feature of Superforms is the capability to tailoring and selecting records. The first line of the Table of Contents...

Stability and reliability

I did manage to abort once with CTRL/C (though only back to Superfile's control level). I have also talked to a user who had some problems with Supertab a few months ago but who is now happy with his package. There are, though, some features which should help with data file integrity — for instance the file is automatically closed and re-opened after each write operation.

User image

The user image of the software itself I found reasonably straightforward, though there were some less pleasant features — for instance the use of arbitrary item names within Superforms to compensate for the fact that a tagname may appear more than once within a record. However, this straightforwardness was recognised only after a long and dozy struggle with the manual, and with the help of a demonstration version, with a maximum of 20 records (is Surname equal to Smith?) for items whose tags are in the index, otherwise a sequential search is used. A search with LOOK will, if prefaced by a pound sign, give the number of records matching the selection criteria. You can also use code numbers to match partly-known item values; for instance, a request to find John* would match all surnames such as Johns, Johnson, etc (and also JOHNSEN, since matching is case-blind).

A single-character wild code can be used where you are uncertain only about one letter; John? would only match Johns (or John). If you don't remember how to spell an item, you can use a 'sounds-like' facility, which will, for instance, retrieve Jon as well as Johns if you ask for names which sound like Johns. (Don't expect too much of this, though; three characters-worth is not very much to produce a reliable Soundex-type matching.) For numbers, you may ask for items which are greater than or less than a constant. If you don't remember which tag to use, you can leave the tag name out. But all these inexistant searches must, of course, read every record and will therefore be slow for large files.

All selection terms are ANDed together, and only those records which match them all are selected. You cannot use OR or NOT to combine terms in selections.

No sorting is provided in the release of Superfile. Although there are plans to include sorting in the Superfile package.

Calculations

Calculations can be performed within records as part of input or look-up, or across records in the file, using a module called CFORM to create forms and a module called FORMS to handle information using forms. The first line of the CFORM's chapter reads "To load FORMS, enter SUPERFILE [sic] (s1.1) and type "FORMS"..." Needless to say, it doesn't work like that (perhaps it would be even worse if it did). However, the lack of proof-reading also provided a little relief — where else would you find that "The detail of interfacing Microsoft Basic 80 to Superfile [sic] is handled automatically..."

Costs

Superfile costs £175 alone, and Superforms and Superfile cost £75 each; these are all single-user versions. A multi-user version is also available for £800. I should have liked the opportunity to test that out, as there are very few true multi-user data management systems around.

Conclusions

At £325 for the total package, Superfile is pretty competitive with those file management systems, such as DMS and dBASE II, which use a more structured approach but which have a wider range of facilities; while Cardbox, which also uses an unstructured approach but which can't do calculations, costs only £155. There are a lot of good ideas in Superfile, and if you have data which doesn't have much structure and if you can cope with the limitations I've described (especially the manual), then it would be well worth investigating. I should add that as yet I've only been able to test the demonstration version, with a maximum of 20 records, so potential buyers should, as always, make sure to have their data file stored on a sizable file. Finally, the originator and supplier, Southdata, is a London based British company, which may make for better support than some.
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Or Computing on Thursday 13th January.

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in the design of a computer that overcomes
the key limiting factors in the current generation's architecture.

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BCC RESTARTER

Although the BBC micro has no equivalent of the Microsoft command CONT, restarting a program which has been halted (eg, by accidentally hitting the 'escape' key) can be achieved by using GOTO. I do not know what restrictions apply to this, but certainly if only the variables A% through Z% are used there is no reason why it should not work. Indeed I have experienced no problems in restarting programs using other variables, however I do not know how lucky I have been in this.

Nicholas Phizackerley

ATOM VARIABLE LISTER

This simple program will print out the values of the integer variables A-Z, and will wait for a key to be pressed before returning to the main program.

Before entering it, type 

?NAME=VAR LIST; 2800

and type this if you press BREAK while entering it. To save it onto tape, use

*SAVE "VAR LIST" 2800

The line numbers of the DATA statements are arranged so that a simple expression can relate the required DATA statement to the month number. Statement 300 uses this expression to set the READ pointer so that statement 400 retrieves the corresponding days in the month and month name.

The technique is especially useful with tables containing mixed data types, and variable length strings, as shown. Considerable space and effort are saved over the traditional method of setting up dimensioned arrays.

Mike Kerry

SPECTRUM LOOK-UP TABLE

The Spectrum Basic includes the READ, DATA and RESTORE verbs. The manual only shows RESTORE followed by a line number — however it will in fact accept an expression. This provides the basis for a fast and economical table look-up technique. The following example illustrates the method:

50 REM month table look-up
101 DATA 31, “January”
102 DATA 31, “February”
103 DATA 31, “March”
104 DATA 30, “April”
105 DATA 31, “May”

This is the trick by which many VIC games provide such good graphics, and I hope that PCW readers will find it just as effective.

Nicholas Weeds

VIC IN HIGH-RES

Here is a tip for anybody with a VIC computer who wishes it had high resolution graphics. The solution to this problem is to redefine the character set to include the patterns required. Normally, the character definition table is held in ROM, and consists of 256 8-byte entries (one for each character), each bit corresponding to one pixel in an 8 by 8 grid. The best way to explain this is by using an example: let’s take a Space Invaders character. This fits on to the grid as shown.

Thus the code for this character is: 60,126,219,255,102,60,129,100

Of course, this wouldn’t help much, except that by poking location 36869 (one of the registers in the VIC chip), the computer can be made to expect the character table to be in RAM. The precise details are:

CONTENTS OF LOCATION 36869

525
523
524
524
525
523

ADDRESS OF CHARACTER TABLE IN RAM

4096
5120
6144
7168

“special setting”

The address shown is the starting address of the table, which in the first three cases would be 2k long. The value 255 is a special setting which allows the first 128 characters to be defined by the user, but which keeps characters 128 to 255 as the usual first 128 characters (ie character 128 is ‘@’, character 129 is ‘A’, etc).

So, to set up your own character set, POKE the table into memory at one of the above addresses, then POKE the location 36869 with the correct value, and afterwards the new characters can be printed just as if they were the originals.

This is the trick by which all the fancy VIC games provide such good graphics, and I hope that PCW readers will find it just as effective.

Mike Kerry

ATOM HI-RES POINT TESTER

This short subroutine will test the state of any point on the mode 4 hi-res graphics screen. The variables X and Y are used to pass the co-ordinates of this point to use subroutine, and the variable P is set to 1 if the point was set, or 0 if it was clear (black).

Mike Harrison
SPECTRUM FLASHY LISTINGS

It is not widely known that ZX Spectrum listings can incorporate colour commands (and indeed OVER and BRIGHT) as well as INVERSE VIDEO. I suspect that the feature is a happy accident of the machine’s logical structure for these attributes — but it allows you to produce pretty listings!

The entrance to those effects is to go into extended mode (E) after the line number. You can do this at any stage — on first entering the line, or when using EDIT. We then employ the number keys, shifted or unshifted to get the effects.

These data are set out on Pages 114/5 of the User Guide. The best way to explore them is to set up a little program of a dozen or so effects:

1. Then employ the number keys, mode (E) after the line number.
2. Inserting more than one such code after a given line number.
3. Inserting one or more at the end of a line.
4. Adding a REM message in inverse in one line, and using ENTER without returning first to TRUE VIDEO.
5. Inserting these codes within the REM message.
6. Doing the same with a

PRINT’ statement.
7. Seeing the effect of resetting PAPER and INK by direct commands before listing. And even INVERSE 1 and/or FLASH 1
8. Try RUN occasionally of course — strange that such flashy listings have little effect on the display when the program is executed!

After a while playing around with these ideas, you should see lots of uses. These include:

a) producing an invisible listing (even when EDIT is attempted);

b) highlighting REM or other statements, perhaps to remind you to check something later;

c) highlighting whole sections of program.

One little note — although (unlike the case of the BBC computer), these control characters do not take up screen space they do take up memory. In fact each E-mode character code takes two bytes, the same as if got direct from the keyboard.

How to restore normality and what happens if you POKE out a REM, I’ll leave you to investigate these ideas:

b) highlighting REM or other statements, perhaps to remind you to check something later;

c) highlighting whole sections of program.

SPECTRUM SCREENS

When writing interactive graphic games for the ZX Spectrum one often has difficulty when using user defined graphics (UDG) because the SCREENS function returns the empty string.

I have written a small machine code subroutine which compares a character on screen with the characters stored in ROM (as SCREENS does) and RAM (ie, UDG).

To use the subroutine type and RUN the program given (48k Specturm owners may wish to change lines 1 and 10 to load the sub-routine higher in RAM). The variable P must be declared before any variable or string in the program as the sub-routine assumes it to be there.

To PEEK a given position return the variable P (which must always be a whole number) with the screen position to be tested, then call the subroutine — ie, LET P=POKE[+32+column]: LET x=USR Peek. The value returned to x is the code of the character at the given position. Character codes 32 to 127 and 144 to 164 are recognised. Sinclair graphics codes 128-143 are not recognised — but if required UDG can be programmed to Sinclair graphics.

PET DO-UNTIL

Most programmers are concerned about making well-structured programs. In Basic, structuring is very difficult as the language lacks the required control commands. This program for the PET with Basic 3.0 gives a DO/UNTIL structure. It resides in the second cassette buffer and has full error checking. DO/UNTIL may be nested to any degree so long as there is sufficient space on the stack.

To enter the program, type SYS 1024 to get into the monitor, then type, after the full stop prompt, code in Table 1. After the colon there is a double space, but all the other spaces are single.

The code may be saved on tape using a save command in the form S”DO/UNTIL”,”01,”033A, 03FA. To initialise the monitor, then type, after the colon there is a double space, but all the other spaces are single.

The mode can be changed by tape using a save command in the form S”DO/UNTIL”,”01,”033A, 03FA. To initialise the mode, type: 0079 4C 3A 03

— not forgetting the double space after the colon. To disable the routine use: 0079 C9 3A B0.

Using the structure is simple. Its basic form is DO: (instructions) : UNTIL (number). The instructions are carried out at least once, but are repeated if the number after UNTIL is zero. The number may be a constant, variable, function or condition.

Remember that a condition that is true returns -1, and that is false returns zero. An example of a condition in a DO/UNTIL loop is DO: GET AS: UNTIL AS=-“X”. The action is obvious from reading the code.

So much for DO/UNTIL — but has anyone got a routine for a proper IF/THEN/ELSE?

J D Slodzni

<table>
<thead>
<tr>
<th>Key</th>
<th>Unshifted makes listing</th>
<th>White shift gives</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>black paper</td>
<td>black ink</td>
</tr>
<tr>
<td>1</td>
<td>blue paper</td>
<td>blue ink</td>
</tr>
<tr>
<td>2</td>
<td>red paper</td>
<td>red ink</td>
</tr>
<tr>
<td>3</td>
<td>magenta paper</td>
<td>magenta ink</td>
</tr>
<tr>
<td>4</td>
<td>green paper</td>
<td>green ink</td>
</tr>
<tr>
<td>5</td>
<td>cyan paper</td>
<td>cyan ink</td>
</tr>
<tr>
<td>6</td>
<td>yellow paper</td>
<td>yellow ink</td>
</tr>
<tr>
<td>7</td>
<td>white paper</td>
<td>white ink</td>
</tr>
<tr>
<td>8</td>
<td>normal brightness</td>
<td>flashing off</td>
</tr>
<tr>
<td>9</td>
<td>bright</td>
<td>flashing on</td>
</tr>
</tbody>
</table>

Any unrecognised character returns a 0'. A 1' is returned if there is an error in p (ie, too large or not a whole number).

Gerard A Allan

1311 209113 JSR 1391
1391 AD0302 LDA 1399
1394 F003 BBQ 1399
1396 4CEBFB JMP FCEFB
1399 20EAFC JSR PCEA
139C C91C CMP =C
139E D013 BNE 1383
13A0 A908 LDA -08
13A2 20EFFF JSR FEEE
13A5 A920 LDA 1390
13A7 20EFFF JSR FEEE
13AA A908 LDA -08
13AC 20EFFF JSR FEEE
13AF 68 PLA
13B0 68 PLA
13B1 A95F LDA+S
13B3 60 RTS

PCW 156
GENE LOWER CASE

Users of the Video Genie will know how it signs up with 'BAD PROGRAM' instead of the more usual 'MEMORY SIZE' question. Also the screen scrolls 26 times instead of giving the message 'BAD PROGRAM'.

There is no control key on either the TRS-80 or Genie, or 'RADIO SHACK LEVEL II BASIC'.

The way to get round this is as follows:

1) REM X=3 DIGIT NUMBER
20 LET u=x-INT(x/10)*10
30 LET h=x-INT(x/100)*10
40 LET t=INT((h-INT h)*10)
50 LET u=t-INT(t/10)*10
60 PRINT "Hundreds=";h;
70 PRINT "Tens=";t;
80 PRINT "Units=";u;
90 END

To get an untouchable line, type the following command line in whatever is used (ASCII, etc.)

13:P.

A=?E04:REP.A=A+1.?A=

If, for example, this returns the value 61 then type:

?E00=61010000

<TURN> and try the kludge again. All will now be well, but make sure you fix any subtle errors which may have occurred in the listing before RUNning it.

ZX SPECTRUM BUG

I recently had the rather dubious honour of finding what I believe to be the first ZX Spectrum software bug (you'd be lucky - Ed.). I stumbled across it when writing a short routine for a friend to extract the hundreds, tens and units from a three digit number. The routine was as follows:

10 REM X=3 DIGIT NUMBER
20 LET u=X-INT(X/10)*10
30 LET h=x-INT(x/100)*10
40 LET t=INT((h-INT h)*10)
50 LET u=t-INT(t/10)*10
60 PRINT "Hundreds=";h;
70 PRINT "Tens=";t;
80 PRINT "Units=";u;
90 END

To amend line 40 to:

40 LET t=INT (h-INT(h)*10)

... will not go away. If you wish to recover at least something, then try typing the following as a command line — ie, one without a line number. (Any lines starting with a number would be fatal at this stage).

A=<E00:REP.B=A:3:
1:A:F=
10:ELSEU.TRUE.A=B;U0
15:ENDIF

When the prompt returns type: END <RETURN>. You should then be free to LIST the remaining if slightly corrupted, part of the program.

Note: without a line number the value 61 may be used as an alternative.

