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CONTENTS
Volume 3 No 9 September 1980

36 NEWSPRINT: Guy Kewney brings you the latest news in his usual style.

43 YANKEE DOODLES: The latest US developments from Tom Williams.

45 COMMONS REPORT: Ian Lloyd MP reports on recent Parliamentary happenings.

46 COMMUNICATION: Our readers in their own write.

48 BENCHTEST: Mike Dennis examines an upmarket micro from BASF.

54 BASIC BASIC: Portable programming with Mike Parr.

56 THE PCW SHOW: Our guide to the show you can’t afford to miss!

63 CHECKOUT: The Hi-Tech S100 colour VDU board.

69 SECRETS OF SYSTEMS ANALYSIS: Lynn Antill starts a new series for the would-be micro user.

73 COMPUTER ANSWERS: Sheridan Williams and his team answer your queries

77 PCW SUB SET: A new series of handy subroutines, co-ordinated by Alan Toothill.

80 BOOKFARE: Malcolm Peetu and others versus Basic!

83 MICRO CHESS: Kevin O’Connell looks at Sargon 2.5.

84 BENCHTEST: The ‘one you’ve been waiting for — CBM’s ‘SuperPET’.

89 NETWORK NOTES: Using a TRS-80 and linking up via cassette ports.

90 GATEWAYS TO LOGIC: Continuing Derek DaMes’ unique series on teaching micro-computing to others.

99 BACK ISSUES: Find out what you’ve missed!

100 LARGER LEDS: Beef-up your MK 14 display.

105 COMPUTER GAMES: David Levy looks at chess this month.

110 CALCULATOR CORNER: A useful aid for the blind.

113 YOUNG COMPUTER WORLD: Especially for our younger readers.

115 NEWCOMERS START HERE: Our quick intro to the world of microcomputing

116 DIRECT ACCESS: Our new PACKAGES section, plus USER GROUPS, DIARY DATA and TRANSACTION FILE.

125 PROGRAMS: Get those fingers tapping with our readers’ latest listings.

132 BLUNDERS: Our monthly confession.

167 CHIP CHAT: Europe’s leading microgossip page with all that’s happening behind the scenes.
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<th>Price</th>
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</thead>
<tbody>
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<td>£375</td>
</tr>
<tr>
<td>SALES LEDGER</td>
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<td>£295</td>
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<tr>
<td>PURCHASES LEDGER</td>
<td>(500+ Accounts, 100 Departments).</td>
<td>£295</td>
</tr>
<tr>
<td>GENERAL (OR NOMINAL) LEDGER</td>
<td>(1000 Accounts, 100 Analyses, multi-purpose package).</td>
<td>£295</td>
</tr>
<tr>
<td>UTILITIES DISK 1</td>
<td>(Diskette patch, slot to slot copy, zap etc).</td>
<td>£20</td>
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<td>APPLEWRITER</td>
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Creative Computing Magazine

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Outline each heading description

Conference (4 and 5 September)

Technology Stream I

Processors and Memory
memory chips – special purpose chips – bit slicing
– new systems architecture – Motorola 6809 –
Intel 8086 – Zilog Z8000 – 16 bit micros

Storage Systems
diskettes – single/double density – single/double sided – hard disks – 8” Winchester technology
– fixed/changeable – costs and reliability

Communications
modem technology – PO facilities – data link controls – high level protocols – local area networks – Prestel – personal computer networks

Systems Review
survey of micro systems – Texas Instruments
TI 99/4 – Apple III – Triumph Adler Alphatronic
Sinclair ZX80 – other new releases

Technology Stream II

Monitors and Operating Systems
CP/M – MP/M – low level monitors – multi-tester
– multi-user operating systems – utility program

Languages
BASIC – Business BASIC – Pascal – PL/1 – APL
language developments

Programming and Quality Control
program design – debugging tools – project control
– program productivity
Programme – as a half-day session

Development Systems
development and programming aids – ROM – EPROM – simulators – testing

Applications Stream
Retail and Distribution
stock control – order processing – point of sale – billing – financial management

Manufacturing
process control – production control – inventory management – job scheduling

Word Processing
special purpose/general purpose hardware – peripherals – displays and printers – cost justification

Professional Office Systems
time recording – client billing – diary management – client services

Teach-ins (6 September)
Game Playing on Micros
DIY Circuit Building
Music and Microcomputers
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Simulation and Business Games
Technology and Concepts for the Businessman
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<td>Pack of ten 8&quot; disks</td>
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<tr>
<td>Ten packs of 5.25&quot; (100 disks)</td>
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<td>Ten packs of 8&quot; (100 disks)</td>
<td>£210</td>
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<th>Size</th>
<th>Standard</th>
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<td>32K</td>
<td>£346</td>
<td>£483</td>
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<tr>
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<th>Description</th>
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<td>(16K RAM and large keyboard)</td>
<td>30K User storage</td>
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<td>PET 3032</td>
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<td>IE2822 Serial Interface 'A'</td>
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<td>IE2-RO232 Serial Interface 'B'</td>
<td>Output only</td>
<td>£100.00</td>
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<tr>
<td>ISA-IO232 Integrated Input/Output</td>
<td>Interface for PET F-6 in ROM plus 32K and 64K</td>
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## SOFTWARE

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<td>2001 (32K)</td>
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<td>PETSOFT</td>
<td>16 Channel AC/DC Converter</td>
<td>Software</td>
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## PRINTERS

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## BASIC SYSTEMS

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## COMPUTERS

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## ADVANCED SYSTEMS

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<td>16K memory</td>
<td>£1245.00</td>
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## PRICES

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Once again, the ubiquitous Guy Kewney offers his unique monthly manifestation of micro news and bric-a-brac.

Intelligence

Don't be deceived by Intel's claim that it is changing its nature in talking about its plans for a 32-bit micro, an incredibly powerful mainframe computer on a chip.

It is true, as the company says, that normally it tries not to talk about future products, and it is also true that it is talking about a whole range of future products. What has happened to do this is not a change of attitude, but a shift of power.

My own relationship with Intel has become a love-hate one (I love them, they hate me) because of the vulnerable position the company has forced itself into. In the market, it has been impregnable, coming out with advanced products, getting the biggest share, and leaving Texas Instruments with egg on its face not just once but several times.

In its press relations, the distance Intel has been in front of the competition has made it slightly paranoid about revealing too much, with things getting to the ridiculous stage of an exclusive interview being set up in a London hotel by a top Santa Clara executive, who sat in his bedroom suite and said "no comment" exclusively for an hour. However it remains true that companies like Intel and IBM cannot keep information truly secret merely by saying no comment. When Motorola, normally number two or three in the micro market, stole a march on Intel with the announcement of plans for the 68000 micro — the big 32-bit micro that looks like a 16-bit micro — Intel's anxious customers approached their supplier and observed that the specification looked a great deal more sophisticated than the Intel 8086. Intel was then compelled to whisper a few secrets behind its hand.