M J Tubby

Table of alterations to Video Genie ROM:

<table>
<thead>
<tr>
<th>Old location</th>
<th>New location</th>
<th>Instruction</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0059 14</td>
<td>0059 14</td>
<td>ASCL value for shift</td>
<td>ASCL value for shift</td>
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<tr>
<td>0105 52</td>
<td>0105 52</td>
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<td>'W'</td>
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<td>0106 45</td>
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<td>0107 49</td>
<td>'I'</td>
<td>'I'</td>
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<td>0108 44</td>
<td>0108 44</td>
<td>'B'</td>
<td>'B'</td>
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<tr>
<td>0109 59</td>
<td>0109 59</td>
<td>'H'</td>
<td>'H'</td>
</tr>
<tr>
<td>010A 00</td>
<td>010A 00</td>
<td>'Shift characters'</td>
<td>Shift characters</td>
</tr>
<tr>
<td>010B 00</td>
<td>010B 00</td>
<td>'R'</td>
<td>'R'</td>
</tr>
<tr>
<td>010C 00</td>
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<td>010D 00</td>
<td>010D 00</td>
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<td>010E 00</td>
<td>010E 00</td>
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<td>'Z'</td>
<td>'Z'</td>
</tr>
<tr>
<td>0110 00</td>
<td>0110 00</td>
<td>'Message terminator'</td>
<td>Message terminator</td>
</tr>
<tr>
<td>0111 00</td>
<td>0111 00</td>
<td>'Sign up message 26 times carriage return</td>
<td>Sign up message 26 times carriage return</td>
</tr>
<tr>
<td>0112 00</td>
<td>0112 00</td>
<td>'Go Genie, or RADIO SHACK LEVEL II BASIC'</td>
<td>Go Genie, or RADIO SHACK LEVEL II BASIC</td>
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<tr>
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<td>0125 00</td>
<td>'Carriage return'</td>
<td>Carriage return</td>
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<td>0126 00</td>
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<td>message terminator</td>
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<td>'Send'</td>
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<tr>
<td>0473 00</td>
<td>0473 00</td>
<td>'A?B+1=255 &lt;RETURN&gt;'</td>
<td>A?B+1=255 &lt;RETURN&gt;</td>
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<td>0474 00</td>
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<tr>
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<td>0476 00</td>
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<td>REM X=410</td>
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<td>0477 00</td>
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<td>REM X=410</td>
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<td>0478 00</td>
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<td>REM X=410</td>
</tr>
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<td>0479 00</td>
<td>0479 00</td>
<td>'REM X=410'</td>
<td>REM X=410</td>
</tr>
<tr>
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</tr>
<tr>
<td>047B 00</td>
<td>047B 00</td>
<td>'REM X=410'</td>
<td>REM X=410</td>
</tr>
<tr>
<td>047C 00</td>
<td>047C 00</td>
<td>'REM X=410'</td>
<td>REM X=410</td>
</tr>
<tr>
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<tr>
<td>047E 00</td>
<td>047E 00</td>
<td>'REM X=410'</td>
<td>REM X=410</td>
</tr>
<tr>
<td>047F 00</td>
<td>047F 00</td>
<td>'REM X=410'</td>
<td>REM X=410</td>
</tr>
</tbody>
</table>

ZX SPECTRUM RAM OCCUPATION

I have found a way to find how much memory your program and variables are taking up in RAM. Also I have found a way to create an untouchable line (useful for copyrights). Both these routines are for the ZX Spectrum. To find out the memory used, type in PRINT (PEEK 23641+256*PEEK 23642)+10 ( .01*h=int(h)*10) which will ensure that the value is rounded up. Such a 'fudge' is irritating and should have been unnecessary.

Another Spectrum quirk but in this case useful is demonstrated by:

PLOT 128,87:DRAW 20,20,780 which will 'fill' a circle. Other high values for the third DRAW parameter give equally unusual results. Setting OVER also makes for an interesting effect.

Larry Carasco

David Julien-Waring

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Larry Carasco

Mark Sanderson
ATOM 'BEEPTAPE'
A considerable frustration for many Atom owners is the lack of a useful 'end of operation' indicator for cassette loading and saving. The only present indication of successful completion is the all-too-silent, and easily overlooked, re-emergence of the screen cursor.
This routine cures the problem by providing an audible 'beep' signal on completion of load and save operations, which repeats until a key is pressed. For good measure, a clearer, visual indication is also provided in the shape of the inverse-video message, 'END OF TAPE TRANSFER'.
To assemble the program, simply type "RUN". I recommend assembling the code starting at #2800, out of the way of normal basic text space. However, line 90 allows an alternative starting address to be entered, if desired. The program automatically advises you how best to save the machine code (see line 370). Line 380 tells you how to re-initialise the new operating system vectors, which needs to be done should you press BREAK. These vectors are automatically initialised for you if the assembled machine code is loaded using the '"RUN' command.
To appreciate the benefit of this small routine, try it the next time you perform a long LOAD or SAVE. Instead of developing square eyes waiting for the re-emergence of the screen cursor, you can safely get on with something more useful, like writing your next masterpiece!

V. Fojut

PET TO REAL-ASCII
For Old ROM PET 2001, this machine-code converts PET ASCII to real-ASCII if characters have to be sent to a printer (device nr 4).
When printing to the screen nothing is changed. Strings in PET are never changed. The program was developed to be able to print lower case characters on an ASCII printer (Epson MX 80 with a standard IEEE-interface).
When loaded any PRINT command can be replaced by SYS (826)AS SYS (826)AS(X,Y)
SYS (826)A
SYS (826)(X,Y)
SYS (826)any expression.

Robert de Rooij

100 REM CONVERTS PET-ASCII TO REAL ASCII
110 REM FOR PET 2001 OLD ROM TO EPSON MAB
120 POKE 94968,14
130 REM AUTHOM R DE ROOIJ
140 REM MELB STOKESTR 35, 5013 BK TILBURG/HOLLAND
150 REM IDEA DERIVED FROM A PROGRAM
160 REM ON PAGE 143 BEST OF UK COMMODORE PET NEWSLETTER
170 REM ATTENTION: DEVIDENCUMBER MUST BE "4."
180 REM STRINGS IN PET ITSELF ARE NOT BEING CHANGED.
190 REM ON THE SCREEN YOU ALSO CAN PRINT BY TYPING THE COMMAND
200 REM SYS (826)A INSTEAD OF PRINT AS, AS NO
210 REM CARRIAGE-RETURN IS GENERATED.
220 REM PROGRAM WORKS FOR ALL EXPRESSIONS (NUMEROUS AS WELL AS STRING).
230 REM IF IT WORKS FOR SIMPLE VARIABLES AND ARRAYS.
240 REM SET PRINTER ON-LINE WITH OPEN4,4:CMD4
250 REM ALL ASCII-VALUES, HIGHER THEN 127 ARE DECREASED BY 96.
260 REM THE CODE IS FULLY RELOCATABLE WITH ONE EXCEPTION.
270 REM DURING PROGR.MODE AS WELL AS IN DIRECT MODE.
280 REM YOU CAN, AT ANY TIME, CALL FOR SYS(826)A$ INSTEAD OF PRINT.
290 REM ON THE SCREEN YOU ALSO CAN PRINT BY TYPING THE COMMAND
300 REM STRINGS IN PET ITSELF ARE NOT BEING CHANGED.
310 REM ATTENTION: DEVICENUMBER MUST BE '4'.
320 REM THE CODE IS FULLY RELOCATABLE WITH ONE EXCEPTION.
330 REM YOU MUST CHANGE THE UNCONDITIONAL JUMP IN LINE 858.
340 REM THE CODE IS FULLY RELOCATABLE WITH ONE EXCEPTION.
350 REM ALL ASCII-VALUES, HIGHER THEN 127 ARE DECREASED BY 96.
360 REM THE CODE IS FULLY RELOCATABLE WITH ONE EXCEPTION.
370 REM DURING PROGR.MODE AS WELL AS IN DIRECT MODE.
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In my time continued fractions were not done at school, so I'll explain briefly this remarkably easy to understand concept which may well have been known in antiquity, and which has ramifications in many branches of higher mathematics.

Any (real) number $X$ has a unique counterpart of the form

$$N_1 + \frac{1}{N_2 + \frac{1}{N_3 + \frac{1}{\ddots}}}$$

with integral $N_i$, either finitely many — when trivially $X = N_i$ or when $X$ is just a common fraction, i.e., rational — or else the 'continued fraction' (technically called 'simple' since all its 'numerators' are 1) goes on for ever, like an infinite series.

Take, for example, $X = 2.285714 \ldots$, which any schoolboy will tell you is equal to $16/7$. To work out its CF:

$$\sqrt{167} = 2 + \frac{1}{2 + \frac{1}{2 + \frac{1}{3 + \frac{1}{1 + \frac{1}{1}}}}}$$

which shows that periodic decimals (being rational) have finite CFs. If, however, you start with a square root like $\sqrt{2}$ we have:

$$\sqrt{2} \approx 1.4142136 \ldots = 1 + \frac{2}{1 + \frac{1}{2 + \frac{2}{1 + \frac{1}{1 + \frac{1}{2 + \frac{1}{2 + \frac{1}{3 + \frac{1}{710678 \ldots}}}}}}}}$$

Considering that we started with an (8-digit) approximation it is a fair guess (and true) that the twos go on ad infinitum — i.e., we have a periodic CF with a 1-digit period, usually abbreviated as $\sqrt{2} = [1,2,2,2, \ldots]$.

In fact, all square roots of integers are periodic CFs, e.g.:

- $\sqrt{3} = [1,1,2,1,2,1,2, \ldots]$,
- $\sqrt{13} = [3;1,1,1,1,6]$,

An important use of CFs follows from the property that, whenever one truncates an infinite CF after any number of terms, a common fraction results which is a 'best' approximation to the infinite CF. E.g.,

$$\sqrt{2} \approx 1 + \frac{1}{2 + \frac{1}{2}} = 1.41667 \ldots \approx \frac{22}{10}$$

$$\approx 1 + \frac{1}{1 + \frac{1}{2 + \frac{1}{2 + \frac{1}{3 + \frac{1}{5}}}}} = 1 + \frac{1}{1 + \frac{5}{1 + \frac{5}{1 + \frac{5}{1}}} = 1 + \frac{1}{1 + \frac{5}{1}}} = 1 + \frac{1}{1 + \frac{5}{1} = 1 + \frac{1}{6} = 1.16667 \ldots}$$

The first of two TI-59 programs is based on a formula of Patz (1941). It displays the list representing the CF of $\sqrt{N}$ (called the list of 'partial quotients') whenever the N is entered and followed by keystroke A. All these lists will be periodic after a certain point, and some periodic CFs will also show other striking regularities first proved by the French mathematician Lagrange (1776).

The simplest periodic CF is $[1,T] = X$, say.

Then

$$X = 1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1 + \ddots}}} = 1 + \frac{1}{x + \frac{1}{x}}$$

### Table: Continued Fraction of $\sqrt{N}$

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Inverse CF Program to recover $X$ from the Continued Fraction of $\sqrt{N}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>76 LBL 032 43 RCL</td>
</tr>
<tr>
<td>001</td>
<td>11 R 033 04 04</td>
</tr>
<tr>
<td>002</td>
<td>99 FPT 035 05 05</td>
</tr>
<tr>
<td>003</td>
<td>98 R05 039 99 INT</td>
</tr>
<tr>
<td>004</td>
<td>42 STO 036 99 PRT</td>
</tr>
<tr>
<td>005</td>
<td>01 01 066 66 PRT</td>
</tr>
<tr>
<td>006</td>
<td>54 RK 038 45 RCL</td>
</tr>
<tr>
<td>007</td>
<td>42 STO 039 05 05</td>
</tr>
<tr>
<td>008</td>
<td>02 02 040 65</td>
</tr>
<tr>
<td>009</td>
<td>59 INT 041 45 RCL</td>
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<tr>
<td>010</td>
<td>42 STO 042 04 04</td>
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<td>011</td>
<td>03 03 043 75</td>
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<tr>
<td>012</td>
<td>98 PRT 044 43 RCL</td>
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<tr>
<td>013</td>
<td>66 R05 045 03 03</td>
</tr>
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<td>014</td>
<td>43 RCL 046 95</td>
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<td>01 01 047 42 STO</td>
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<tr>
<td>016</td>
<td>75 046 03 03</td>
</tr>
<tr>
<td>017</td>
<td>49 RCL 049 33 33</td>
</tr>
<tr>
<td>018</td>
<td>03 03 050 94 94</td>
</tr>
<tr>
<td>019</td>
<td>33 55 051 95</td>
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<tr>
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<td>55 052 43 RCL</td>
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<td>42 STO 053 01 01</td>
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<td>04 04 054 95</td>
</tr>
<tr>
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<td>76 LBL 055 55</td>
</tr>
<tr>
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<td>12 15 056 43 RCL</td>
</tr>
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<td>43 RCL 057 04 04</td>
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<td>026</td>
<td>02 02 058 95</td>
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<td>027</td>
<td>43 RCL 059 42 STO</td>
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<tr>
<td>028</td>
<td>43 RCL 060 04 04</td>
</tr>
<tr>
<td>029</td>
<td>03 02 061 61 GTD</td>
</tr>
<tr>
<td>030</td>
<td>95 062 12 B</td>
</tr>
<tr>
<td>031</td>
<td>063 00 0</td>
</tr>
</tbody>
</table>

Enter X and press A.
hence \((X - 1) (X + 1) = X\), ie, \(x^2 - x - 1 = 0\)

Of this equation \(X = \sqrt{\frac{1}{2} + \frac{1}{2}} \approx 1.62\)

is the relevant root, since \(X > 1\). Many will recognise this equation as the one for the famous ‘Golden Section’, which defines a rectangle with sides \(1\) and \(\approx 1.62\) respectively, and that the so-called ‘convergents’ of \([1;1,1,1,1,1,1,1,\ldots]\), ie, \(\frac{1}{1}, \frac{2}{1}, \frac{3}{2}, \frac{5}{3}, \frac{8}{5}, \ldots\), contain the well-known Fibonacci numbers. (This example also shows that there are periodic CFs which are not just the square root of an integer.)

Having loaded the CF-program into the TI-59, any real number can also be entered — eg, \(\pi\) (with IT \(3.141592654\)), which gives the CF of \(\sqrt{\pi^2}\) = CF of \(n = [3; 7, 1, 292, 1, 1, 1, 2, 1, \ldots]\) accurately to 10 places.

Although unending, no periods or regularities have been discovered among the first several thousand partial quotients of this CF, nor in any other irrational reals excepting square roots and the Euler number \(e = \text{INV In 1}\) and some simple arithmetical formulas based on these two exceptions. (Enter \(e\) and discover a ‘regular’ non-periodic infinite CF!)

The CF of another Euler number called \(\gamma\) (gamma) = the limit \((as n \to \infty)\) of \((1 + \frac{1}{2} + \frac{1}{3} + \ldots + 1/n - \ln n) \approx 0.577\ldots\) has also been calculated to several thousand digits without finding any regularities. This makes it likely by unproven that this number is not rational, but here is one of the famous unsolved problems of mathematics, namely whether \(\gamma\) (gamma) is the root of some algebraic equation or is transcendental like \(e\) and \(\pi\), or is rational after all.

Now to use the inverse CF-program: Enter in sequence the partial quotients of some CF by pressing after each of the first five the keys E,A’,B’,A,B, respectively, then follow further entries by alternating between keys A and B. After any entry and appropriate key stroke the corresponding convergent is displayed, first its numerator, then the denominator. After the first two entries (E and A’), whenever zero is entered and followed by the keystroke which was used last, the decimal value of the convergent reached so far is displayed and the program is reset.

**Examples**

a) \(\pi \approx [3; 7, \ldots]\)
   Enter 3,E; display 3.
   enter 7,A; display 22(PAU/PRT) 7
   enter 0,A; display 3.142857143

b) \(\pi \approx [3; 15,1,292,\ldots]\)
   Enter 3,E; display 3.
   enter 7,A; display 22(PAU/PRT) 7
   enter 15,B; display 333(PAU/PRT)106
   enter 1,A; display 355(PAU/PRT)113
   enter 0,A; display 3.14159292

It is noteworthy that the approximation \(\pi \approx 355/113\), known already in China in antiquity, which is accurate to \(2.7 \times 10^{-7}\) is followed by the unusually large partial quotient 292. Such large PQs in CFs often give a clue to hidden and obscure interrelationships (Churchhouse, 1973).

Regarding the (so far unending) CF of \(\gamma\) (gamma) it is — as for the CF of \(\pi\) — not even known whether the partial quotients have an upper bound, but that they are unbounded for \(e\) was already known to Euler (1701-1783). Finally, the convergents of \(\sqrt{\gamma}\) readily supply integer solutions of the famous PELL equation \(X^2 - N.Y^2 = 1\) (Beiler, 1964) — but that is another story.

**References**


Churchhouse RF: *JIMA*, 1973, 9, 17

Charles Babbage is remembered as the man who nearly invented the digital computer. Working in a pre-electronic age he nevertheless discovered principles which were not put into practice until Von Neumamin in the 1940’s. His mechanical computer was defeated by the lack of precise enough manufacturing techniques. Nigel Holder tells the story.

This is an account of the work of the pioneer of automatic calculating machines, Charles Babbage. His Difference Engine and Analytical Engine will be discussed. The emphasis is mainly historical, and as such there will be no detailed descriptions of how the machines work. A general overview of the calculating machines is given, as well as a description of the problems that Babbage faced.

With the advances in technology towards the end of the eighteenth century, mathematical tables assumed an increasing importance as an aid to calculation. These tables were more often than not riddled with errors, introduced either during the original computation or at the typesetting stage.

The Difference Engine

The method used to calculate the tables was the 'method of differences'. This had the advantage of using addition only in calculating the next value of a function, even if the function was very complex. This simplified the task of the computers (the name given at the time to the human evaluators), and reduced the risk of error since addition is easier to perform than multiplication. Another great asset of this method is that each result obtained relies on the previous result. Therefore, if the hundredth result is correct then it is almost certain that all of the previous results are also correct.

The method of differences work as follows (see PCW Dec pg 134):

If a function such as $F(x) = 3x + 7$ is evaluated for successive values of $x$, the difference between adjacent values of $F(x)$ is found to be constant.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$F(x)$</th>
<th>$D^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>19</td>
<td>3</td>
</tr>
</tbody>
</table>

$D^2$, the second difference, is constant in case of $F(x) = x^2$.

In general, for a polynomial of degree $n$ ($x^n$), the $n$th difference will be constant. Although all polynomials have a constant difference, functions of much greater interest, such as logarithms and trigonometric functions, do not in general have a constant difference.

In order to produce tables for these functions by using the method of differences, it is necessary to divide the function into sections which may be approximated by suitable polynomials.

In 1820 Charles Babbage, aware of the problems inherent in producing tables (he had already produced a few of his own), decided to design and construct a machine which would compute and typeset mathematical tables — a Difference Engine. By
1822, after devoting a great deal of his time towards the project, he had a working model which was capable of working with 6-digit numbers to a constant second difference. This machine was a prototype, built to show what could be achieved. In order to finance a project to construct a full scale Difference Engine, Babbage petitioned the government of the day for aid. The government asked the Royal Society to prepare a report on the project's viability; they replied that, in their opinion, Babbage's work should be aided where possible. The government agreed to advance £1500 towards the project; Babbage agreed to provide between £3000 and £5000. This would, in Babbage's opinion, provide sufficient resources to construct the Difference Engine (presumably based on his experience with the prototype), in two to three years, at which time he hoped that the government would reimburse his financial outlay.

But Babbage discovered that a full scale Difference Engine was a great deal more complicated to construct than a prototype. The machine was larger and more complex, and thus required finer tolerances of components. He also found that the state of engineering at the time was not sufficiently advanced to construct the Difference Engine in time. He therefore decided to devote the first few years of the project to advancing the art of mechanical construction. This involved designing a part and then designing a tool for making the part. During this process, an alternative and often simpler method would sometimes appear — the whole process of design and construction would then be repeated. Although this was a costly and time-consuming process, Babbage's work advanced the state of engineering in Britain by many years.

Due to the project taking longer and costing a great deal more than originally anticipated, Babbage frequently found himself asking the government for more money; he had the Royal Society audit his accounts to prove that the money was being spent on the project. Unfortunately, the audit and the government's deliberations on the future of the project meant a delay each time (up to four years in some cases) before Babbage received any money. During this time, work on the project all but stopped; most of the engineers working for Babbage were disbanded (however, this helped to spread Babbage's engineering advances throughout Britain) — each time the money was received Babbage had to hire and train new engineers before work could commence on the project.

It was during one of these enforced breaks in production, in 1833, that Babbage had a disagreement with his chief mechanic (Joseph Clement, who had always stayed with Babbage — even during the breaks in construction). This was never settled and, under British law, mechanics possess the right of property of all tools that they have constructed, even if construction was paid for by their employers. This right was exercised, and the plans to the Difference Engine were also taken, although they were later returned. This would have considerably delayed the project if it had continued, since all of the tools would have had to have been constructed again; this, however, was not the case.

During this time Babbage, while attempting another modification to the design, conceived the idea of the Analytical Engine. This would need a much more sophisticated arithmetic mechanism than that currently employed in the Difference Engine — he therefore set about designing one. After over 20 different designs, he produced one which he considered could not be improved. He decided that this new improved design should be incorporated in his Difference Engine, and informed the government that, in his opinion, it would be quicker and cheaper to incorporate his new design into the Difference Engine than to complete the old one. The government was dismayed at the thought of yet another redesign after nine years of delay (and a change of government) and in 1842 informed Babbage that they would not continue financing the project. The government offered to let Babbage keep everything, but Babbage, remembering the original terms of the agreement, said that the machine's future was in the government's hands — the Difference Engine now resides at the Science Museum in London.

In all, Babbage had spent £17,000 of government money, and it is estimated that he spent a further £20,000 of his own personal fortune. The Difference Engine that Babbage had constructed at the collapse of the project was a working model which had a constant third difference, and handled 6-digit numbers.

Had it been fully completed, the Difference Engine would have been approximately 10 feet high, 10 feet wide and five feet deep. It was to have worked to a constant sixth difference, handling integer numbers to a precision of eighteen digits. Babbage had realised that truncation could lead to errors when accumulating results; he therefore devised a rounding mechanism to round off the eighteenth digit correctly.

Once the initial values had been loaded (set up) into the machine, the machine would have operated as follows:

- A cycle would consist of two steps:

  **Step 1:** Add ODD differences to EVEN differences
  **Step 2:** Add EVEN differences to ODD differences

The result of the next value is now obtained. For successive results, repeat steps 1 and 2. Each step consists of two parts since after addition any carries generated had to be added, allowing them to 'ripple through'. Each step consisted of turning the operating lever half a turn backwards (producing the addition), followed by half a turn forward (addition of any carries generated). The words 'Calculation Complete' would be displayed at the end of each cycle.

### The Analytical Engine

In 1833, Charles Babbage began work on what turned out to be the most ambitious project of his life's work: the Analytical
The Analytical Engine was a decimal calculating machine. It was to be capable of doing virtually any mathematical operation. According to Babbage, his machine would have been built. It is a shame that Babbage is mostly remembered for his failures; he was a brilliant mathematician and design engineer, and yet he is more important as a philosopher than as a practical engineer. His ideas were a century ahead of their time. Babbage himself was the prime cause of his failures; he was always updating and modifying his designs - if he had kept to a single design throughout he would have probably been granted financial aid for the Analytical Engine - it is just possible that, given enough time, the engineering technology of the day would have permitted the machine to have been constructed. It is ironic that Babbage himself was the prime cause of his failures; he was always updating and modifying his designs - if he had kept to a single design throughout he would have probably completed the Difference Engine. His work was not in vain, though, for it stimulated others into designing and constructing their own Difference Engines, as well as advancing the state of engineering in Britain by many years.

It is not known exactly to what extent Babbage's work affected the development of early electronic computers, although it is thought to have been only superficial - in which case it is remarkable that Babbage's concepts are so similar to those of modern computers. It is almost certain that computers would have evolved earlier if the Analytical Engine had been built. It is a shame that Babbage was mostly remembered for his failures; he was a brilliant mathematician and design engineer, years ahead of his time.

For anyone interested in early mechanical and electronic computing, an excellent book to start with is The Origins of Digital Computers, edited by Brian Randell and published by Springer-Verlag. The price is £18.45, and the ISBN is 0-387-11319-3. This book contains selected papers, and for the really keen person, the bibliography contains over 850 items.
Assembly language programming is prone to difficulties that are not generally in higher level languages. One major factor is that assembler programs are notoriously difficult to read, and thus difficult to understand. Such difficulties make programs in writing low level language routines slow compared with equivalent progress in high level languages. As the size of programs increases the difficulties become more apparent, with the result that development of assembly programs increases the difficulties become slow compared with equivalent progress in high level languages.

The techniques emphasise the role of finding the logical solution to a problem in terms of the program before such considerations as language and coding are dealt with. Because of this the techniques are essentially language independent and are therefore applicable to all types of programming problems.

Resultant programs are logically correct before they are coded and inevitably work ‘first time’ bar any typing errors from those of us that suffer from keyboard dyslexia. As an example of the technique in use, I have selected a relatively short utility subroutine called DUMP whose purpose is to dump the contents of a selected page of memory in hex form and in printable characters called DUMP whose purpose is to dump the hexadecimal contents of the 16 bytes and secondly by the character representation of those same bytes. Non-printing characters (ie, control characters) must be printed as a period. Figure 1 shows an example of the required format.

Steps in program design

Having described in words what we want our program to do we now attempt to express this in terms of a Warnier-Orr diagram. Figure 2 is such a diagram and contains the bare essentials of our problem. If you are not familiar with the basic concepts then previous articles in PCW (October 1981 and April 1982) will be of use. I will restate the essential conventions. The diagrams are sets of hierarchical square brackets that are read downwards within each bracket. The brackets contain statements of what actions are to occur and statements of what decisions are required at certain stages of the program. A statement with a bar written over it signifies the logical opposite — ie, in Figure 2 there is a statement ‘16 lines printed’ which is interpreted as the logical opposite — ‘16 lines have not been printed’. Statements that are mutually exclusive are written with a @ sign separating them. Such statements infer that only one of the actions will be performed. When the word ‘SKIP’ is written in a bracket it means that no actions are associated with the bracket. If a bracket to the right of a statement does itself contain further statements then these are actions to be performed if the higher level statement has been performed.

Figure 2 tells us that we are dealing with a routine that is called ‘DUMP’ and that it has some form of beginning block and another as yet unspecified ‘END’ block. Two mutually exclusive options exist depending on whether or not 16 lines have been printed. While 16 lines have not been printed we perform an action called ‘PRINT LINE’. If 16 lines have been printed, then, since there are no corresponding actions within the bracket on the right, we skip the bracket and perform the ‘END’ block.

Notice that we have not specified how to print a line or how we start or finish our routine. We are only interested initially in attempting to create on paper some form of basic structure consistent with the essential details of our problem.

The next stage in the design process is one of ‘iterative refinement’ — ie, we look at our problem and attempt to find areas that we can specify in greater detail. In this case our original problem specification indicates that we can add more detail to the ‘PRINT LINE’ bracket since we have specified that we wish to print the contents of 16 bytes on each line. Figure 3 is the diagram showing this.

Notice that we add to our initial diagram by progressive expansion rather than by altering the basic structure.

Our problem tells us how we are to print each line and we can expand Figure 3 to show that we are to print the contents of each 16 bytes in hexadecimal form and then in ASCII character form. Figure 4 reflects this and also introduces statements that indicate we will be using some means of counting how many lines we have printed and how many bytes of current line have been printed.

This process of ‘iterative refinement’ can
be continued because we also know from our original specification of the problem that having printed the hexadecimal form of our 16 byte line we print the ASCII form of the same bytes. But... if the character is non-printing then we must print a 'period' instead. These additional restraints are shown in Figure 5 as an expansion of the Figure 4 statement 'PRINT SAME 16 BYTES AS ASCII FORM'.

Notice that as we expand the statement bracket we do not alter any of the other parts of the diagram. The diagram as it 'evolved' is separating the problem into distinct separate logical entities and it is this effect of the design technique that is particularly significant.

At this stage I would mention that these diagrams evolve very quickly once you are used to the technique and as they do they formalise the 'logic' of the problem in a way that is obviously language-independent.

Since the problem we are dealing with is simple it is instructive to combine Figures 4 and 5 to show the complete representation that, as you will see, is the solution in terms of the program design.

Figure 6 is then the combined diagrams of Figures 4 and 5. It represents the logical solution to the associated problem of designing the program. It is possible to continue the process of iterative refinement to any level that is desired, but for the purposes of this example I now wish to consider the transition from our Warnier-Orr diagram to the coding of an 8085 assembly language program. The coding was written for a CP/M environment utility subroutine.
used to dump, at the line printer, selected pages of applications programs under development. To facilitate discussion of such diagrams I frequently identify along the top of a diagram various 'levels of brackets'.

The transition is accomplished in general by treating the brackets in the Warnier-Orr diagrams as called subroutines. Occasionally the first or last statement of a bracket may be included in the coding of the next highest level bracket, but this is often a matter of personal preference. The ideas are best explained by referring to the example of coding provided. I have numbered the lines of the assembler program (END blocks) in case of reference and have placed plenty of remarks within each of the routines.

The basic core of the program will reference several subroutines that come without modification from a library of my assembler routines. The example itself, ie, the DUMP utility, has proved quite useful and is also now a library program.

The names that are used to call these various library subroutines together with a brief description of their functions are now listed for convenience. Since DUMP is not expected to be resident in any finished programs I have not made any attempt to save bytes. It is my personal opinion that in most cases it is more important for routines to map directly to their design layouts since this facilitates maintenance in large programs.

LSPRINTSBC Prints BC register pair at line printer
LSPRINTSPACE Prints a space at line printer
LSPRINTSTAB Prints a tab at line printer
LSCLFL Prints a carriage return - linefeed sequence at line printer

The above routines use another subroutine
LSOUCH to actually print the characters.
LSOUCH uses a CP/M 'BDOS' call to handle character output.
BINSHEX This converts a single byte number held in the accumulator into the hexadecimal form which is returned in the BC register pair.

Let us examine first the initial section of the DUMP subroutine. This is shown as lines 6-23 and corresponds to the first or highest level bracket (this is the one containing the BEGIN and END blocks). The BEGIN block is in fact lines 6, 7 and 8 of the source listing. We push existing register values onto the stack, load HL with the starting address of the page to be dumped and initialise a line counter (the D register) by placing the value 16 in it.

Lines 9-21 constitute a loop that is executed 16 times. First the starting address of each line of information is to be printed, followed by the contents of the 16 bytes starting from this address. Lines 9-11 print the H register contents. Lines 12-14 repeat for the L register. Lines 15-17 simply print an 'H' character followed by a tab for format spacing. Line 18 calls a subroutine DUMP2, and this label was inserted before the coding for DUMP2 had been written. Line 19 prints a carriage return-linefeed sequence ready for dealing with the next line of printing. Once these operations have been performed we decrease the line counter (ie, the D register) and providing 16 lines have not been printed we repeat the loop. Lines 22 and 23 constitute the END
The subroutine DUMP4 - ie, lines 46-59 - uses a simple loop counter as in previous routines to print the contents of the 16 bytes. Since DUMP4 is now dealing with the ASCII forms it is necessary to check that the character is printable, ie, has an ASCII code between 32 and 126. You will see from the coding that cases where this is not true result in a period being printed in the ASCII form. The solution is simple. First we save all registers by pushing them onto the stack, then as before we set up a loop using a simple counter. This loop will be executed 16 times. Using a MOV,A instruction we place each of the sixteen memory location contents into the accumulator and then print them by using calls to subroutines BINSHEX, LPRINTSBC and LPRINTSSPACE. As we step through the loop we use a INX H instruction to point HL to the next location to be examined. In this way we are able to deal with printing the hex form of a Line. Our Warnier-Orr diagram tells us that having done this we must print the same bytes in ASCII character form. The solution is simple. First we reset the HL memory pointer by POP H (which restores the original values) and then we write another subroutine call using a further 'dummy label'.

In this case the dummy label is DUMP4 and it corresponds to the statement in Figure 6 of 'PRINT ASCII CHARAC-TERS'. Since the diagram indicates that no further actions are required to complete this 'brace' we simply restore the registers that have still to be returned to their original state and return from the subroutine.
You don’t need a Cray 1 to do interesting things with images; even a micro can handle digitised video (although not quite as quickly!). C Grant Dixon explains how.

DIGITAL VIDEO

One of the areas where microcomputers will be making their mark in the future is in the processing of visual images. Of course this is already being undertaken in certain specialist laboratories where the analysis of space photographs and the use of enhancement techniques are the day-to-day workload. Other research workers are looking into the problem of pattern recognition with a view to tying up the computer controlled robots with a television image of the scene where the robot is operating.

Amateur computer enthusiasts have, so far, done very little in this field, but after my article in PCW (April 1981) I received a number of requests for information on digitising video signals - so here’s some further information on the subject.

The normal 625-line TV picture is generated by interlacing two fields of 312.5 lines each, the field rate being 50 Hz (mains frequency). The aspect ratio of the picture is 4:3 and if we work in round figures this means that we have 400 picture elements (pixels) along a line and 300 pixels in the vertical direction, assuming a sequential scan with no interlacing. Thus in 1/50th sec we have 120,000 pixels, a data transmission rate of 6,000,000 pixels/sec. Can your computer cope with this rate of data flow? Probably not! But there are several ways in which we can reduce this high-speed requirement; first of all we can say that each pixel can be described by a 4-bit word, giving 16 possible grey levels, and packing two such words into one byte. This would give a data transfer rate of 3 Megabytes/sec which is still rather fast.