So it was that first, the "8086" was rumoured (it's the basis of Intel's 32-bit microsystem) and second, the unofficial Intel view that the Motorola 68000 was beyond the capabilities of Motorola's technology. This latest rumour backfired. Nobody ever believed Motorola's claims about when the 68000 would be available (nobody seems to believe Intel's claims about the IAPX 432 range, either), but when Intel said that it would be, not just late, but never "because the chip is not viable" people deduced that it was beyond Intel, Intel, they said in the bars, must have tried it and failed. Hence the "break with tradition" and the willingness to talk about the IAPX (the i stands for intel) 432 and its support of APX 186 and 286 families.

That willingness doesn't go all that deep. Most of the details released, while very interesting, are more conceptual than factual. The points Intel wants to make are not how many pins, and what voltage, and what clock speed, but first, we can build it and we will, and second, your old software will run on this. Normally, old software claims can be dismissed.

There is, for instance, an Intel conversion package for re-writing 8086 code to run on the 8088. The 8088 is an 8086 (16-bit, big memory) with an 8-bit data bus, which means the user of an 8086 can get most of the power of the 8086, without throwing away his memory boards or system buses.

This package, say users who have tried it, is great for converting the sort of assembler code generated by compilers. Run a PLM compiler, generate 8085 code: or run a Coral compiler, generate 8085 code, and that code can be converted to 8088 with ease and no loss of efficiency. The same does not apply to human generated code because humans tend to be cleverer than compilers. They tend to take advantage of oddities of the code, and no conversion program can really reproduce the function of this sort of assembler writing on the next machine because it won't be aware of what foxy assumptions the writer has made about the condition code and so on.

When one gets to the 32-bit system, the APX 432, the power available makes it largely irrelevant that conversion software may be less efficient. Intel has no intention of providing an assembler for this system — it will provide a high level language, with the chip able to run instructions at a level normally handled by the operating systems on today's 8-bit micros. So Intel strikes a big blow in the credibility stakes, keeps its anxious customers happy, and the micro market can cheerfully ignore the whole thing for another two years. By then memory will be cheap enough for us to use the 8858 and 8857's 384K, and the 8858 needs no change (other than a different memory size) to cope with the 16-bit words without crippling the budget. And designers at 1his weekends have produced an APX 432 board for the $100 bus, and nobody will be able to afford it.

Bright ideas

There's a great difference between an adult approach to computers ("What is there that I do which a computer could do??") and a childish attitude ("What magic can I do with this Sorcerer??"). I was astonished just how much more useful the second approach was to the other winners of the judges of the recent Educational Computing competition.

By far the most impressive entry (they were all essays or paintings) came from a handwriting student, Daure Pead, who won a Video Genie computer for his scheme for computerising a weather station, a station he happens to be building for himself. His idea was simple enough: to have a computerised crocodile, programmed to bite enemy soldiers, was not really feasible (the idea did win a prize). A child would not have had sufficient general knowledge and scientific background to realise that a computerised crocodile, programmed to bite enemy soldiers, was not really feasible (the idea did win a prize).

An adult would dismiss the idea of a home weather station as a pointless project because it could never be as accurate as the Met Office... or maybe that isn't quite right, but never mind. A teenager was able to blend adventure and sense and find an idea that was both truly innovative and genuinely feasible. Remember this in
The industry has largely grasped, satisfactorily, the fact that I don't like sexist pictures selling goods. So somebody sent in this one, of a cash register at the Cafe Royal. It's obviously designed to make you so hungry that you buy a cash register. (Some mistake here, surely? — Ed.)

your next system design phase.

Neat ensemble

An American designer has come up with a new system which shows some concern for the human who will use it — by concentrating on the display technology. Mark Underwood, product development manager of a San Diego firm called Integrated Research and Information Systems (Iris, or Irisystems), had noticed the strange fact that most microsystems might be either TV screens, or black boxes.

The display subsystem of today's microcomputers is very important to users, yet tends to be overlooked by designers. We have tried to package a system which accommodates the different needs that users express," he says.

The result is a product called Ensemble 120GX, for which most of the product announcement talks about pixels — points of light on a display screen, and normally mentioned only in describing the matrix of dots used in generating screen characters.

The standard Ensemble is not cheap — but then the list is of contents of what "might be easily mistaken for a terminal" is impressive. For your $3464, you get a Pascal Microengine — a powerful 16-bit processor that runs instructions written in P-code rather than clumsy machine code — plus high resolution graphics, plus a video screen, plus a 1-2 slot box of $100 standard (ie cheap) cards for adding memory, special features and so on. There is a keyboard too, plus a 'big' floppy, plus 128 kbytes of memory, and an alternative 20 slot processor to let you run CP/M and all the pre-written applications that come with this operating system. A cheaper version, at $3464, offers only the 280, one mini disk and a much smaller screen.

Underwood is proudest of the pixel count of the Ensemble: "We believe the greatest need is for higher resolution black and white graphics. The Ensemble can present a 768 by 480 pixel format, in 8 by 16 pixel characters, some of which can be user-designed," he says.

Apparently it can handle colour too. Details on (714) 457 3730, or from 10150 Sorrento Valley Road, Suite 320, San Diego, Ca 92121.

They're coming down

Printers are still much too expensive and there are healthy signs that users are starting to realise it. More importantly, there are signs that the manufacturers are starting to realise it, too.

A recent advertising campaign by Anadex promised, "The waiting is over" for its DP950 printer, which can print 120 characters per line for less than £100. The advertising campaign, unfortunately, was prepared well in advance of the arrival of the printers themselves from America and it seems from the evidence that the American production people let down the marketing ploy.

Anadex is admitting to problems with the plastic cases, saying that the printers will be getting into peak volume in another two months now that there are sufficient plastic cases to match the mechanisms. Customers tell me that there is a more involved problem: the printer works well enough at its slower speeds, but there is a fault with the handshake signal which causes it to send a 'busy' notification back to a computer only after the printer has sent one more letter than the buffer can hold - so the letter is lost - at high print speeds.

Either way, the problem is being worked on, and no doubt the waiting will be over soon. But the moral behind the tale is an economic one: it shows that a printer maker has realised, perhaps for the first time, that availability is getting to be important.

A computer printer is essentially a very simple mechanism. Compared with a mechanical typewriter — say a good manual one — costing a couple of hundred pounds — it has very few components, almost a hundredth the number in fact. This should make it a lot cheaper, not rather more expensive. The electronics are almost as complex as those in a $10 calculator and the motors are costly only in a relative sense — they are more expensive to make than the battery job that shakes itself to pieces in a $5 massage vibrator, for instance.

Shortage of printers allows the makers to sell them for the prices they do. That is caused by relatively low production volume, compared with the volume of, say, the new Smith Corona golf-ball typewriter, which is entirely mechanical, and sells for just over £100. However, Smith Corona (SCM) is itself well aware of the production savings it can make by building electronic typewriters rather than motorised clockwork ones and such products can be expected next year from SCM and from most other alert typewriter makers.