Secondly, we can slow up the scanning process by converting the fast-scan signal to a slow-scan signal, or even by generating the video signal by a slow scanning process in the first place. We gain by being able to manipulate the video signal at a rate which the computer can handle but we lose the ability to display movement. Slow-scan TV is for still pictures, or, at best, a series of ‘snapshots’ of a movement. This is no detriment as far as computing is concerned, as the computer will normally be used to store a single image.

When converting from a fast-scan signal to slow-scan it is only necessary to have a temporary buffer store to hold one line of data as the whole picture is being repeated at the fast rate. If, however, the original picture contains movement, it’s better to load the whole picture at the fast rate into a temporary picture store using TTL hardware for the purpose. This will give us a kind of ‘snapshot’ as mentioned above, but it involves a fairly large extra memory which has to be interfaced to the computer — unless, of course, we use the computer memory itself and access it by DMA techniques.

The actual conversion of the analogue signal to a digital one is not possible by the usual A/D techniques which employ counters operating over a given period. The alternative technique, suitable for video frequencies, uses a chain of comparators (Figure 1) which gives an almost instantaneous digital value for the analogue input. Potentiometers W and B are used to set the voltages for white level and black level to match the incoming video signal; the outputs A, B, C, D are then a digital representation of the signal in Gray code. This code has the advantage that only one bit changes at any level transition and it is less liable to cause trouble with ‘glitches’ on the power supply.

There are two ways of handling this information. One is to store it in a memory of the appropriate size and to read it back out of the computer for further processing. The other is to use it as a direct input to the computer — in this case we have to transfer the data at a rate of 3 Megabytes/sec and since the computer is reading this data it has to allow for the computing time as well as the transfer time. So the data transfer rate has to be increased to about 9 Megabytes/sec. This can be achieved by using an A/D converter (Figure 2) which can do the sampling at the fast rate while using a parallel shift register to store the data temporarily. When the whole picture is loaded into the register then a slower clock signal is used to transfer the data into the computer at a rate of about 10 Megabytes/sec.

In summary, we have to be able to transfer the picture data into the computer at a rate of 9 Megabytes/sec or more, to store it there and to allow for the computing time. This can be achieved by using special memory devices, by expanding the computer as far as is possible or by using DMA techniques. The conversion of the video signal to a digital form is only a small part of the total picture and the real advantage will only be seen when the data is further processed by the computer.
A typical slow-scan converter adapted for linkage to a computer is shown as a block diagram in Figure 2. For those people who are not interested in SSTV as such, and whose only concern is to be able to load video information into a computer, the area to the right of the dotted line can be ignored. In the scan-converter, a 4-bit wide shift register memory is used and a fast clock shifts the video data along the register until one line has been stored. This is then replaced by a slow clock which delivers the data at the output end of the shift register during the next three frames of fast-scan TV. This process is then repeated for a line further down the picture until all lines have been stored. The SSTV used by radio amateurs has a square picture of 128 lines with 128 pixels per line. Thus, every alternate line of the fast-screen picture is sampled and a few lines at the top and the bottom of the picture are ignored. The total storage area for a picture to these standards is 8 kbytes, with each byte holding two pixels. When SSTV is transmitted each line of 128 pixels is sent in 60 ms ... approx 1 ms per byte or 500 µs per pixel. Now a lot of useful computing can be done in 500 µs and the digital video signal which emerges from the shift register memory can be read at a computer input port and hence stored in computer memory. Special effects, such as contrast enhancement, can be achieved by using a look-up table before storing the pixel.

If the digitised fast-scan signal (Gray code) is converted to binary and then reconstituted by a D/A converter, the signal can be viewed on a TV monitor and it will be found that, despite the A/D and D/A conversion, the picture is still good quality even though we have used only 16 grey levels. Conversion between Gray code and binary can be performed by the circuits of Figure 3; if you prefer doing it by software then refer to PCW Sub Set, October 1981. The type of D/A converter usually used for fast-scan video work is a simple weighted resistor network as in Figure 4; the resistors are in the ratio 8:4:2:1 to match the binary digits — the largest resistor gives the smallest current and corresponds to the LSB of the video signal.

Another possible way of digitising a video signal is shown in Figure 5; this is only put in as a suggestion by the author as it has not been tested in practice. We have an 8-bit up-down counter which is continuously driven by a fast clock; the output of the least significant five bits is converted to an analogue signal and compared with the incoming fast-scan signal from the camera. If it is of greater amplitude than the camera signal, then the comparator switches the counter to count down; conversely if it is lower, the comparator switches to count up. The least significant bit is likely to be oscillating rapidly when the video signal is at a steady level so we take the next four bits from the counter as the digitised video signal (binary, not Gray code) and this can be latched when required. For fast-scan TV, a clock frequency of 12 MHz would give 6 Megapixels/sec which is almost right.

It is worth noting that an A/D chip has recently appeared on the market as a 'flash digitiser' capable of handling frequencies...
DIGITAL VIDEO

up to 15 MHz; this is the RCA CA3300D.
The main snag is the price — in the region
of £66 per chip (summer 1982)!

Now we have the picture in the computer's memory we want to display it on the VDU, which is, of course, a fast scan device. Once again we run into problems with speed, and the most promising answer seems to be the elimination of the microprocessor chip and the use of direct memory access (DMA) with some form of hardware interface, possibly using one of the CRT controller chips. Clayton Abrams has successfully used the 6843 CRT controller for displaying stored pictures on a monitor screen (see Ham Radio, July 1979). In my equipment, the picture in computer memory is converted to a slow-scan signal which is then sent to a separate slow-to-fast scan-converter with its own 8k memory which can be read out at high speed.

Notice that with access time of 150 ns or 200 ns for a modern dynamic RAM chip, the speed of the memory is no longer the problem — it's the speed of the processor and the amount of processing needed which is the limiting factor. Hardware circuits can be used to eliminate the processing needed when, for example, the two 4-bit pixels have to be packed into or unpacked from one byte. Figure 6 shows suitable circuits for doing this. The 74LS 157 is equivalent to a 4-pole 2-way electronic switch and the 74175 is a 4-bit latch used as a temporary store. The switching must take place at a speed which is twice the speed of the memory address clock.

Perusal of PCW's advertising pages, not to mention the helpful equipment reviews, reveals that most computer manufacturers are keen to stress their machines' capability for high-resolution graphics or colour; very few make any mention of any form of grey-scale which is almost essential for picture display, yet the CRT in the VDU is ideally suited for displaying a full greyscale picture. When one comes to the adverts for printers, however, it's a different story. Quite a few manufacturers illustrate their machines with what looks like a photograph emerging from the roller — despite the fact that a printer is essentially a black and white device; even thermal printers are unable to reproduce a satisfactory grey-scale.

The secret is, of course, in the dot-matrix print-heads which are so popular. Examination of some newspaper photographs reveals that they are composed of lots of dots of ink which are closely or sparsely spaced to give the overall impression of the required shade of grey. This is a task for which the dot-matrix printer is ideally suited as long as it is possible to program each individual dot in the print-head. Figure 7 shows the result obtained by Martin Emmerson (G30QD) using a dot-matrix printer to obtain a hard copy of a slow-scan TV picture. In this case the picture resolution was 128x128 pixels and the rather elongated appearance results from the fact that the printer was not geared to produce an equal number of dots/inch in the horizontal and vertical directions.

To show how it is done, let us take an example. The Thomson 96364 display chip uses a rectangle for each character measuring eight elements wide by twelve elements vertically; within this area is the
Each block of dots represents one pixel, and by choosing to print any number of dots from zero to 16 we can, in fact, have 17 levels of grey. Care is needed in choosing which dots to print for a given value of grey as it’s possible for the dots in adjacent squares to join up and form an undesirable patterning rather than the overall grey effect which is desired. Figure 8 gives a set of recommended pixels. The resolution of a 128x128 picture is not, of course, anything like as good as a standard TV picture, but does give an adequate picture for radio amateur purposes and possibly for other purposes also. Figure 9 shows a picture which was stored in the memory of my Triton computer, block shifted for tape recording, and sent to Alan Strong (G3WXI) of Sheffield. Alan has a Nascom with a different recording format, but a simple program was written to read the Triton tape into the Nascom memory as a hex-dump whence it was fed to a specially built fast-scan display. The original photograph shows clearly how each pixel is represented by two TV lines.

Figure 10 shows a picture printed by the technique outlined above using an Epson MX100 printer. This printer uses approximately the same number of dots/inch in both directions and thus gives the correct aspect ratio of 1:1. Not all printers are able to do this, and if this technique of picture printing becomes popular some manufacturers may have to modify their machines to give equal resolution in both directions.

Another point to note is that the printed dots may possibly be larger than the space they are supposed to occupy due to the lateral spreading of the ink in the paper; future experiments will attempt to improve the picture buy using a look-up table to modify the pixels before they are stored in memory.

The field of video computing is rapidly expanding and offers a challenge to computer enthusiasts who are looking for something different on which to exercise their skills.
Z80 anybase conversion

Last month we had the 6502 routine, XBIN, to convert an unsigned ASCII encoded number, in any base from 2 to 36, to a 32-bit binary number. This prompted me to fish out a set of routines in Z80 code, which I have had for some time, to do a similar conversion into the 16-bit HL register. These Z80 routines, ANYNO/CTON/DEXBC, are from Jim Chance of Birmingham University. In the input string, digits greater than 9 are represented by the characters A to Z. Note the meticulous validation of the ASCII encoded input.

Datasheet

>ANYNO - gets base 2-36 number to HL
//CLASS: 2
//TIME CRITICAL: No
//DESCRIPTION: Gets hte hte binary hte in HL from digit
//strings at DE base eg 2 for binary
//ACTION: Start at left digit, get to binary (+15, G=16 etc).
//add to partial result. If no digits, multiply by
//base and loop for more digits.
//SUB DEPENDENCY: CTON, DEBC (loops)
//INTERFACES: A byte in RAM, pointed to by IX, is used to hold
//the number of digits in the ASCII string and is
//reduced during the routine to zero.
//INPUT: (1)number of digits, (2)number base, (3)HL(keeps digit).
//OUTPUT: HL=base number, NC,OK, deleterr. (IX)&,BC,DE
//destroyed.
//REGS USED: A, BC, DE, IX, IX
//STACK USE: None
//PROCESSOR: Z80
//TIME STATES: 256 max.
//LENGTH: 95
//REGS USED: AF, BC, DE, IX
//STACK USE: None
//CLASS: 2

Z80 square roots

Steven Weller's very fast square roots (August '82) have not gone unchallenged. Both K P Leary of Chislehurst and John Kerr of Glasgow have sent amended versions and pointed out that, in Steven's versions, the correct remainder is not always returned. As KP puts it, since (n+1)^2 - n^2
= 2n + 1, extracting a square root k bits can leave a remainder of k+1 bits, since the largest remainder when extracting n is 2n. In other words, a 15 or 16 bit square can have a 9 bit remainder and a 31 or 32 bit square can have a 17 bit remainder.

In the original DSRTZ the 17th bit of the remainder is in the carry flag, though this was not stated, but in SROOT the 9th bit of the remainder is actually set to zero. There is very little to choose between the two corrected versions of the 16 bit routine so, to counter John's move to take over the whole of this issue's SUB SET, we give K P Leary's version in Datasheet SQR15/16.

Datasheet

>SQR15: 15 bit square root. SQR16 - 16 bit square root.
//CLASS: 3
//TIME CRITICAL: No
//DESCRIPTION: SQR15 calculates square root of 15 bit 2s
//complement positive number.
//SQR16 calculates square root of 16 bit unsigned
//assumed positive number.
//ACTION: Shifts pairs of bits in A, 1 left through A, D, L,
//untrial subtraction from 4 times (last reminder in D)
//next part of root in D. If part root == trial root
//if subtraction, 0 if not.
//SUB DEPENDENCIES: None
//INTERFACES: None
//INPUT: number in HL
//OUTPUT: SQR15: 15 number +, NZ state, registers unchanged. Else
//SQR16 and SOR16: 1 state, 8 bit positive signed root
//in HL, 9 bit positive signed remainder in DE.
//REGS USED: AF, BC, DE, IX
//STACK USE: None
//LENGTH: 35
//STATE: 843 max.
//PROCESSOR: Z80
Error flags

The error correction routine EFIX8 by John Kerr of Glasgow printed last month was the subject of a late amendment which unfortunately resulted in the documentation giving false information. The original version used the N flag to signal whether a correction had been made but the output state of the N flag is uncertain in the amended version. In all fairness to John, who did alter his documentation accordingly, I take full responsibility for not correcting this part of the Datasheet.

However, I do not feel particularly repentant as the incidence does highlight the necessity of careful attention to flag conditions. The point I made last month about using any hard flag result to carry information out of, or indeed into, a routine was that it should be easy to test, perhaps of greater importance is that the exit flag conditions when used to pass information ought to be specifically set, and commented on. Relying on the happy accident that instructions immediately prior to exit produce useful flag results is risky when the slightest change to a routine could destroy the whole set-up.

6502 data protecting

The two Datasheets ECAL6 and EFIX6 are the 6502 versions of ECAL8 and EFIX8 printed last month and also sent by John Kerr.

To recap briefly on the method used by the routines, ECAL produces an error correction byte (ECB) for a data block up to 31 bytes in length. This can be appended to the data before its storage or transmission. On retrieving or receiving the data and ECB, EFIX calls ECAL to get a new ECB for the data block and compares it with the appended ECB. The difference between the two ECBS gives a correction code which is in effect an index to any single bit which may have suffered inversion during storage or transmission.

In order to calculate the ECB, a parity mask is formed. The highest 5 bits of this mask index the bytes not from the start of the data block but from the end. The lowest three bits index the bits within each byte. Eq. the parity mask for each bit in the byte that is 23rd from the end would be 10111XXX where the Xs would take values 111 down to 000 for bits 7 down to 0 in that byte.

The ECB is initially reset to 00000000 and each bit of the data block is checked in turn. If the bit is reset (0), no action is taken, but if it is set (1) then its unique parity mask is exclusive-ORed with the ECB. This inverts the bits of the ECB which are in the same position as the set bits of the parity mask.

The completed ECB is a collection of eight parity bits such that bit 0 of the ECB shows the parity of alternate data bits, bit 1 shows the parity of alternate pairs of data bits, bit 2 shows the parity of alternate groups of four data bits, and so on in a binary pattern. Any difference found between the stored and new ECB in EFIX will be a binary pattern representing the parity mask of one bit which, because of inversion of that bit, affected one ECB but not the other. As this correction code is exactly the same as the parity mask, EFIX can use the highest five bits to index the byte in which the error has occurred and the lowest three bits to create an inversion mask to re-invert the corrupt bit in that byte.

Have you anything just a wee bit fallible?
### Datasheet

**EEFIX6:**
- Processor: 6502
- Time States: Average 192 a
- Length: 53
- Stack Use:
- Regs Used:
- Error found:
- Cy reset: no error found:
- Input:
- Datasheet

**EXIT1:**
- RGB Monitor Lead

**EXIT2:**
- PLA

**EXIT 3:**
- PLA

**EXIT 4:**
- PLA

### Military two-step

I have been advised that perhaps not all of SUB SET readers are aware of the old story about the message, 'Send reinforcements, we are going to advance', being passed by word of mouth along the trenches. Battalion HQ were surprised to receive the request, 'Send three and fourpence, we are going to dance.' Try decimalising that!

### Prices

**COMPUTERS**
- BBC Model "A" (in stock now) £299.00
- BBC Model "B" (in stock now) £399.00
- BBC Model "A" plus extra 16K memory £330.00
- 16K Hitachi memory (as fitted by ACORN) £31.00
- FULL UPGRADE KIT (Genuine ACORN issue) £90.00
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- Cassette Recorder (Sony) £37.95
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- EPSON MX100 F/T III £530.00
- SMITH CORONA Daisy Wheel Printer £557.00
- Printer Cable £18.40

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- 12" Green Screen MONITOR £126.00
- RGB Monitor Lead £5.00
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Moore on Kuma

Word processing for Sharp
User-friendly and user-oriented are much used over words in computing, but it is difficult to find more suitable phrases to describe the WDPRO word processing package for the Sharp range.

It's a really professional system, that is probably better than you'll ever need. Its only drawback is the price. At £39.90 and £79.95 for cassette and disk respectively, you might believe it is too cheap to be true.

Well, it is true and Kuma can provide an impressive postbag of endorsements. They also supply a "Layman's (or, Layperson's) Guide" with a practical, step-by-step, approach. If you can't follow this - give up computing and try knitting.

Low cost photsetting
If you're in a business or organisation that buys typesetting, take a careful note of the following. A system is now available that can slash typesetting costs by 60%.

Using a Sharp micro, the text is typed and posted in cassette form for specialist photsetting. The data is fed directly into a photosetting machine thus eliminating that major cost item - the compositor's time in retyping the text. How about that Mr Zgorelec? For more details phone John Felthan on 01788 2458.

VAT Panacea
Do you suffer from VATphobia? Many small businesses do, which is why Dean Software has brought out a new version of its SOLID STATE VAT accounting system called EASIVAT.

It caters for over 200 entries per month, produces monthly and quarterly VAT payments at the touch of a button, has full search facilities, can generate end of year profit and loss accounts, and many more.

It's available for Sharp micros on cassette at £39.50 but a disc version will be here soon.

Other small business programs from Dean Software include a really useful "electronic card index" called SOLID STATE Database and offering a full sort and summary print facility that can be changed at any time; and a SOLID STATE Stock Control package that can handle up to 200 items.

New Sharp software catalogue
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PCW 175
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CONFUSION NOW HATH MADE HIS MASTERPIECE!

(Macbeth II.iii.)

Hardly a month goes by without news of another launch issue of a new computing title. We stopped counting earlier this year when the total reached more than 25 regular microcomputing magazines in the UK.

To read them all would, by our calculations, take approximately a fortnight each month. And that would be a superficial reading only! Confusion indeed.

As the first microcomputing magazine in Europe (launched way back in 1978) we welcome competition. But, frankly, there are only so many good editors in the business. Only so many experienced editorial staff. Only so many first class contributors. Somewhere, quality must suffer.

One place where you can be certain editorial quality will never be allowed to fall off is Personal Computer World. PCW is one of the finest microcomputing journals in the world. We constantly strive to stretch our own and our reader’s abilities and comprehension of the subject. We will not lower editorial standards in the mad scramble to gain new readers.

The truth is, astonishingly, that we do not have to. Despite the plethora of magazines that cater only to gamesplaying and yet another ‘learn Basic course’ and despite the fact that we know that many of our readers find PCW a challenge to read, sales of our magazine continue to outstrip every other competitor in the business. We thank you for that.

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the ability to make decisions and to act upon with other data. It's the latter function that exist, computers, several standard coding systems they are called, ranging from 00000000 to is represented by eight binary digits or bits as numbering which uses only Os and Is. Thus in bytes. The rules are called Memory). The CPU can read information stored in RAM — and also put information into machine code and then feeds it into the processor for execution. It has to do this each time the same instruction has to be executed. Two straight lines, you will bear in connection with Basic are PEEK and POKE. They give the programmer access to the memory of the machine, if it's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to hardware, this means the physical construction of a system, such as a box which can be programmed using a special device, called a disk operating system, the computer keeps track of exactly where data is stored and can get to any item of data by moving the heads to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: soft sectoring where special signals are recorded on the surface and hard sectoring where individual sectors are numbered. Hard disk systems are also available for microcomputers, they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the usual display unit, tape cartridge, faster than a cassette but cheaper than a disk system. Hard disk systems are used for complex tasks; often these are built into the system, sometimes they're separate. If you want a written record (hard copy) of the computer's output, you'll need a printer.

The computer can send out and receive information in two forms — parallel and serial. Parallel output/input (0/0) requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial 0/0 involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device which a byte is about to start and when it has finished. The speed that data is transmitted is referred to as baud rate and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second. To ensure that both receiver and transmitter line up without any electrical horrors, a standard exists for serial interfaces; the most common is RS232 (or V24) while, for parallel interfaces to printers, the Centronics standard is popular.

Finally, a modem connects a computer, via a serial interface, with the outside world allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need permission; instead you could use an acoustic coupler, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn't so uppity about the use of these.

Welcome to the confusing world of the microcomputer. First of all, don't be fooled: there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will be part of our everyday English language. Until that time, PCW will be publishing this guide — every month.

We'll start by considering a microcomputer's functions and then examine the physical components necessary to implement these.

The microcomputer is capable of receiving information, processing it, storing the results or sending them somewhere else. All this information is called data and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called binary — a system of numbering which uses only Os and Is. Thus in most micros each character, number or symbol is represented by eight binary digits or bits as they are called, ranging from 00000000 to 11111111.

To simplify communication between computers, several standard coding systems exist, the most common being ASCII (American Standard Code for Information Interchange). As an example of this standard, the number five is represented as 0010101 — a collection of eight bits is called a byte and computer freaks who spend a lot of time messing around with bits and bytes use a half-human, half-machine representation called hex. Each hex equivalent of a byte is obtained by giving each half a single character code (0—9, A—F).

In hex, the number five is 05, which in hex is 0010101. A floppy disk is made of thin plastic, coated a suitable envelope, is placed in a disk drive which rotates the disk's envelope, is placed in a disk drive which rotates the disk's coated surface and is driven by a motor. The disk's coated surface is divided into concentric circles called tracks, each of which is divided into sectors. If you have any item of data by moving the heads to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: soft sectoring where special signals are recorded on the surface and hard sectoring where individual sectors are numbered. Hard disk systems are also available for microcomputers, they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

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This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!
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<th>Machine</th>
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<th>Main Distributor(s)</th>
<th>Hardware</th>
<th>Software</th>
<th>Miscellaneous</th>
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<tr>
<td>Apple II (£895)</td>
<td>As above.</td>
<td>Apple (UK) 0442 4815 (200 +)</td>
<td>OS: Basic: Pascal: Fortran: Pascal:</td>
<td>280k £175 high resolution graphics; Option: single 5&quot; V/D (146k) £349.</td>
<td></td>
</tr>
<tr>
<td>Atari 400 (£200 inc VAT)</td>
<td>16k RAM: 6502: C int:</td>
<td>Atari UK: Slough 33344</td>
<td>OS (10k ROM):</td>
<td>High resoloution colour graphics. 4-chanel sound. Four games controller/light pen sockets. BT 10/80. (S).</td>
<td></td>
</tr>
<tr>
<td>Atom (£120)</td>
<td>2-128k RAM:</td>
<td>Acorn: 0223 245200 (160)</td>
<td>Basic in 8k ROM:</td>
<td>High resolution graphics on bigger model. Single 5&quot; V/D £960.</td>
<td></td>
</tr>
<tr>
<td>Clerio Table Top 525 (£1750)</td>
<td>64k RAM: Z80A: dual 8&quot; F/D: 2x5/S:</td>
<td>As above.</td>
<td>CP/M: MBasic: W/P:</td>
<td>Wordstar &amp; Logicalc included in price. Many options</td>
<td></td>
</tr>
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**List of Abbreviations**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tr>
<td>A</td>
<td>Assembler</td>
</tr>
<tr>
<td>BT</td>
<td>Bench Tested</td>
</tr>
<tr>
<td>C</td>
<td>Cassette</td>
</tr>
<tr>
<td>E</td>
<td>Extensive</td>
</tr>
<tr>
<td>F/D</td>
<td>Floppy disk</td>
</tr>
<tr>
<td>G/C</td>
<td>Graphics card</td>
</tr>
<tr>
<td>H</td>
<td>Hardware</td>
</tr>
<tr>
<td>H/D</td>
<td>Hard disk</td>
</tr>
<tr>
<td>I</td>
<td>Interface</td>
</tr>
<tr>
<td>I/E</td>
<td>I/O Expressive</td>
</tr>
<tr>
<td>P/P</td>
<td>Parallel port</td>
</tr>
<tr>
<td>S</td>
<td>Software</td>
</tr>
<tr>
<td>S/P</td>
<td>Serial port</td>
</tr>
<tr>
<td>T/E</td>
<td>Text editor</td>
</tr>
<tr>
<td>TBA</td>
<td>To be announced</td>
</tr>
<tr>
<td>U</td>
<td>Utility</td>
</tr>
</tbody>
</table>

*Note: Software items listed in italic are not included in the basic price of the equipment. All prices are exclusive of VAT.*
IN STORE

<table>
<thead>
<tr>
<th>Machine (Price from)</th>
<th>Main Distributor/S (No. of Dealers)</th>
<th>Hardware</th>
<th>Software</th>
<th>Miscellaneous (Documentation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour Genie (£200 inc VAT)</td>
<td>Low Electronics 0629 4057 (100+)</td>
<td>16-32k RAM: Z80: 16k ROM: C int: 24x60 TV int: Audio port: RS232 port: P/P</td>
<td>ExBasic</td>
<td>160x96 colour graphics. 16k RAM. £30. Many options incl joysticks and light pen. F/D avail soon. (B)</td>
</tr>
<tr>
<td>Commodore 500 Series (From £859)</td>
<td>As above</td>
<td>12-896k RAM: 6509: 24x80 VDU: Option: dual 5144 F/D (Mb): IEEE-488 port: RS232 port.</td>
<td>As above</td>
<td>8088 or 80 second processor option Tilt and swivel screen.</td>
</tr>
<tr>
<td>Compucorp 655/ 675/ 670/ 675 Y (from £500)</td>
<td>As above</td>
<td>64k RAM: Z80: Up to 4x514 F/D (16k 9 Mb): 9&quot; 20x80 or 12&quot; 20x80 or 20&quot; 60x80 VDU: 40 pin printer: RS232 port.</td>
<td>As above</td>
<td>Prices inc installation and training. Opt: 20 10 Mb H/D</td>
</tr>
<tr>
<td>Commodore 64 (£299)</td>
<td>Data Applications (UK): 0285 2588 (£)</td>
<td>64k RAM: 6509: 25x40 TV int: C int: 13:3:160</td>
<td>Basic</td>
<td>8088 or 80 second processor option Tilt and swivel screen.</td>
</tr>
<tr>
<td>Eagle II, III and IV (from £2350)</td>
<td>Meditheat Busi Sys: 01 903 4372</td>
<td>64k RAM: Z80A: dual 514 F/D (75b): 1.5 Mb or single 514 F/D (754k) with 10Mb H/D: 2x XRS232 ports: 2x P/P.</td>
<td>CP/M: Classic: Cobol: Fortran: Pascal:</td>
<td>Many different configurations available. Full range of applications software</td>
</tr>
<tr>
<td>Equinox 200 (£7500)</td>
<td>Equinox: 01-739 2387 (N/A)</td>
<td>64-128k RAM: Z80: 10 Mb: 1200 Mbd H/D: 6x6/S: 1. P/P</td>
<td>CP/M: Classic: Cobol: Fortran:</td>
<td>Multi-user MVT/FAMOS available in place of CP/M 16 bit version (Equinox 300 £10,000, (5&amp;41)</td>
</tr>
<tr>
<td>Gecas 64/2 (£3305)</td>
<td>Cereas Micros 01 629 3758</td>
<td>64k RAM: Z80A: dual 8 F/D (2 Mb): 100 bus.</td>
<td>CP/M: Cobol: Basic Pascal Fortran</td>
<td>Up to 4.8 Mb F/D. Expandable to multi-user/multitasking system.</td>
</tr>
</tbody>
</table>

List of Abbreviations:

| A | Assembler |
| B | Bench Tested |
| C | Cassette |
| E | Extensive |
| F | Floppy disk |
| G | Graphics card |
| H | Hard drive |
| I | Introductory |
| M | Macro assembler |
| N | Not available |
| O | Operating system |
| P | Parallel port |
| S | Software |
| T | Test editor |
| U | Utility |

Please note: Software items listed in italic are not included in the basic price of the equipment. All prices are exclusive of VAT.
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It's rather like finding the remedy to the common cold!

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<table>
<thead>
<tr>
<th>Machine</th>
<th>Price from</th>
<th>Main Distributors</th>
<th>Hardware</th>
<th>Software</th>
<th>Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEC PC 8001</td>
<td>£119</td>
<td>IBR 0734 66411</td>
<td>2k RAM: Z80A; dual 15&quot; F/D (F00k): RS232 port; P/P</td>
<td>Basic: CP/M: Colomb Fortran</td>
<td>Options: dual 5.4&quot; F/D (700k): £685. 48k RAM £130.</td>
</tr>
<tr>
<td>Oki if 800</td>
<td>£3000</td>
<td></td>
<td>128k-512k RAM: Z80B1: 2.4k: RAM: dual 15&quot; F/D (F60k): RS232 port; P/P</td>
<td>Basic: PCGS: A</td>
<td>Alternative 8086 processor board to run CP/NB &amp; MS-DOS. Options: 11 Mb H/D (integral); printer £73.8. (B) T 9/82</td>
</tr>
<tr>
<td>Pascal Microengine (£2295)</td>
<td>Pronto Electronic Systems Ltd: 01-554 6222</td>
<td>64k RAM: MCM 1600: 2x RS232 ports: 2x P/P</td>
<td></td>
<td></td>
<td>Pascal.</td>
</tr>
</tbody>
</table>

**List of Abbreviations**

- A: Assembler
- BT: Bench Tested
- C: Cassette
- E: Extensive
- F: Floppy disk
- G/C: Graphics card
- H: Hardware port
- H/D: Hard disk
- I: Introductory
- Int: Interface
- M/A: Macro assembler
- N/P: Not available
- N/S: Serial port
- N/P: Numeric pad
- O/S: Operating system
- P/P: Parallel port
- S: Software
- T/E: Text editor
- U: Utility
- **(E)**: Exclusively available in England
- **(S)**: Exclusively available in Scotland

Please note: Software items listed in italics are not included in the basic price of the equipment. All prices are exclusive of VAT.
<table>
<thead>
<tr>
<th>Machine</th>
<th>Price from</th>
<th>Manufacturer/Supplier</th>
<th>Hardware</th>
<th>Software</th>
<th>Miscellaneous (Documentation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharp PC1500 (£150)</td>
<td></td>
<td></td>
<td>3-11k RAM: CPU: 16k ROM: 26 char LCD:</td>
<td>Basic</td>
<td>Full system with dual cassette</td>
</tr>
<tr>
<td>Sig/Net 100ZS</td>
<td>(£1299)</td>
<td>Shelton 01 278 6273 5</td>
<td>64k RAM: ZX80A: dual 5&quot; F/D: F/D (499k): 2xRS232 ports</td>
<td>CP/M: Basic: Cobol: Fortran: Pascal</td>
<td>Various disk options, up to 16</td>
</tr>
<tr>
<td>Sharp ZX Spectrum</td>
<td>(£125 inc VAT)</td>
<td>Sinclair</td>
<td>16-48k RAM: ZX80A: 16k ROM: TV Int: C Int:</td>
<td>Options: 32k RAM £60: RS232 port and</td>
<td></td>
</tr>
<tr>
<td>Sord MZ80K</td>
<td>(£4020)</td>
<td></td>
<td>819k: 6Mb H/D: 2xS/P: P/P:</td>
<td>Silicon:</td>
<td>Microdrive disks avail.</td>
</tr>
<tr>
<td>Tandy TRS-80 Colour</td>
<td>(€2199)</td>
<td></td>
<td>16-32k RAM: 6809: 816k ROM: C: 16 x 32 TV int: RS232 port:</td>
<td>Colour Basic:</td>
<td></td>
</tr>
<tr>
<td>Tandy TRS-80 Model</td>
<td>(£3651)</td>
<td></td>
<td>Colt 01-577 2686</td>
<td>TRS DOS: A: Cobol:</td>
<td>Network with 16 users. 8 and 16</td>
</tr>
<tr>
<td>Terodec PBM-1000</td>
<td>(£4020)</td>
<td></td>
<td>808: RAM: ZX80A: single 5&quot; F/D: (819k): 6Mb H/D:2xS/P: P/P</td>
<td>CP/M: CP/Net Classic: Fortran:</td>
<td></td>
</tr>
</tbody>
</table>