At that point, expect the office of the future,' merchants with their handcrafted daily wheel word processors to start wiping egg off their faces. And expect the cost of computer printers generally to come down like mad.

PROMs news

Programmable permanent memory chips with 8 kbyte capacity are available from Celdis. The number is 74S478, from which one can deduce that they are fast with a 20 nanosecond access time, according to Celdis. The really important thing about them is the fact that Celdis has them: it points out that there has been a shortage. Details on 0734 582211.

Nascom comments

The man who founded Britain's most popular micro, Nascom 1, is now trying to handle America's number two, the Apple II. John Marshall, having handed over the reins of the collapsed version of Nascom to the receiver, is running a component company called Interface. He already has a

The sounds of Space Invaders can drive inveterate players mad; now you can take this infuriating concept to the home, office or train, with a £25 toy. It's called Galaxy Invader, and it comes from Computer Games, tel 01-891 5654.
Commodore PET franchise, he says, plus a Sharp agency, and is trying to get an Apple dealership.

He never meant to get into the computer business: he started the whole Nascom enterprise as a way of getting hold of components cheaply and interface was part of that plan. "It just happened a bit sooner than I originally hoped," he told me; "but it's what everybody was expecting me to do eventually."

The old employees of Nascom have been dispersed, and the receiver/manager says that the business runs from day to day, supplying computers and making a satisfactory profit, paying its bills on a cash basis.

Several people are interested in buying the company. I could make some enemies and print the names of some who were definitely interested, but there seems little point. Experience of these takeovers shows that the person who finally does the deal is more often than not somebody who didn't know the company was for sale until the day before they signed the forms, and a list of three or four companies known to be wandering around with money for investing would be of interest only to people too stupid not to realise that the money was there. Wait until the deal is announced before you pay any attention to rumour, no matter how well founded.

In the meantime, don't expect a Nascom 3 for ages. The project exists, but by the time it gets under way as a full-scale development, with funds from the NRDc virtually promised, it will need considerable revision, because the market will have changed.

The new Nascompany won't be set up and running (assuming it ever is) for at least another six months, more likely another 12. It will then have to spend at least a year getting the design right, and it'll be a year after that before production starts. Don't hold your breath waiting.

Rumours

I don't like telling you things of which I know less than I want to but you are bound to hear crazy rumours: that Julian Allson, head of the biggest publisher of PET software, Petsoft, has left ACT, the parent company, to run a magazine called Printout; that Richard Pawson, former Editor of Printout is joining MicroACT as a software marketer, and that Petsoft, having dabbled in Appleware, is about to launch Sinclair programs.

At the time of writing, all I know about this is that it is all true, but as to why, I have yet to find out.

PET plug-in

Plug-in software can make programming on the PET easier; the latest offering is from Supersoft. An unsolicited review dumped in my 'in' tray reads as follows:

Last month it brought you hi-res PET graphics, this month Supersoft launches a ROM-based set of new features — the Petmaster superchip. I counted 15 utilities, of which the most useful was single key entry of many Basic keywords, and the most useless (or should I say least useful?) a variable cursor flashing speed. I've tried the package and I particularly liked: the repeat feature which allows you to define a delay after which a key will repeat itself at any speed you care to choose; a lower-case graphics 'toggle' which allows you to switch between the two line insertion and deletion; deletion of characters on a line up to or from the cursor; retrace which lists the last ten lines executed on demand (it slows the program down by about ten percent); and a shrink routine which removes spaces and remarks from your program if you're tight on space. The two-way scroll facility has its uses but once the image disappears off the screen it cannot be recovered. Post your cheques for £45 + VAT to 28, Burwood Avenue, Eastcote, Pinner, Middlesex or telephone 01-866 3326 for further details.

Refreshing memories

Memory chips that can refresh their own memories are just starting to appear — Celdis has announced the new Mostek 4816 chip with 2 kbytes of read and write memory — and they are so obviously useful that it seems a mystery as to why it wasn't done before. The answer is that a memory which needs refreshing can do its own refreshing — but needs to know when to do it.

Refreshing is a very simple process: it involves recharging static electricity charges in memory cells. The circuitry takes care of the problem of deciding whether there was or was not a charge in the cell to start with by reading the cell first. Unfortunately, there is a computer in most memory systems, busily reading the memory cells too. Refresh and computer reads have to be done separately, or things get very confused. The trouble is that different micros do their memory reading at different stages in the instruction cycle. A memory designer looks at the clock cycle of the processor, and arranges for refreshments when the memory is off duty. Put another processor into the system, and it will find the memory enjoying light refreshments when there's hard work to be done. The Mostek 4816 gives the decision (when to refresh) to the system designer. But it is much easier than normal; you just tell the chip 'refresh' and it does it. In the future, the circuitry on the memory chip that bustles around refreshing each cell, will become even brighter. Next year, Motorola promises to have a 64 kbit memory chip which can study the clock cycles of the micro used and deduce from the pattern of pulses what microprocessor it is — and refresh itself accordingly.

In the club

A discount club for micro buyers has been launched, offering members bargains such as 10% off a PET, 20% off disks and so on. The club is called the Computer Club and is organised by Roger Frampton, a well known figure in the computer world and previously associated with successful promotions and exhibitions.

Against cynical expectations, Frampton thinks that this one will work. Members pay £7.50 for their cards (the rate goes up after September 1) and get discounts from the following: Comma Computers, Microbyte, Compashop, Lion Computer Centre, Cole Associates, Transam Components, London Computer Store, and Hanover Fair Travel. Discount travel is also to be arranged to next year's US exhibition, the NCC, plus SICO in France. Details on 01-434 3914.

Nascom multi-tacker

"I'm not quite sure what you would use a multi-tasking monitor on a Nascom 1 for, but I've written one..."
Buy a microcomputer for under £1,000 and you could be on your own! Unless it’s a Commodore PET.

Commodore produce Britain’s number one microcomputer. But we don’t stop there. We also insist on providing comprehensive support throughout our national dealer network.

Our dealers can examine your needs and demonstrate which hardware and software will suit you best. Their trained engineers are always at hand and a 24-hour field maintenance service is available. Your local dealer can tell you more about the following Commodore Services.

**The Commodore PET**

The Commodore PET computer range covers everything from the self-contained unit at under £500 to complete business systems at under £2,500.

**Commodore Business Software and Petpacks**

Our software range covers hundreds of applications. Business software includes Sales and Purchase Ledgers, Accounting, Stock Control, Payroll, Word Processing and more. In addition over 50 Petpacks are available covering such titles as Strathclyde Basic Tutorial, Assembler Development System, Statistics, plus our Treasure Trove and Arcade series of games.