List of Abbreviations

- A: Assembler
- B: Bench Tested
- BT: Bench Tested
- C: Cassette
- E: Extension
- F/D: Floppy disk
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- H/D: Hard disk
- Int: Interface
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- M: Memory
- N/A: Not available
- N/P: Numeric pad
- O/S: Operating system
- P/P: Parallel port
- S: Software
- T/B: Time block
- T/B/A: Time block...
- T/E: Text editor
- U: Utility
- W/P: Word processor
- X: Cross section
- Y: Yield
- Z: Z-axis
- (E): English
- (S): Spanish
- (W): Welsh

Note: Software items listed in italic are not included in the basic price of the equipment. All prices are exclusive of VAT.
BUSINESS SOFTWARE
NET INC VAT
Access 176.00 195.56
Calculator (CPI/M)(90 column spread sheet) 90.00 101.68
DBase II (CPI/M) 298.00 334.05
Data Star (CPI/M)(powerful data entry) 127.00 149.50
D.B. Master version 3.02 186.80 211.60
D.B. Master exaggerates 58.00 66.70
D.B. Master utilities (links with visic) 58.00 66.70
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Graphic Mag-Bug graphs, pie charts, etc 35.00 40.00
Mathematic 52.00 59.00
Multiplex (microsoft superior spreadsheet) 195.00 223.50
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PFS Graph 68.85 78.20
PFS Report 53.00 60.95
SuperCalc (CP/M) 75.60 85.34
The Sansurtr Manager 68.00 78.20
Versocom (form generator in Pascali) 193.00 223.85
Visic + (Visicadlevalication) 30.90 35.51
Visicalc 105.00 120.75
Visicalc-expandable (use with 30K/128K cards) 52.00 60.95
Visicale utilities 34.00 39.10
Visicale 122.00 140.30
Visifile 115.95 133.34
Visicelle 103.00 119.05
Visischedule 144.00 165.60
Visistandard 142.00 163.30
WORD PROCESSING
Apple Writer II 72.00 82.80
Executive Secretary 145.00 165.75
Executive Editor 59.00 69.75
Format II 200.00 230.00
File Writer (91 column) 69.00 79.95
General Editor (now fast proof reader) 69.00 79.95
Screenwriter II (70 col word card) 12.58 14.71
Super Text III (80 column) 108.00 125.75
Writer/2 (110 CP/M) (enhanced features) 135.00 155.25
Zinta 125.00 143.75

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Beer Run (Sinuss) 15.95 17.95
Carnival of Bill (Night Games) 15.95 17.95
Chairfall (Brodurband) 15.95 17.95
Epoch/Sinus 15.95 17.95
Fight Simulator (Simulation) 15.95 17.95
Keysight of Drum (use with Wizardry) 15.95 17.95
Lift (Online Systems) 15.95 17.95
Minitor (Sinuss) 15.95 17.95
Pinball (Sinuss) 15.95 17.95

SCREENMASTER 80
This new 80 column card is the most advanced feature available like: 9x10 matrix, 3 scrolling speeds, shift lock, user definable graphics, supports all Applesoft commands and Appewriter II. Well worth the £185 + VAT.

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THREE NEW REVOLUTIONARY CARDS FROM DIGITEK

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40PCW
The Inspector (disk snooper, needs 16K cd) 36.00
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16K Ramcard Digitek 75.00
16K Ramcard Ramex 65.00
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32K Ramcard Saturn 120.00
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128K Ramcard card 270.00
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Cool stack (holds 2 drives & monitor + fan) 60.00
ODS upgrade kit (0.2 to 3.3) 36.00
E-Z Port (game socket adapter) 11.45
Keyplus Numeric Keyboard 83.00
Lower Case adapter (CP/M 4.2 +) 74.75
Romplex Card 85.00
The Mill 6809 with Pascal speed up 189.00
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VC-Expand Ramex (loads 136K visi in 20 sec) 40.00
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Z Card Inc CP/M & Supercalo 179.00
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PCW/13

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• Converting microcomputer to Viewdata (Prestel) receiver

KEY FEATURES

• Snap-fit acoustic link between standard telephone handset and terminal equipment
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• Lightweight and compact
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PAC-M1: This acoustic modem provides a link between telephone line and Serial Data socket of a microcomputer, thus allowing conversion into a Prestel receiver and facilities for transfer of telesoftware programmes. £135 plus VAT, p&p.

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PAC-1: Provides an acoustic link between standard telephone handset and all types of Prestel and private Viewdata terminals, TV sets and adaptors. Powered by a single PP3 battery, this acoustic coupler allows Viewdata equipment to be used in office or home without a fixed BT socket. £85 plus VAT, p&p.

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Software available for:
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Tel: 0930 519099 Telex 64157

PAC-M1
PAC-M2
PAC-1

PCW/13
A New! Low-Cost Printer With Dot Addressable Graphics. DMP-100. Prints high-density graphic information or standard 10 cpi alphanumeric. 480-byte full-line dot-buffer, selectable parallel and serial interfaces (600/1200 baud) and adjustable tractor, 4½ to 9½". Uses fanfold paper. With ribbon cassette. 26-1253

B. New! Low Cost Daisywheel Printer. Select 10 or 12 characters per inch or proportional spacing. Features ½ line feed, underline, boldface and programmable backspace. Also gets 1½x10" space and 1/48" line feed. With Courier 10 print wheel and carbon ribbon. 26-1250

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D. New! CGP-115 Colour Graphics Printer. Creates beautiful graphics in red, blue, green and black, plus prints alphanumeric. Built-in commands simplify drawing and plotting. Text mode prints 40 or 80 characters per line at 12 characters/sec. Software controls additional character sizes and rotation. 28-1192

DMP Means Dot Matrix Printer
DWP Means Daisy Wheel Printer

Send For Your FREE 1982/3 TRS-80 RSC-8 Computer Catalogue
Computer Marketing, Tandy Corporation (Branch U.K.), Tameway Tower, Bridge Street, Walsall, West Midlands. WS1 1LA
IN STORE

Zenith WH-11A (£2673)
Zenith Data Systems (£2594)
Eldon11 (£1757)
Zilog MCZ 1/05 portable: MCZ 1/0A (£3250)
Thames Systems: 084421

Machine
TI 99/4A (£199 inc VAT)
TI: 0234 676466 (TBA)

Main Distributor/No. of Brains
Tuscan CP/M Starter (£999)
Transam: 01-405 5240 (N/A)

Hardware
16-48 RAM: 26k ROM: 9900: 2 x C int: 24 x 32, 16 colour TV int: 3 zones & noise: P/P:

Software
OS: Basic.

Trade names for the various clubs
This month is going to be a month of clubs. I have been so keen to waffle about national things in the last few issues that I have neglected mentions for the various clubs around the country. But first, as they say, here is the news.

The ACC held its AGM at the ACCumulator in large numbers, it seems to sound rather like Julie Dawn's Valley area. Anybody interested in forming a group start-ting up in Manchester, and there seems to be a group starting up in Manchester.

The idea of the scheme is therefore to return to the maintenance fee of £3 per member (with discounts beyond 50 members). The ACC is a programme or a chairman's let-ter and then distribute it. Any-body interested in this for their club, please write to me for details.

Uncle Baxyle tells me that there is a Pascal User Group (PUG) lurking in the rain forests of Pinner. They are interested in promoting 'standard' Pascal. They are interested in micromachines of whose names start 68, which means 6800, 6809, 68000 (ie the Motorola Appreciation Society).

Chelsmford. So here is your answer, Mr Sadler awaits your letter.

Further down my postbag, I find a similar enquiry from Mr D Norden of 138c Church Rd (01 Harrow Wood, Romford, Essex. Perhaps you and Mr Sadler could get in touch. (This is beginning to sound rather like Julie Dawn's pen pals spot on Radio 2 in the middle of the night).

The Royal and Ancient Borough of Slough is apparently still devoid of microcomputer help. Last time I mentioned these worthy people's plight, I received a letter from a Mr P A Seal of 1 Ormonde Flats, Church Road, Iver Heath, Bucks, in which he said that all he knew of was evening courses at Evesham Adult Education Centre (Contact Mr D de Silva). However, he is intending to try to form a club, so why not get in touch?

Back in the business Metropolis, I hear tell of '68 Microgroup'. This is half-way between a London based club and a national club, they are interested in promoting a newsletter. They are interested in micros whose names start 68, which means 6800, 6809, 68000 (ie the Motorola Appreciation Society).

The club is described as 'relatively non-profit-making' and the subscription is £5 pa plus £1 per meeting. The Chairman is Jim Anderson, of 41 Pembworth Road.

Rupert Steele presents his monthly round-up of news from the Amateur Computer Club.

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Uncle Baxyle tells me that there is a Pascal User Group (PUG) lurking in the rain forests of Pinner. They are interested in promoting 'standard' Pascal, rather than having the same proliferation of dialects as Basic industry has suffered. Quarterly newsletter: enquire Nick Hughes, 01-866 3816, or via PUG, PO Box 52, Basildon, ESSEX 3FE. Lonely Mr Sadler, of 18 Wannescot Road, Brentwood, Essex, CM15 9HD is canvassing for support for a computer club in the Brentwood Area. Now, I've had to send them to Ilford or...
be a general club dealing with many different machines (I wonder if they are interested in a Thames Valley Association of computer clubs). Anyway, contact: W. Tubbs, Ellwood Way, Chalfont St. Giles.

Another club in the London area is the Hatfield Technological College Computer Club, which meets fortnightly on Thursdays at 7.30 in Room W102 at the above Tech. Contact: Mrs. Martin, Prioronius on 01-882 2282 (subscript 65). At the other end of the AI, we find the Edinburgh ZX Computer Club. This is an extremely active organisation of Scottish Sinclair freaks. Their activities include producing a bi-monthly newsletter containing news, articles and holding fortnightly meetings (2nd and 4th Wednesdays) at the Claremont Hotel, Clenthem Crescent, Edinburgh (7.30pm). Tutorial groups are held at their meetings, so that benefits from the more experienced members. Subjects covered include Basic and machine code at all beginners' and advanced levels.

By now they should have organised two ZX computer fairs in Edinburgh, the first (in July) having attracted 1500 people. Their membership rates are £5 pa, or £3 for children, students, pensioners and the unemployed. For more information contact the Secretary, Keith Mitchell, 19 Meadowdale Road, Edinburgh or phone 031-334 4843.

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All Transaction File ads must be submitted by readers on this form or a photo-copy of this form. Maximum 30 words. Print one word per box, very clearly. Name, address and/or telephone number must be included in the 30 words. All ads must be accompanied by a flat fee of £2.50. Make cheques or Postal Orders payable to Personal Computer World. Ads accepted from private readers only. Ads cannot be repeated (unless sent in on another form) and we cannot guarantee to print an ad in any specific issue. Please help our typesetter to produce a bi-monthly newsletter of extremes, books, magazines, articles and holding fortnightly meetings (2nd and 4th Wednesdays) at the Claremont Hotel, Clenthem Crescent, Edinburgh (7.30pm). Tutorial groups are held at their meetings, so that benefits from the more experienced members. Subjects covered include Basic and machine code at all beginners' and advanced levels.

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TRANSACTION FILE

CHRISTOPHER

For further information on ComputerTown UK! see "CTUK News" or Prestel page #000803 #

Patrick Coley
52 Queensway
Gardenways
London NW1

Alison Holley
21 Brammy Drive
Tottenham
Hull HU8

Steven Chiswell
Vernon Quaintance
52 Southchurch Road
Norbury
London SW16 4UN

B J Candy
9 Oakwood Drive
Guildford GL3 3JF

Roger Shears
11 Hollow Lane
Bitterne Park
Southampton SO2 4PY

magazines, A Working Knowledge available. All in very good. Sinclair, Spectrum complete, with interface and cassette recorder. £260. Tel: 01-561 4918.

Alan Hooley
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50243.

Roger Shears
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Bitterne Park
Southampton SO2 4PY

Peter Jarvis
c/o Health Dept
London NC2

Derrek Knight or Bob Carter
Rayners Lane
Imperial Drive
Rayners Lane
Middx

Ray Skinner
62 Central Avenue
Billingham

Brian Taylor
Tomorboy Ley
Avethylene Avenue
Tombridge
Kent

Lyn Antill
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Barbiton
London EC2

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Sharp MZ80A pocket computer with interface, printer, manuals. Tel: 01-434 1365

Microchess games utilities education equipment etc, price list. Tel Reading 0734 6434.

Lyn Chappell
Fruit Lovers Park
Tonbridge
Cleveland TS23 1LN

£140. Tel: Exchange 0734 6434.

Acorn Atom - Acorn built 7k RAM 8k ROM, all leads, manuals, £20 Tel (0922) 6830 (West Park). £25. Tel: Kendal (0539) 27058.

£300. Tel: Homdean 597066 (STD)

Acorn Atom - 12k RAM 12k ROM complete with PSU. All leads, manuals, in original packaging, including Invacube, Framix, Machine, etc. £15. Rings ross 088 4046 West Midts.

Epsom MX -80 printer, plus printer face complete (including software). £300. Tel: Kidlington (0865) 624661.

Software £375. Tel Kidlington (0865) 624661.

£425. Tel Kim Swain 01-407 8989

£1199. Tel: Rossendale (0706) 15 282, 2 for £6.00. Langworth 15 Hitchin

£300. Tel: Southport (0706) 15 282.

£150 - cassette, keypad, numeric pad, all steel cased and packed. Tel: 01-942 2385 any time.

£360 ono. Jackson Tel 061-437 5621.

£575. Tel Southport (0706) 15 282.

£260 ono. Tel- 01-561 4918.

£425. Tel: 01-561 4918 after 6pm ask for games on cassette, boxed, £400. 4, dustcover, manulas, PET Games £300. Tel: (0792) 701186.

£1199. Tel: 01-561 4918.

£400. Tel: (0792) 701186.

£250 - HP digital cassette drive £300 - each with charger.

£325. Tel: 01-749 2069.

£450. Tel: 01-996 2551.

£30 of books, 2 WC plus others.

£490. Tel: 01-749 2069.

£35 of boks, 2 WC plus others.

UNIX, Interface plus all manuals and extra software £375. Tel Kidlington (0865) 624661.

£260 ono. Tel Brentwood (0277) 212114.

£139 for bigger computer Ipswich (including newdos), manuals, leads, etc £335. Tel 01-510 0474 after 6pm

£350. Quick sale only £250. Tel: Tamworth (0827) 250429


£90. Tel: 061-437 5621.

£260 ono. Tel- 01-561 4918.

£650 ono. Tel Brentwood (0277) 212114.

£90. Hounslow 272 2008 on.

£220, KE/16, Interface + Cassette Interface £50, Kenilworth (0821) 724008

£150 - cassette, keypad, numeric pad, all steel cased and packed. Tel: 01-942 2385 any time.

£400. Tel: (0792) 701186.

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£400. Tel: (0792) 701186.
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These are alterations and additions to the complete listing published in the August issue. The next full listing will appear in the February 1983 edition.

USE GROUP INDEX

National
Forth Interest Group – membership fee £7 pa. Includes Newsletter ‘Forthwrite’, issued bimonthly. Meetings held in London on first Thursdays monthly at the Polytechnic of the South Bank, Borough Road, London SE1. Contact: Keith Goldie-Morrison, 15 St Albans Mansion, Kensington Court Place, London W8 5QH.

Forth Group – research and development organisation dealing with BBC, PET, Apple, Commodore, TRS-80 and all sorts of micros welcome. Meetings 7pm 2nd and 4th Mondays monthly. Contact: Ian Thornton-Bryar, Tel: Clitheroe 25933.

Ribble Valley Microcomputer Group – new informal group held informal meetings in Harpenden on alternate Monday evenings. Contact: Richard Barbarian, 114 Lansdown Road, St Albans, Herts. Tel: St Albans 61236.

Portsmouth Co-Operative Computer Club – new informal club aiming to give advice on home computers and to use different machines. Meetings every Sunday, 5pm at 53a Heidelberg Road, Devonshire Square, Southsea. Contact: Mr A H May, 30 Delanore Road, Southsea (Tel: 0705 850603).

SODAT Computer Club – new address, B25 Bertridge House, Hillfield Road, London NW6. Membership 50p per meeting. Telephone enquiries can no longer be accepted. Anyone interested in Contact: Brian Milligan, 50 Linkletter Ave, Ashford, Middlesex.

Towns
Birmingham User Group for Atari Owners. Meets 2nd and 4th Thursdays monthly at the Matador public house, Bull Ring, Birmingham City Centre. Magazine soon to be launched. Contact Lea Ellingham on 0785 41133 or 021 233 1488 if you want to know more.

Caterham Computer Club Meets every Thursday at 8pm in Caterham Leisure Centre, Godstone Road, Caterham. A BBC micro is available for demonstrations. Contact: Mr M Godbold, Caterham 48304 or Mr J Hughes, Caterham 43316.

Chiltern Computer Club meets on 2nd and 4th Mondays monthly at 7.30 in the function room of the Manor House, Abingdon Street, Henley on Thames. Membership £5 per meeting. Contact: Mr J Hodges, Caterham 48304 or Mr J Hughes, Caterham 43316.

SWAC – Society of Warwickshire Amateurs. Meets 2nd Monday in the month 8pm in the Old Pheasant Inn, New St, Worcester. Secretary: John Stafford, 29 Somerville Road, Worcester WR4 9QG. Tel: Worcester 20297.

Five Bells pub in Eaton Bray. Users of all micros welcome. Contact: Steve Metts, Eaton Bray 20922. Forming a computer club for Hampstead should contact: Mr T Kayani at the above address.

Tilbury, Chadwell and Grays area of Essex. Is anyone interested in forming a computer club in this locality? If you're over 16 and would like to run the club or just help out with ideas for discussions, contact John Mayhew on Tilbury 2424. It's hoped that would-be members will help out with their own equipment for demonstrations to non-owners.


NETWORK NEWS

These are all the European networks of which we're aware. Most are free — but phone them for details.

Forum-80 Hull ... (Forum-80 HQ) Tel: 0482 859169. System operator: Frederick Brown. International electronic mail, library for up/down loading software. Forum-80 Users Group, Pet Users section shopping list system hours, 7 days a week midnight to 8.00am, Tues/Thurs 7.00pm to 10.00pm. Sat/Sun 1.00pm to 10.00pm.

Forum-80 Milton ... (TRS-80 Users Group 80-Nett) Tel: 0908 700660. System operators: Leon Heller and Brian Pain. Electronic mail, library, newsletter, TRS-80 information system hours: 7 days a week 7.00am to 10.00pm.

Forum-80 Holland ... Operator: Nico Karssemeijer. Tel: 01 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours: Tues-Sat 1800-0700 nightly, continuous from, 1800 Sat-0700 Tues.

CBBS London ... Operator: Peter Goldman, Tel: 01-399 2136. Facilities: electronic mail, program downloading. Hours: Wed 0700-0900 & 1900-2200, Fri 1900-2200, Sat 1600-2200.


ACCC ... members bulletin board, Stockholm (Sweden). Tel: 010-468 19052.

ABC-80 ... Stockholm (Sweden). Tel: 010-468 23660, guests use password "66,66" for access. Elfa Sweden 010-468 7300 706.

Tree Trade ... Sweden 010-468 19052.

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.

Swansea (Leisure Centre) Microshow. Contact: Centre for Trade and Industry, 0792 50821 13-15 Jan

USA (Atlanta, Georgia) Southeast Electronics Show. Contact: ECL (Exhibition Agencies) Ltd, 01-486 1951

18-20 Jan

Birmingham (NEC) Which Computer Show. Contact: Clapp & Pollak Europe Ltd, 01-747 3131 18-21 Jan

London (Bleeasdale Computer Systems, Unix and C courses. Contact: 01-828 6661 24-29 Jan

London (Cunard Int. Hotel), Peripherals Suppliers Exhibition. Contract IPC Exhibitions Ltd, 01-643 8040 2-4 Feb

London (Heathrow Park Hotel) Video Software Show. Contact: Link House Magazines (Croydon) Ltd, 01-688 2599 20-22 Feb

London (Barbican Exh Centre) Information Technology Office Automation Exhibition and Conference. Contact: BED Exhibitions Ltd, 01-647 1001 22-25 Feb

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As all programs in PCW are checked either by a referee or by one of the editorial staff, it can take some time for a program to actually appear. If you don't hear from us within two months or so, it usually means your contribution is in the referee pipeline. It's essential to ensure that your program is fully debugged before you send it in — get a friend to try it out first — and all programs we publish are paid for at a regular rate. Send contributions to: Maggie Burton PCW Programs, 62 Oxford Street, London W1A 2HG — and please enclose an SAE if you want material returned.

More on Star Trek

Some clarification seems necessary on the subject of the program 'Star Trek' published in October PCW. Inundated as I was with phone calls from readers with calloused fingers who'd found it won't work, I contacted the author in a state of manic desperation. Only two actual errors have been discovered in the listing: line 2610 should read IF D THEN LET D=D-10 and the end of line 21000 should read GOTO 2300. I hope that will clear up many readers' problems with this program, but the following points are worth bearing in mind.

It is essential to include the REM statement in line 10 (the program is so long it's possible that a lot of people will have left this out in the interests of saving time), which should contain at least 28 full stops. This is because the machine code routine is loaded into this by lines 20-29. You can check this routine by entering lines 10 to 29 (inclusive), running them, and entering RAND USR 16514, upon which the top ten lines of the screen go black.

The character in lines 520, 540 and 560 which is referred to as 'graphic H' is not the inverse video 'h' but the chequered character on the 'H' key.

This kind of thing has been said before in these pages, but Star Trek contains a lot of POKEs to the display file and a great deal of numbers which must be entered with great care if the program is not to crash. Lines 4180-4264, 5090-

This edging is the chess board type graphic symbol on key 'H'.

Fig 1

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This game, for a 3.5k VIC, is a game of Othello type in which player and computer take it in turns to drop black or white pieces onto a 7x6 grid. The winner is the first player to obtain a line of four white pieces onto the actual display. Care must be taken to ensure that the right amount of spaces are used in any strings — some of them contain two together and this is not always apparent from just reading the listing. It’s best to try them with two at first and then if it looks wrong to go back and alter them.

I hope this clears up any problems readers have had with this program. If anyone is still having trouble with it after reading this and they’re sure the trouble is in the program rather than in the arduous task of keying in a long listing on that unfriendly ZX81 keyboard, then they are welcome to write in and I’ll send a list of variables which should make it easier to understand the program.

**VIC Connect-4**

by Adrian Millet

This game, for a 3.5k VIC, is a game of the Othello type in which player and computer take it in turns to drop black or white pieces onto a 7x6 grid. The winner is the first player to obtain a line of four either horizontally, vertically or diagonally on the grid. To input the position on which you want to play a turn, simply type in the appropriate column numbers when the prompt is given.

The reverse video '/' in line 8020 is not directly available from the keyboard and can be left out if desired. I’d like to thank Softex Computer Accessories for this program, which was listed on a ZX Printer using the Softex Printerface.

**Programs**

5270, 6030-6302 and 9030-9150 all involve POKEing the display and should be checked carefully. Incidentally, in line 1100 the variable S contains the address in the display file of the top left hand corner black square in the display. It is used as a base address for calculating all the other display POKEs, so a mistake in this line will definitely cause problems.

The two diagrams should help with any problems encountered with the display. Figure 1 is the display as printed by lines 5020-5050. The other squares in the grid shown are black on the actual display. Figure 2 is the display handled by lines 510-610 and through looking at this it should become apparent why using decimal numbers for the warp factor will ruin the display. Care must be taken to make

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Microscope

6 Battenhall Road, Birmingham B17 9UD
Here's a program which is really much more interesting than directly useful (I hope the author isn't offended by that statement...). I say this because it's a machine code monitor written in Basic. All routines are, therefore, handled through a monitor emulator rather than a monitor proper. The use of Basic for this type of application also detracts somewhat from the speed of execution.

For the novice to machine code it will make a fair introduction to the subject, although a beginner's book on machine code and some instruction material on programming the 6502 processor would be necessary. Machine code aficionados will find its actual uses are rather limited, but it's unusual to see a program like this in the Programs mailbag.

Here is a list of the commands available:

The 'M' command (format M xxxx) loads byte values into memory from the file specified. This subroutine prompts for start and end addresses which should both be given as four-digit hex numbers.

The 'H' command (format H n) gives the hexadecimal value of decimal number n.

The 'D' command (format D xxxx) gives the decimal value of xxxx which must be a four-digit hex number.

Lastly, but not leastly, the 'X' command (format X "filename") saves byte values from memory to the tape file specified. This subroutine prompts for the filename and data files and these cannot be loaded into memory using the normal Basic LOAD command.

The 'S' command (format S "filename") loads byte values into memory from the tape file specified. This is likely to crash the program. This routine uses data files and these cannot be loaded into memory using the normal Basic LOAD command.

The 'G' command (format G xxxx) tells the computer to execute the machine code program starting at xxxx.

The 'L' command (format L "filename") loads byte values into memory from the specified tape file. This subroutine uses data files and these cannot be loaded into memory using the normal Basic LOAD command.

Readers who use this program should beware of incorrect syntax on input as this is likely to crash the program. This would, in fact, be quite easy to remedy with some nifty error trapping routines in the appropriate places. Apart from that little complication it is easy to use and well put together.
**PROGRAMS**

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**KENT MICRO BUSINESS**

Boks 53, Nordstrandhoga, Oslo 11 NORWAY
Here’s an ingenious little routine for the Atari 400/800. As far as I’m aware nothing like it has been published before for this machine, certainly not in the popular press, anyway, but I’d stand corrected if this were not so. The whole program serves to demonstrate the Atari’s internal register graphics modes which are not documented in the user manuals. In fact, most Atari owners are blissfully unaware of their existence and they cannot be accessed through the normal Basic GRAPHICS statement. If you’re an expert you should be able to build on this program and make fuller use of your Atari’s hidden potential, and if you’re a beginner then looking hard at this program should teach you quite a bit about your micro’s internal workings.

Basically, these internal modes centre around the Atari’s ‘Antic’ LSI chip and are numbered 3, 4, 5, 12 and 14. Internal modes 4 and 5, which are dealt with here, are character modes. To use these, the ‘display list’, a small machine code routine for the Antic processor, has to be found and loaded into RAM at a suitable address. The whole program serves to demonstrate the internal register graphics modes.

The first part of the program loads a small machine code routine into RAM at ‘page 6’ (hex 600, decimal 1536), which is reserved space. This routine is accessed using the User Select Read function and it loads a redefined character set as five bit-maps into a position just below memory top. The $, %, & and . keys are then altered, which is very slow from Basic. This program does the job much more quickly and efficiently.

The diagram below, this is how the colour controls work: colour location 708 (line 370) controls the colour if B is shaded; colour location 709 (line 350) controls the colour if A is shaded; colour location 710 (line 360) controls the colour if A and B are shaded and colour location 712 (line 380) controls the background colour.

![Diagram of character set](image)

When you run the program, first type $, %, & and . Then go into inverse video and type the % key again. An explanation of the alteration of the % key can be found by treating a row of pixels in the graphics square as a binary number, each shaded square being a 1. The %’s top row as it now appears in inverse video is 10101010 which, translated into decimal, is 170 (128 + 32 + 8 + 2). This comes from line 170 in which all the data items are 170.

**Program of the Month**

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By A Ferguson

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DAVID MCKERAN
23 WARWICK DRIVE, EAST HERRINGTON
SUNDERLAND, TYNE & WEAR SR3 3PU
Unfortunately there are no instructions contained within this program as the VIC-20 doesn't have enough memory to incorporate them alongside the game. Readers with expanded VICs should have no trouble in coding if they want to.

Custom-made graphics characters and effects are used to give some really interesting effects at the beginning. The object is to shoot down a squadron of UFOs and then to land safely. Keys S, F, E and C are used to line up your sights (left, right, up and down respectively) and function 5 controls your gun.

What actually happens when you 'line up your sights' is that the UFO moves in relation to them — although the end result is exactly the same. As the UFOs move randomly it’s a fairly easy job to get them lined up long enough to be shot, and the more you destroy the more unreliable your gun becomes although your chances of landing safely increase.

When you're ready to land you have to 'drop down' using the sights until your instruments pick up the ground, which is indicated by a flashing green 'land' in the top left hand corner of the screen. The frequency with which it flashes indicates how near you are to the ground. When you are directly above a dot between two men, you hand control over to the automatic pilot by pressing 'return' until your amount of fuel is printed on the screen in red. If there are still UFOs on the screen you shouldn't land as you can't shoot them once the automatic pilot has taken over and they will bomb your ship. If you crash when landing you lose 5 points. A landing cannot be aborted once it has begun.

Finally, 3.5k VIC owners should avoid using too many spaces as this will cause 'out of memory' errors. If David Taylor is reading this, could he please contact me as I have mislaid his address.

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This program, which runs in about 16k on 4000 series PETs, is meant to show a small section of the Forth language for the beginner. As it's a bit mean on instructions, a book on the lines of Starting Forth for the comparatively few who are interested (FORTH TEACHER ANDREW ASHWOOD) should be a supplement to using this model.

It also allows the compilation of additional words in the Forth fashion and gives a visible display of the stack contents at each operation, so demonstrating the effects of a word, a number of which are provided in the program.

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press 'C' you are told how much longer the voyage has to run.

As the voyage draws on, three effects can be seen. The first, stellar aberration, makes the stars seem to draw together around your destination star, so that even the sun (which is actually behind you) becomes visible ahead. Doppler shift is best known within the confines of earth for the fall in pitch of the sound made by a speeding object as it passes you (listen to police sirens and car horns), but astronomers know that Doppler shift can be seen in the spectra of stars, either when they are travelling fast or, as in this case, when you are travellng fast past them.

It manifests itself as a 'colour shift' in the spectrum in which one end of the spectrum is effectively lost to the eye and the red end (if something is moving towards you) or the blue end (if something is moving away) increase in prominence and size. Here, stars red-shift or blue-shift into invisibility. The colours used here are representative and in reality they depend on the colour of the star. Bear in mind that Doppler shift can only be seen on the spectrum of a star which is moving very fast — close to the speed of light, in fact, which gives an idea of how fast you are meant to be travelling in this simulation. The last effect that can be seen is that of Parallax, in which close objects move past those further away.

When the voyage is over you are put back to the beginning, except that you are in a new location. Before loading or keying in the program, it is necessary to type in the following two direct commands to allow for the graphics: POKE 324650,0 and then POKE 44,32 then NEW. The program runs on a VIC with either an 8k or a 16k memory expansion.
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BBC Gomoku by Jeff Aughton

Although, in days of yore, PCW published a Gomoku game for PET, this program bears very little resemblance to it. It runs on a BBC Model B in about 6k and includes instructions. It takes the computer a maximum of eight seconds to make its moves, which compares very favourably with some games of this type written in assembler. Certainly it's fast for a BASIC program. But the reason for this speed is that the computer looks only one move ahead. In spite of this it plays a reasonable game and often makes seemingly peculiar moves which turn out to be sensible on analysis. It makes a worthy opponent.

Draws are spotted immediately — i.e. as soon as the computer knows neither player can win and not before. This is announced and the game can be finished without having to be played to an uninteresting end.

Should any reader require details of the author's algorithm — which can be applied to almost any two-player strategy game — they are welcome to get in touch with me (enclosing an SAE) and I will supply them with a flowchart.

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HOW TO MAKE EPSOM, WORDSTAR AND ORSONBE TO DISC

Continued from page 147

SuperCalc models with Wordstar has forced me to make full use of this. I also prepared a document with a right margin at column 50 and reformatted before the final print. Hence the following patches.