**Commodore Approved Products**

Compatible products of other manufacturers with Commodore’s mark of approval are also available.

**Commodore Courses**

Commodore offer a range of residential training courses and one day seminars. An excellent start. And when you have installed your system the PET User’s Club Newsletter can keep you informed of new ideas and latest developments.
anybody interested?" At a cost of £10 or less for the programs, Ian Turnbull is prepared to load it into erasable read-only memory chips for anybody who is interested.

"I wrote it for my own interest and I'll handle up to eight separate tasks. It's interrupt driven, and it works on a 'round Robin' basis giving priority to the first task. There's a second scheduler which gives priority to no task, but shares time equally."

The code occupies around 1,5 kbytes in two 2708 EPROM chips, which have to be sent to Turnbull to be 'burnt'. Contact him on Pangbourne (07357) 2618 for instructions of how to wire it in and where to send the chips.

**Look Sharp, TI!**

Two late challengers to the micro market are making themselves for the real struggle by adding disk and printer capabilities to their product lines. One is the Japanese Sharp MZ-80K and the other is the struggling Texas Instruments home computer. The Sharp machine was cheap enough for this to be not much more than a useful addition: the prices aren't available yet on its disk and printer, but presumably the same price policy will apply. Paul Streeter has let it be known that prices "will be very competitive" and he's the man in charge so we may take his word with some weight.

The Texas machine may suddenly start selling. Its basic handicap of not being compatible with UK colour television sets is not expected to be resolved until 1981 - word from Bedford is that the central processor chip is being redesigned so that it no longer thinks all televisions use the US standard (NTSC, Never Twice Same Colour) but will be switchable to use the UK and German PAL standard.

However, with a £500 disk offering 92 kbytes of usable storage plus the option of adding on two more drives at £340 each, the cost of an entire system becomes comparable with other expanded systems, such as Apple.

It would seem that Texas's original hope (that people who wanted a home computer would need another TV anyway) has been switched because the sort of people with that kind of money (wait for it) already had at least one colour television set anyway. Texas's printer, at £269, is aimed smack at the new Apple printer and apart from the fact that it attaches to the Texas machine, not the Apple, will be an important peripheral.

Another important breakthrough for the TI machine can be expected in the late Autumn, when it releases its £30 (including VAT) Personal Records software module. This will operate on one 16 kbyte file of data at a time, loading the entire file into memory and performing all sorts of useful functions - searching, matching, transforming and analysing information - on it. This means that the sort of self-employed businessman who would like to buy one for his children to understand computers, can actually use the thing and justify putting it on his tax allowances. Currently, Texas describes its 'stake' on the 99/4 as "in test market". It will admit to no figures on sales (they are in the low hundreds in the UK) the peripherals and software may start the ball rolling.

Details of Texas products on 0234 67466; of Sharpon 061-969 7131.

**Colour board**

Picture drawing on a Nascom is the feature offered by an add-on board produced by Winchester Technology of Eastleigh Hants. The product is called the WT625, and it is a board which generates teletext compatible colour - like Ceefax, Oracle and viewdata - for UHF televisions. That gives 13 colours plus features like flashing characters, and 5760 individually addressable pixels or picture dots.

Support in software comes in the form of a memory chip - a 2708 reprogrammable chip which contains graphics subroutines and which your program can call to perform functions - you can call these from Basic or assembler programs.

Examples: a chessman can be defined and then moved around the screen without redefinition or labourious, detailed, code writing.

The board is sold assembled and tested, says Winchester Technology, for a £136 price tag, with a 42 page manual with a hardware description in it, plus details of programming, installation and fault finding. Details on 0215 66916.

**Spot spotter**

When a disk wears out, it doesn't do so all over its whole surface simultaneously. Instead, one or two spots flake away, causing errors. A program which keeps track of these spots and ensures that the system avoids them has been produced by Lifeboat at a US cost of $ 80 for systems using the CP/M operating system. Details from New York at 1651 Third Avenue, NY NY 10028, or phone (212) 860 0300.

**Ball game**

Most IBM 'golf ball' typewriters are not electronically driven; instead a system of magnetic actuators (solenoids) pulls the ball into different positions mechanically. However IBM did produce a printer, the IBM 5982, which used the golf ball, but was driven by electronic pulses and many of these have now appeared on the second-hand market.

In their original second-hand form, they are virtually useless, if cheap. The electronic pulses are not in the familiar "golf ball" mode, but the most micros know and love and the wires that take the codes are colour coded in an intriguing manner designed to baffle anyone who tries to fiddle with them. Having a manual for the colour coding doesn't help much, according to someone who has done it; he describes the IBM colour coding in a highly technical term: 'a lie.' How harsh.

Chess can be played by the Texas Instruments 99/4 home computer. The graphics are beautiful and the amazing David Levy was a major consultant in the design, so it must have something going for it. The point that will ensure that it really takes off is the four levels of playing skill. On the announcement of the chess package, it was said that the chess game plays in three styles - normal, aggressive, or passive. On the version I saw demonstrated, it also offered a fourth. It plays a strategy called "losing", at its beginner level. Irresistible, but I still didn't manage to beat it.
BASF gives a Good Deal

To an entrepreneur building up his own business, or to a company needing to distribute its data processing, the BASF 7120 gives a good deal.

Our 7120 is basically a stand-alone microprocessor giving high performance at low cost. It’s a powerful desk-top computer for around £5,500.

The main features include:
* Main memory of 64 K bytes
* File control system memory of 24K
* Dual Z80 microprocessors
* Extended BASIC for business applications
* CIS COBOL and CIS FORMS 2 for interactive programming
* Specially designed keyboard to ease operator interface
* Free word processing package.

The whole deal is offered by BASF, whose computer interests also include supplying media, CPU’s, add-on memory and plug-compatible peripherals for large mainframes.

Finally the deal is completed by selected dealers providing sales and technical support where you need. Including Computer Services in Canterbury, Dataforce in Bristol, Dataview in Colchester, Davies & Brown in Shoreham, HB Computers of Kettering and Verles in Birmingham.

For more information and the name of your nearest dealer, please contact: BASF Computers, Haddon House, 2-4 Fitzroy Street, London W1. 01-637 8971. Ext. 30.
**Microdigital takeover**

Currys, the washing-machine giant, was the first; now hi-fi vendor Laskys has joined the selling-micro-computers-to-the-consumer bandwagon. Unlike Currys, which is starting totally from scratch, Laskys has taken a short cut by buying Microdigital, the Liverpool micro retailing company (founded by the flamboyant Bruce Everiss) which also publishes something called the Liverpool Software Gazette.

Rumours about a possible takeover of Microdigital have been in the air for a while now, with various immense figures being quoted knowingly as the asking price. What Laskys actually paid remains undisclosed; the firm does, however, say that it intends to set up micro-computer departments in its main shops (it has 40 altogether in the UK), and that Bruce Everiss and Graham Jones, both of whom were Microdigital directors, will remain with Laskys, developing and expanding its microcomputer division.