Default right margin 50 0380 33
Set screen size to 120 0349 78

Now let's put the icing on the cake by utilising the function keys of the Osborne. These can be used to make life very simple by merely transferring the ^P options directly to each function key. This reduces key strokes and you can put a prompt card behind the numbers on the alpha pad. But remember, the aim is flexibility. I have used these function keys to combine couples of ^P options, and secondly to store sequences I may send directly from the keyboard (because I can't remember them). To configure the function keys use SETUP, which is located on your CP/M system diskette. I won't explain how to use this. The Osborne manual does it far better than I could. Figure 2 shows my function key template.

Table 4 shows the values entered for each number. I have called the combination of Double Strike and Emphasised 'Super Bold' and Enlarged/Condensed combination 'Style 66'. Using these different options to the full, the screen can get cluttered with control characters (roll on the day when screens emulate printers!). I have put ^OD on the template, because I find it useful to be able to turn these control characters on and off easily. To achieve a zero with a slash through it is also cumbersome, hence function key 0. We could put a few cherries on top of the icing by redesigning the print menu to reflect the changes we've made. Use DDT on WMSG5.0VR — consider this one your project.

I have enjoyed giving these three wordprocessors a thorough bashing. However, my investigation has highlighted some areas of frustration. On the Wordstar front it wouldn't be super if there were more ^P function keys available for us to access? Unfortunately ^PB, ^PD and ^PS are now virtually redundant, but we're unable to amend them fully so that we can use them for something else. It would also be nice if there were some user-definable dot commands. I would use these for selecting line heights. On the Epson front — having a different deselect sequence for each option doubles the number of function keys needed. Also, most of my deselecting merely sets the printer back to its default
values. I have tried using the initialisation string, but this is no good in the middle of a document. It sends a line-feed and a carriage return.

What about the Osbornes? Well Adam, the pencil tray in the new case is a splendid idea, but where do I stick my template?

Stepping aside for a moment, I hear that Epson will soon be launching a new, super dot-matrix printer that will knock spots off their daisywheels. I can't wait to get my hands on it.

Lastly, the MX-80 I have been using is a type III. It has some differences to the type II. Notably, the lack of true sub/super-scripts and proper underlining on the earlier version. I am also told that the sequences may be different on the MX-100. Compare closely the relevant sections of your manual with the procedures herein. You should be able to establish the correct sequences for your printer. On some earlier MX-80s, using select and deselect in the same line cancelled the option before printing. The Osborne uses Wordstar version 2.26. Version 3 allows lines to continue beyond column 120 without wrapping around on the screen. If you’re not using the Osborne the keyboard direct-entry sequences may be different. There is a good chance that the relevant memory addresses will be the same.

LEISURE LINES

646 entries were received to October’s puzzle — either the puzzles are just too easy or the readership is growing at an astonishing pace. If we get that number of entries for the Manx hamfest, then we’ll know that it’s the latter reason!

Anyway it was a fairly easy puzzle and the answer was 29031 — most readers got it right. The winner, chosen by a random number generated on an HP41CV, was entry number 492 which came from Switzerland — E R Fulton. Congratulations!

It’s the latter reason!

On Tuesday each stall again has 300 apples, therefore stall A collects £10 and stall B £15 — a total of £25.

Each stall sells 300 apples, therefore stall A collects £10 and stall B £15 — a total of £25.

On Tuesday each stall again has 300 apples, therefore stall A collects £10 and stall B £15 — a total of £25.

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On Tuesday each stall again has 300 apples, therefore stall A collects £10 and stall B £15 — a total of £25. This is the last entry.

Quickie

There are two stalls in a market selling apples. Stall A sells them at three for 10p, the other stall B at two for 10p. On Monday

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infomatics MICRO BULLETIN

BE UP-TO-DATE WITH ALL THE VITAL NEWS IN THE MICRO COMPUTER INDUSTRY.

In our fast-moving business the right piece of news can often put you ahead of your competition... alter your plans... even the very strategy of your business... but only if it reaches you in time.

The Infomatics group of publications is launching a new weekly newsletter to cater specifically for people in the micro computer industry. Published every Monday, the Infomatics Micro Bulletin will be packed with information about what is happening on the micro front - both hardware and software. Produced by the same publisher as Personal Computer World and MicroDecision, the micro newsletter will carry up-to-date information on what is happening in the US and Japan, as well as news from the UK.

We'll be talking about new products coming along from the Japanese and American manufacturers and spotting those who want representation in the UK and Europe. And we'll be reporting on those companies abroad which want to market British systems and software.

The information will be aimed at people in the business - software houses, dealers and manufacturers - rather than hobbyists and users. It will therefore be essential reading for those who want to stay up-to-date with events and pick up the best deals first.

Annual subscription to the Micro Bulletin is £85, and will include an automatic subscription to Infomatics magazine.

So send off now for this week's FREE issue of the Micro Bulletin and for details on how to subscribe.

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PCW 215
How to turn your HP-41 into a handheld computer.

Introducing the Hewlett-Packard Interface Loop.

Starting today, your HP-41C or HP-41CV can be more than just a great little calculator. It's a great little computer, capable of controlling a quickly-expanding family of peripherals.

The new Hewlett-Packard Interface Loop (HP-IL) makes it all possible. HP-IL is an easy-to-use, low-cost interfacing system, specifically designed for battery-operable devices.

The Interface Module and Peripherals.

At the heart of the system is the Interface Module, which plugs into any one of four HP-41 ports. You can control up to 30 peripherals, using only one port in your HP-41 calculator.

One of the key HP-IL peripherals is the new Digital Cassette Drive. This battery-operable device provides an incredible 131,000 bytes of mass memory.

Another work-saving HP-IL peripheral is the new battery-operable Thermal Printer/Plotter with enhanced formatting options and graphics. This is just the beginning. There are many more HP-IL products on the way. And they're all designed to provide the versatility and adaptability you expect from HP.

You see, Hewlett-Packard is committed to a very big idea: small devices talking to each other, giving you big system capabilities—at small system prices!

There’s a dealer list opposite to help you get started!

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The Super Printmaster III, as well as having many high-text features, also dumps from the screen both Hi-Res and Lo-Res graphics.

In the buffering mode your Super Printmaster III will ‘cue’ up to 256 of your print files; in fact it will take over the whole of your printer management.

So make the most of your Apple system, install the Super Printmaster III. You certainly won’t be disappointed.

Dealer Enquiries Welcome

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Digitek, Super Printmaster III, Screenmaster 80, and Ram Master are registered trademarks of Digital Interconnect Ltd. Apple is a trademark of Apple Computers Incorporated. CP/M is a trademark of Digital Research. VisiCalc is a registered trademark of VisiCorp. Super Printmaster III patent pending.
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Personal Computer

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SOFTWARE IN BASIC FOR ATARI

Invoicing for Small Business

This program makes writing invoices easy. Store your products in DATA statements with order number, description, and price. The program later retrieves the description and price matching to the entered order number. The shipping cost and the discount may be automatically calculated depending on the quantity ordered or entered manually. The description to the program tells you how to change the program and adapt it to your own needs. Comes with a couple of invoice forms to write your first invoices on it.

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- Order #7202 disk version $39.95

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This program is menu driven. It gives you the following options: read/store data, define items, update inventory, inventory mainteance (including outgoing), reports. The products are stored with inventory number, manufacturer, order level, present level, present code number, description.

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The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power. You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics. You have the facility to support separate data files. You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM. Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175! You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white). Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing. There's no need to stop there. The ZX Printer—available now—is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232/network interface board.

Key features of the Sinclair ZX Spectrum

- Full colour—8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound—BEEP command with variable pitch and duration.
- Massive RAM—16K or 48K.
- Full-size moving-key keyboard—all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution—256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set—with upper- and lower-case characters.
- Teletext-compatible—user software can generate 40 characters per line or other settings.
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- Sinclair 16K extended BASIC—incorporating unique 'one touch' keyword entry, syntax check, and report codes.
The ZX Printer—available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set—including lower-case characters and high-resolution graphics. A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. 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 ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.

The ZX Microdrive—coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing. Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy. The transfer rate is 16K bytes per second, with average access time of 3.5 seconds. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum. All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.

How to order your ZX Spectrum

BY PHONE—Access, Barclaycard or Trustcard holders can call 01-2000200 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, Barclaycard, Access or Trustcard. EITHER WAY—please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt—and we have no doubt that you will be.

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<tr>
<th>Product</th>
<th>Price</th>
</tr>
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<tbody>
<tr>
<td>PLUTO</td>
<td>£399.00</td>
</tr>
<tr>
<td>DOUBLE RESOLUTION OPTION</td>
<td>£50.00</td>
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<tr>
<td>8MHz PROCESSOR OPTION</td>
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<tr>
<td>NEW ROM</td>
<td>£60.00</td>
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<tr>
<td>PLUTO MANUAL</td>
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Data-Writer is, for most microcomputers, a new concept in Database Management. It adapts techniques which have been known and used on mainframe computers for quite a long time. A "normal" microcomputer Database Management program constructs its file in a single plane and is probably more accurately described as a file handling system. All of the data written into each record is filed away on disk in the same place, and it is all recalleld and acted upon by the computer as one chunk of data.

Data-Writer approaches Database Management in an entirely different manner in that, subject to one or two requirements, it is not concerned as to how the database came about or the form of it. Indeed, one of the most attractive features of the program is that the data itself can even be written on a word processor — not by Data-Writer at all. So far as we have been able to ascertain, any word processor may be used that writes a plain ASCII file. Certainly, ADEITT and Scripsit are supported. If you do want a word processor, or do not wish to use it for the manufacture of your database, then there are sections in Data-Writer which in themselves constitute mini word processors and enable the user to manufacture a database very easily.

In the foregoing paragraph we use the words "word processors" in the plural, and this gives a clue to a rather important feature of Data-Writer. The whole concept of the software is that it is a Management program. A number of earlier databases have suffered very seriously from what the author no doubt thought was economic writing; in that if a section of a program (for instance the word processing section) is used by a number of sections, only one is included and is accessed by various sections. At first sight this might indeed appear to be economic writing and we suppose in fact it is, but the result is that the disks are continually thrashing around as access is made to them. Disk access is probably the slowest task that the CPU carries out and if it is done frequently it slows the program down very considerably. Many past Database Management programs have suffered from this deficiency. Data-Writer on the other hand has a mini word processor in each section of the program where it is needed. This has the great advantage of obviating the necessity for the drives to be thrashing around, but almost as importantly means that the format of the mini word processor can be changed for the various sections of the program, so that the best advantage can be made of it in each. Thus every section is entirely separate and gives a very high degree of efficiency and user friendliness.

There are very few restrictions with Data-Writer. The number of records which one can handle in any given database is, essentially, unrestricted, although any that span disks would have to have different names. In any event as the Sort section of the program does have a restriction of sorting 4,500 records at a time, this effectively imposes a restriction on the length of the file if one intends to be able to sort it all at one time. The maximum number of fields permitted to a record is 20 and the maximum number of characters per field depends on whether you use the Entry section of Data-Writer to enter your data or whether you use a word processor. In the latter case the maximum number of characters per field is 250. In the former it is 30. The maximum number of characters per field label or title is 20.

Data-Writer has a very powerful mathematical section whereby many complex arithmetical functions can be carried out on your data. Up to 20 equations may be defined per run. The section will have available 10 scratch pad memories for use and as the calculations are carried out in double precision they will be carried to 18 decimal places.

Data-Writer also contains a very powerful "Mail Merge" section. Almost any personalisation can be added to a letter or report, and once again the letter or report may be constructed either on the mini word processor provided in Data-Writer or by way of an external one. Indeed we should make it clear that this remark applies to all data manipulation in Data-Writer. In other words, a word processor may be used at any time when its functions would be helpful in Data-Writer. To return to the Mail Merge feature, Data-Writer supports up to 20 different insertions per letter or report and the form letter may be constructed either on the mini word processor provided in Data-Writer or by way of an external one. Indeed we should make it clear that this remark applies to all data manipulation in Data-Writer. In other words, a word processor may be used at any time when its functions would be helpful in Data-Writer. To return to the Mail Merge feature, Data-Writer supports up to 20 different insertions per letter or report and the form letter may be constructed either on the mini word processor provided in Data-Writer or by way of an external one. Indeed we should make it clear that this remark applies to all data manipulation in Data-Writer. In other words, a word processor may be used at any time when its functions would be helpful in Data-Writer. To return to the Mail Merge feature, Data-Writer supports up to 20 different insertions per letter or report and the form letter may be constructed either on the mini word processor provided in Data-Writer or by way of an external one. Indeed we should make it clear that this remark applies to all data manipulation in Data-Writer. In other words, a word processor may be used at any time when its functions would be helpful in Data-Writer. To return to the Mail Merge feature, Data-Writer supports up to 20 different insertions per letter or report and the form letter may be constructed either on the mini word processor provided in Data-Writer or by way of an external one. Indeed we should make it clear that this remark applies to all data manipulation in Data-Writer. In other words, a word processor may be used at any time when its functions would be helpful in Data-Writer. To return to the Mail Merge feature, Data-Writer supports up to 20 different insertions per letter or report and the form letter may be constructed either on the mini word processor provided in Data-Writer or by way of an external one. Indeed we should make it clear that this remark applies to all data manipulation in Data-Writer. In other words, a word processor may be used at any time when its functions would be helpful in Data-Writer. To return to the Mail Merge feature, Data-Writer supports up to 20 different insertions per letter or report and the form letter may be constructed either on the mini word processor provided in Data-Writer or by way of an external one. Indeed we should make it clear that this remark applies to all data manipulation in Data-Writer. In other words, a word processor may be used at any time when its functions would be helpful in Data-Writer. To return to the Mail Merge feature, Data-Writer supports up to 20 different insertions per letter or report and the form letter may be constructed either on the mini word processor provided in Data-Writer or by way of an external one. Indeed we should make it clear that this remark applies to all data manipulation in Data-Writer. In other words, a word processor may be used at any time when its functions would be helpful in Data-Writer. To return to the Mail Merge feature, Data-Writer supports up to 20 different insertions per letter or report and the form letter may be constructed either on the mini word processor provided in Data-Writer or by way of an external one. Indeed we should make it clear that this remark applies to all data manipulation in Data-Writer. In other words, a word processor may be used at any time when its functions would be helpful in Data-Writer. To return to the Mail Merge feature, Data-Writer supports up to 20 different insertions per letter or report and the form letter may be constructed either on the mini word processor provided in Data-Writer or by way of an external one.

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Bob Maunder is co-author of 'The ZX80 Companion' and author of 'The ZX81 Companion'. He is a Senior Lecturer in Computer Science at Teesside Polytechnic, holds an MSc degree in Computer Science, and is a Member of the British Computer Society.
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PCW 303
We hear that the erstwhile editor of a certain other micro magazine was running a talking database at Compec. This is great, fine etc, but the speech synthesis was related to spelling. Imagine, then, the confusion when, the poor overworked machine tried its best to say 'Cholmondeley' and just think of the incredible verbal gymnastics had the machine been told to read 'Mr St John Beauchamp, 122 Beaulieu Avenue, Gloucester' ...

Our handsone Editor was spirited off to Madrid recently by Philips (the makers of that good-looker, the P2000) for the launch of the P3000. After having spent some time watching a show in which "chimpanzees were hurled around" (to quote another member of the party), and even more time on the traditional ceremony of the bottle (getting drunk to you) everyone who went was presented with an ashtray bearing their picture at the bottom of it. We plan to use this particular ornament as a spitoon if Rodders ever lets us see it... Rumours are circulating in the busy microcomputer world that CP/M is not a registered trademark in the UK. This leads us on to two points: a) how many other American companies have made this same mistake? and b) how long will it take for some shark to register CP/M in the UK and sell it for a ridiculous sum to Digital Research? ...

Peachtree Software is certainly 'blossoming', as its recent advertising says (see the Dec PCW, page 33). Those who have read this ad will know that it's directed at hardware and software suppliers, encouraging them to enter into a Peachtree 'software partnership'. Perhaps the partnership here is actually the one that involved Peachtree's partnership manager and his assistant leaving but a fortnight before this column was written. They'll have to change the photo in that ad now...
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