**DTS Counting on Abacus**

As mentioned in last month's 'Chip Chat', Derek Rowe's company Abacus has been put up for sale and bought... by Data Type Systems. As is so often the case when a company runs into some sort of difficulty, various stories about the circumstances surrounding the failure are put about by people whose grapes are less than sweet. I'll confine myself, therefore, to saying that it appears that the backer who put up the original £30,000 to start Abacus decided to withdraw from the scene.

The new boss, Gerry Tuffs, won't tell me what Data Type paid for Abacus but I guess it must have been around £50,000.

Data Type offers some hope for the micro industry. I won't make too much of it in case it turns out to be a false dawn, hence the appearance of this gadget at the bottom of the story, not at the top: Data Type started out as a terminal maintenance firm. If the company can extend itself into terminals (a new factory in Cwmbran) and intelligent terminals and microcomputers and also shift its maintenance activities into the micro field, it will set a welcome precedent. I hope it makes a lot of money out of this excellent basis.

**ZX80 software**

There are already 10,000 Sinclair ZX80 computers out in customer's hands. The software available is just starting to appear; first with a product is a new company called Econosoft, of 4 The Loont, Winsford, Cheshire CW7 1EU. It has announced a £5 cassette with four games — Simon, a memory test, Mindbender (like Mastermind), Fruit Machine, and Destroyer. There's little point in expecting these programs to be up to the standard of the latest Petsoft offerings at £100 — the machine isn't up to that and neither is the price — but as an improvement on the crude code in the ZX80 manual it must be a bargain. They run on the basic Sinclair, while programs for the expanded 2 kbyte machine will be launched towards the end of the year. Details from Trevor Daniels.

**TV adventure**

You've read the book, watched the movie, viewed the TV series, and seen the play. Have you played the game? The well known computer game of Adventure has turned into the basis of a plot for a TV series, apparently on Saturday night on BBC1. If you get to see it, the computer on which the fiendish Argonds make the Tellurians (people from Tellus, or Earth) play is a Hewlett-Packard 9845B desktop computer.

The Editor is coming off his trolley. He has presented me with a press release announcing the 24th Congress of FIPAGO (the federation international of manufacturers of gummed papers, in French, I suppose) in Corsica. He's potty, because, vital though this may be, it already happened in Corsica on May 18 to 21. Plans were made to form a new division to promote the use of flat gummed papers for labels and postage stamps. I shall start a Federation for the Automatic Repetitive Typesetting of Instructions on Non-Gummed envelopes.

**Value for money**

“"We prefer to sell a lot of software at low prices rather than a little at a high price," says Gay Wilhelmy, managing director of Databank Software Services.

Databank has just launched five new programs on this excellent basis (remember, a program is debugged to a depth directly proportional to the number of people using it). They are two business and two general purpose word processor and Salesman — two maths packages one for graph plotting and statistics, and a crossword game. All run on PET, and on Apple II or ITT 2050. Details on 0509 517671.
YANKEE DOODLES

Tom Williams, our man in Silicon Gulch, reports on the latest US micro marketing dilemmas.

Software dilemma

Here’s a puzzle for all who concern themselves with the legitimate use of licensed software — and with the problems that software piracy poses for the industry. Let us suppose there is in existence of some kind that has decided to install four or five desktop microcomputers around the office to do word and data processing. The installation comprises four standalone units each with its own CPU, RAM and at least one built in floppy disk drive. One of the tasks involved requires that each machine runs the same commercially available software package.

A problem arises when the owner of the business approaches the software vendor. Being a conscientious person, he realizes that quality software is only possible if authors have the proper financial incentive, and that outright piracy of software ultimately harms everyone involved. Besides, it’s dishonest.

Now software is generally licensed for use on a single CPU and our hypothetical businessman has four CPUs, possibly in the same room.

There’s a natural reluctance on his part to purchase four identical copies of the package when he could more easily and cheaply buy one and make copies for each of his stations. The software vendor quite understandably insists that the owner of the business is required to obtain (and pay for) four licences to use the programs.

One possible solution is that more programs for microcomputers be licensed for use at a given ‘site’ or ‘installation’ with provision for a multiple use fee — which would be a fixed surcharge. This latter provision, though difficult to enforce, would at least have the appearance of being just.

Great moral arguments could be made for paying multiple use fees in order to encourage the development of more and better software; they would no doubt fall on deaf ears just as do today’s pleas against software piracy.

Nonetheless, an intransigent attitude on the part of software vendors is not going to help anybody. The only advice I can offer is that it’s much easier to induce people to comply voluntarily with a situation if they feel that all are getting equal treatment. That’s not to say that they will, but a sure way to make them not to is to give them a feeling of righteous indignation.

OSI’s department store experience

There’s a vague feeling in the microcomputer industry that there lurks an as yet untapped market awaiting the lucky company that discovers the key to placing a computer in every home. Although this particular grail has not yet been found, there are many knights-errant galloping about in search of it.

One idea that has been that micros were placed in the proper distribution channel — say a large chain of department stores — they would find their way into the home and win mass acceptance. Ohio Scientific Instruments, whose main computer line is concentrated on higher end machines for business, recently completed an experiment in marketing their low-end computers through selected Montgomery Ward stores in the US.

What OSI discovered was that the customers who were interested in microcomputers wanted to know about business applications. Unfortunately the Montgomery Ward sales clerks were not qualified to answer the type of questions these customers kept asking. Most department store personnel are only able to handle concepts at the washing machine and hair dryer level and thus a great many potential sales were lost.

Undaunted, the company made an arrangement with Montgomery Ward whereby OSI would establish computer shops in the department stores which would be staffed and run by OSI dealers. This may increase OSI’s sales, but it will not reach that magic customer... the object of the present quest. There’s an enormous difference in perspective between the traditional microcomputer dealer and a retailer on the level of huge department stores. This can be illustrated by the fact that the Montgomery Ward S100 multiuser system. Now if our businessperson had bought an S100 multiuser system with four terminals, I doubt very seriously if any software vendor would have dared suggest that he pay a licence fee for each of the terminals accessing the program. The question is, for the end-user, what is the difference?

If there really is no difference from the point of view of the people who ultimately will decide whether or not to purchase a program as a commercial product, then some solution must be found which will render, in the eyes of the user, the relative software expense for the shared disk resource and the time-shared type system to be as equal as their functionality. You are simply not going to find that many businessmen willing to forego their own interests for the sake of conscience in the face of what appears to be a truly inequitable situation.

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Competitive edge

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My name is ___________________________
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After a great deal of prodding from the backbenches, the Leader of the House has at last agreed to a debate on information technology. Appropriately enough, it was held started with a formal presentation on the subject by a GEC team — led by Sir Robert Clayton — to the All-Party Committee. This was the last of a series which has included John Diebold, Professor le Gates (Director of the Information Technology Programme at Harvard), Herbert Grosh, Ferranti, the Post Office, Inmos and Lucas. At the beginning of the parliament, these were poorly attended, but interest has grown and some of us find it encouraging that within a fortnight there should have been a half-day debate on Inmos, a full Friday’s debate on the general issues, and a front-page article in The Times summarising a ‘confidential’ Labour Party policy statement on the subject. Nothing, of course, remains confidential at Westminster these days and if we put an Information Technology Act on the statute book we shall doubtless find ourselves obliged to have confidential discussions in secure rooms lined with lead.

The growth of complexity

Though I invariably learn something from every lecture, article or presentation on this subject, during the last few weeks my perspective on information technology has been altered as a result of a series of visits which I have just made to the control rooms at Three Mile Island (there is a separate system for each reactor), the operating reactor at Zion, the incredibly realistic simulator at the training school nearby, the new reactor being built at Byron, near Chicago, and the CANDU reactor (heavy water) at Pickering near Toronto. In addition I have visited the control rooms on the Murchison rig in the North Sea and at the Isle of Grain, a nuclear power station in Kent. All three systems rely heavily on big computers. The computers at Three Mile Island have been installed seven years ago and although they don’t control the detailed operation of the reactor, they do record and monitor virtually everything that happens. I enquired why it was then that, when the operators obviously had difficulty taking in and reacting to the information appearing on several thousand dials (at least), the computer could not be programmed to deal with an ‘incident’. The answer was illuminating. The computer, I was told, became swamped with data once something such as the pressure failure at Three Mile Island occurred. It ran several hours behind ‘reality’ and by the time the print-outs started arriving the instructions and information were irrelevant, because the diagnosis was wrong or had to be revised. At the peak of such an incident, my guide added, the computer was receiving an input rate of several million units of information a minute.

Progress may be an illusion, but the simulator control room at Zion had even more powerful hardware and software of conspicious sophistication and, at least to my impressionable mind, sheer brilliance. All the lessons of Three Mile Island have now been incorporated in the system and the operators, who come from all over the world for training in the normal routine and abnormal operation of the reactor, who come from all over the world for training in the normal routine and abnormal operation of the reactor, can be placed in a console which even an expert would not be able to distinguish from the real thing. Here every conceivable normal routine and abnormal occurrence can be simulated. The trainees’ responses sharpened and tested. It is an expensive course, well beyond the reach of individuals, but I cannot imagine a better way of achieving the important objectives of safety and efficient operation.

The oil rig in the North Sea and the oil-fired station at Isle of Grain are no less complex and must conform to equally rigorous operating and safety criteria. Doubtless all three systems could be run without computers, but the loss of efficiency would probably be considerable and acceptable safety levels would certainly have to be lowered. Human beings cannot monitor complexity on this scale continuously without great strain.

There are of course, outstanding examples of modern information technology. At the Isle of Grain several hundred analogue inputs and over a thousand digital inputs have to be received, processed and transformed into meaningful information. By any standards these are impressive performances and reveal the high-powered computer at its best. Incidents such as the failure of the NORDAD defence computers still encourage some to complain that the computer is a monstrous and dangerous device, but I share Sir Robert Clayton’s view that our judgement should really be based on the fact that all the safety procedures worked. Ten further steps would have had to be taken before any missiles could have been fired. There is, of course, no other way in which we could assess the significance of satellites appearing over the Arctic Circle every few seconds.

There is, equally, no other efficient way of dealing with the information complexity inherent in the operation of a nuclear power station, a North Sea oil rig, or even a conventional oil-fired power station, such as the Isle of Grain, one of whose alternators produces a power output equal to the whole of Battersea. Their complexity is staggering as the information technology which has been developed to control them.

The information technology debate

Hansard — a product as yet of the old technology of Gutenberg has recorded every word spoken during the debate. It was a fairly broad and useful tour d’horizon but there issues dominated the exchanges. The first was the extent of Government support for and involvement in the industry; some invidious comparisons were made with the United States, France and Japan. The second was whether the cause of information technology would be better served by the appointment of a Minister with a clear responsibility — such as the position Pierre Aigrain enjoys in France. This was first suggested in a brochure produced by a group which I chaired just before the ‘79 election and has been strongly endorsed by Kenneth Baker in a recent Online Conference and in his speech during the debate. It merits more serious consideration, though most speakers agreed that they had received so far, but I would not support a second-rank appointment at this stage. The subject is too important, the Government machine is still too lethargic and only a man with the drive and authority of a Lord Beaverbrook could match the contribution to the requirement of the hour — as he did when he took Merlin production and repair by the scruff of the neck in the last time before the Battle of Britain.

The third issue was the Inland Revenue computer order and the appropriate treatment of ICL in this context. Both points of view were expressed in the debate, but most speakers considered that it would be at best unfortunate and at worst iniquitous if ICL lost the order. We shall doubtless hear more of this issue before it is resolved, but my own view is that the geographical boundaries of the nation state are now a severe handicap to rational thinking and that this is particularly true in the sphere of information technology, which, as I argued in the debate, is an industry whose rationale, structure, markets, research and development and competitive challenges are no respecters of frontiers. I wish ICL the best of luck in an important contest, but it is the country’s overall growth, performance and standards in the whole field of information technology which must decide the issue.

Readers may buy this relevant copy of Hansard (vol 958 No 211) at 80p from HMSO — Ed
Get the connection

Being something of a novice to microcomputer systems and to electronics generally I was intrigued in this month's edition of your excellent magazine to notice reference to 7-pin DIN plug, 64-pin Eurocard connector, BNC video socket, and phono plugs, all within the article on the Acorn Atom (p48).

I wonder how many of your other readers are perplexed by the proliferation of connection types available and in use in different applications. Would it be possible for your magazine to produce a guide to connection types (at least the "standard" ones), their normal uses and wiring configurations? (Perhaps as a set of Friends and Enemies in the Face to Face column?)

Personally and particularly, I would very much like to know what relationship the 7-pin DIN plug to cassette from the Acorn Atom may have to the 5-pin DIN which my music system bears.

Christopher E Mathews, London

What a good idea. Anyone out there an expert on connectors? Perhaps you'd like to tell us all you know.

We'd like to hear from you like to tell us all you know.

What a good idea. Anyone like to tell us all you know.

We'd like to hear from you like to tell us all you know.

Cut it out

My employer has recently taken delivery of an Apple II with two disk II floppy disk subsystems. Since the manuals state that only one side of the disks can be used, I was surprised to find that a disk containing demonstration programs for the SuperTalkers peripheral had data recorded on both sides. There were no problems in reaching this data.

On trying to write data to the "back" of an Apple I disk I got a message indicating that the disk was write-protected. This was because the write-protected switch is on the wrong side and an examination of the SuperTalker disk showed that it had cutouts on both edges of the disk casing. I carefully cut another write permit cutout opposite the one already on a BASF floppy and found that I could use the second side without any trouble.

It seems to me ridiculous that one side of a floppy should be rendered useless simply through the lack of a hole punched in the disk case.

D Watson
Banchory, Kincardineshire

We definitely do not advise readers to follow Mr Watson's example. Manufacturers test both sides of each disk; if one side is faulty then it's sold as a single-sided disk, using only the good side; so any data recorded on the reverse side of a single-sided disk could be corrupted. Now it's possible that, to satisfy the demand for single-sided disks, some are sold which are fault-free on both sides; however you can't take advantage of this because inside the disk's protective envelope there's a wiper which cleans any dust or dirt from the disk's surface as it revolves, inserting the disk the other way round to use the reverse side will, by reversing the disk's rotation, spread the collected dirt over the good side — and then you've really got problems!

For the same reason, you shouldn't try using a properly double-sided disk in a drive designed for single-sided disks — Ed.

Atom postscript

We would like to comment on the Acorn Atom review in the July issue of PCW. The fact that you were supplied with a prototype machine and an incomplete manual may explain some of the inaccurate comments made; despite this we think the record should be put straight.

First, we would like to comment on points where the reviewer suggests there are imperfections with the Atom.

It is the fact that, in the high resolution mode, the effective display area shrinks noticeably to about two-thirds of its previous size... In fact the display area stays exactly the same; it is simply that the black border is replaced by a white border in the high-resolution modes, thus nearly filling the graphics area. Finally, it should be pointed out that the Atom communications interface uses the IBM standard SDLC protocol, which is not the same as the Cambridge Ring.

We hope that readers will take the time to visit one of the computer fairs or one of our distributors, and supplement the review with their own judgements.

David Johnson-Davies
Member of the ATOM design group

Thanks for the clarification. As you rightly point out, the documentation did cause a few misunderstandings — Ed.

68XX pleas

Let me first congratulate you for your fine magazine; I confirm this opinion by enclosing my first subscription form.

I have one gripe though. You are missing a column of 68XX micros. Users of 6800/6809/68000 equipment are a relatively small group but a proud pack (after all, everybody knows that the 6809 is the best 8-bit micro ever, 68000 is the best 16-bit micro ever, SS50 is the best...)

PCW 46
Algo168

I have followed with interest the correspondence from Alberto C Moreira, and in this world of animals, fruits and rubbish bins we are probably one of the few groups still doing serious computing. In case you go along with this idea, I am ready to offer my support and collaboration, and I think that many other 68xx users would assume the same position. The lack of a 68xx column is a glitch in an otherwise excellent magazine.

Algo68

I have followed with interest the correspondence from Raymond Anderson and Melvyn Anderson concerning Algol 68 for microprocessors. I do not know if possession of this surnane is a prerequisite for entering the correspondence, but in any event I would like to offer a few comments of my own.

There is no doubt that Algol 68 offers many programming advantages over Pascal. The only question is whether these extra facilities justify the implementation effort which will be an order of magnitude greater than for Pascal. Certainly there is little to be gained by moving from the older version of Algol (ie Algol 60) unless there is a severe lack of memory space. One gains dynamic arrays in Algol 68 but any possibility of decent data structures or character handling is irretrievably lost.

No, the only way forward is via a language which combines all the good points of Algol 60 and Pascal and throws in a lot of extra goodies as well. Algol 68 fits this bill exactly. However, we have to remember the very potent advantages possessed by Pascal from the point of view of implementation. The very limited space Algol fanatics find so annoying — the static nature of array bounds, the restricted ways in which pointers can be used and so on — are precisely those which ease the compiler writing task considerably. In addition Pas-
cal can easily be parsed with a class of parsers known in the trade as LR(1). Essentially these allow the compiler to recognise the nature of an incoming Pascal construction simply by knowing the next character in the input stream.

Algol on the other hand is the very devil to parse by such methods, for there are constructions which, in general, require you to look indefinitely far ahead in the input stream before you discover what kind of Algol 68 construction you are dealing with.

Equally, the extra facilities offered by 68, such as array slices, free use of pointers and the ability to deliver objects of any type as a result of a procedure do lead to some very knotty run-time problems, and even going to the Algol 68S subset will not completely get rid of them.

Nevertheless, the aim of producing an Algol 68S compiler for microprocessors is a very worthy one. The only generally available 68S compiler known to me at the moment runs on a PDP 11 and produces code only for that machine. A less defining a new compiler would be to modify this compiler to be a cross compiler for a range of microprocessors. Unfortunately few personal computer users will have access to a PDP 11...

Dr D F Brailsford, Nottingham

ZX80 answers

Recently my father bought a Sinclair ZX80. I have discovered it is a delightful machine, but cannot find two things: how to work the "timer under program control" (as the advert put it), and how to display the amount of memory left. The second point I found very irritating as I only have 1K of memory to play with.

Richard King, Bristol

To answer your questions we must first explain how a two-byte value is translated into an integer. In the ZX80 it is necessary to multiply the contents of the second byte by 256 and then add it to the value of the first byte. Having said that, you will be interested to learn that locations 16414 and 16415 contain the number of frames displayed since the machine was switched on. By PEEKing these addresses and then doing the necessary arithmetic you have the equivalent of a clock. In the UK this count is incremented 50 times per second and in the USA 60 times.

After much study of the Sinclair manual we reckon that locations 16394 and 16395 give the address of the top of the program while 16396 and 16397 mark the bottom of the display file. Once again, by doing the necessary arithmetic and then subtracting the former result from the latter you will then know how much space is left — Ed.

Ripple raspberry

As I am at present engaged in designing and building a PSU, I read the two articles on power supplies in June PCW with considerable interest. A point which I feel should have been mentioned in one or both of these otherwise very good articles is the ripple current rating of the capacitor immediately following the rectifier diodes. As the value of this capacitor increases, so the ripple current is decreased, but so is the time available for the capacitor to recharge during each half cycle. Hence the ripple current through the capacitor rises. A quick calculation for the PSU presented in Derek Chown's article indicates a ripple current of about 11 amps. (For a 6 amp load current.) If premature failure of this capacitor is to be avoided, a suitably-rated capacitor must be used.

Now a suggestion for a topic you might wish to explore in future editions. I have been unable to find any designs from EPROM programmers in any text books. Could you run a series on the mechanism of EPROM programming and erasure, and perhaps a design for a programmer for, say, a 2708 EPROM?

A. A. Huntingdon, West Wickham, Kent

We published an article on converting the Mk14 (now available cheaply on the second-hand market — see our "Transaction File" each month (into an EPROM burner in September 1979 (Vol. 2 No. 5) with a follow-up in March this year (Vol. 3 No. 3). - Ed.

School system

We have just read with interest the article entitled "Pupil Power at Sandbach" in the June issue describing a "low cost, very flexible system based on radically new lines". As an official Ohio Scientific dealer we have been offering a very similar system for over 12 months. This is based on an OSI C2 or C4 'parent' system supporting up to 16 Superboards (or any other system with Basic in ROM and an RS232 port).

At a price of less than £2000 for the 'parent' machine (including twin 8" floppies) and approximately £160 per 'daughter' Superboard, we do not think this system can be bettered on price or performance and it's available now.

We can, of course, provide further information to any interested parties. S Havley, CT8, 1 Higher Calderbrook, Littleborough, Lancs.

"We're trying to get the computer to mal-function so we can start the war"
BASF 7120

BASF is one of the largest companies in the world and it manufactures a seemingly endless variety of products. For some time now it has manufactured a range of floppy disk drives and diskettes but the 7100 series is BASF's first venture into the world of complete systems and is aimed quite definitely at the top end of the market. Two models are currently in production and this is the first review ever of either of them. By Mike Dennis.

Rather than design a completely new system from scratch, BASF cast around for a machine that was closest to its own ideas as to how things should be done—the search ended with an American firm called Digilog. With typical Teutonic thoroughness the company injected large sums of money, ideas and engineering expertise and the result of this 'merger' turned into the 7100 series.

Both machines in the range feature the same integrated approach, with all the essential components—such as screen, keyboard and disk storage—being grouped in the one housing, thereby eliminating the usual bird's nest of wires. The two models in the range, the 7110 and 7120, are very similar in specification, the main differences being the addition of an extra disk drive and multi-tasking package in the 7120.

Hardware

The machine is enclosed in a functional and pleasant looking two-tone grey moulded case that measures 21" wide x 13" high x 20" deep. A substantial cast chassis provides support for all the electronics and the total weight is fairly low at around 80lbs; it can be quite easily moved around. Inside, the electronics are mounted on six main boards with at the front the boards for the keyboard and VDU and to the rear, three boards consisting of the disk controller, 64k RAM card and CPU board—mounted horizontally on top of one another. Interconnection between these three is via a 50-way IDP cable and all the boards can be quickly removed for servicing. The bus is BASF's own design.

A substantial power supply completes the complement which has its heatsink located outside at the rear of the case—just as well as it gets pretty hot to the touch (i.e. it's doing its job). All the internal gubbins are kept cool by a fan which on the review sample was a bit 'grumbly'; I suspect that this could be easily remedied. The general standard of internal construction was very professional indeed and I particularly appreciated the ease with which the monitor and disk drive assembly could be hinged and fixed well out of the way to allow easy access for board changing and maintenance.

The system sports twin Z80A processors running at 4 MHz; one is delegated to handle the File Control System on the disk drives, the other looks after the rest. The disk equipment is isolated from the remainder of the system and data is passed between the two by the DMA controller. As can be seen from Figure 1 this also controls access to the display screen—it must be really beavering away to itself while the system is up and running. I judge the whole concept to be quite innovative in the world of micros and as the only ROM in the system is on the disk side; this means that all the available 64k of RAM is available to the user. Admittedly, some of this is needed for storing the Basic interpreter but conversely the set-up also means that the user is not tied to any one operating language—as is usually the case with ROM. Other manufacturers such as Cromemco adopt this approach but BASF scores by keeping all the disk handling elsewhere.

Much use is made of LSI circuits, particularly the Intel range of support chips for the 8080, and I counted about five 8255 peripheral interface chips, one 8251 communication interface and an 8259 interrupt controller. The disk controller, which uses the Western Digital 1791 chip, also has its own 16k of dynamic RAM separate from the main system RAM. Even the VDU card has its own complement of LSI chips and I think I spied another micro—an 8040—on the keyboard itself.

I found the whole design concept aesthetically very pleasing and devoid of irritating compromises. Indeed the only thing I can find to criticise is the very annoying high-pitched whistle that seemed to originate from the power supply. It wouldn't have been so bad
had it been constant in pitch and intensity but as it fluctuated with the demands placed on the power supply, it was most upsetting. BASF says it is aware of this problem and is looking into it.

Communication with the outside world is via a 15-pin DIN parallel printer socket and this is slightly non-standard as most people tend to stick with '25-pinners'. Two RS232 serial ports are available (although only one is fitted as standard) and there's also an output for an auto-dialler which enables the 7120 to hook up to automatic calling equipment (I hear British Telecom approval is still being sought). Small DIP switches at the rear enable the baud rate, character length and parity to be selected for the serial ports. Two other user-controls are provided for adjusting the screen brightness/contrast and the internal loudspeaker volume - which is perhaps just as well as the chirps it emits remind me of a strangled chicken.

The keyboard is comprehensive - indeed it has a plethora of facilities. The keys have a very silky action and all except the ESC key (which is easily confused with shift until you get used to it) fall easily to hand. The Qwerty keyboard has both shift lock and caps lock - the latter is very useful as only letters are shifted, as the name suggests. Function keys are provided by using the top row of keys in conjunction with the FUNCTION key. There are a total of 26 function keys but as 13 of them necessitate the use of shift, they aren't as convenient to operate as dedicated ones would be.

The on-screen editing is one of the best that I have seen. Fourteen keys are used and both lines and characters can be inserted, deleted and altered at will. The screen can be cleared completely to the end of a line or to the end of the screen from the current cursor position. More important perhaps, is the added convenience that these controls can be used at virtually any time during program development. The cursor can be moved in any direction and all of the keys can be emulated by suitable control characters from Basic.

The operating system or OIM is a separate software module and it provides the interface between keyboard, screen and program. The basic principle that it works on is that all lines normally must have an SOM (start of text) and EOM (end of text marker). Everything within these two markers is interpreted by the software and processed. If you type in a Basic statement such as: 100 PRINT "Now is the time for all good men" then all you have to do to correct the error on the last word and re-enter the line to cursor up and along to the offending character, change it and then hit ENTER; the OIM automatically looks back over previous characters until it finds the SOM and then reads in the line until it hits EOM. It's a difficult concept to put over and probably sounds more complicated than it really is. However, providing you remember to hit EOM and ENTER (which is virtually one continuous action as they are adjacent to each other) then it all works exceedingly well. Indeed I soon found the system a joy to use, my happiness marred only by the slowness at which the interpreter checked out the syntax of my offering (of which more later).

A separate numeric keypad is sensibly provided to the right of the edit/enter keys and the final feature of the keyboard are the seven MODE keys at the extreme right. These are used in conjunction with the screen highlighting. Again they are very flexible in their approach and many features are available such as reverse video, reduced intensity, underlining or flashing or any combination of these that you may require. These features can also be selected from Basic and together with another facility they enable the formatting of the screen to be carried out very easily.

This other facility is the 'protected' feature whereby the entire screen can be set to protected — and then selected windows defined into which data can be put. The basic technique might be to define the screen as fully protected, having typed in messages such as Name, Address etc and then to open windows opposite these headers. If the windows are opened only so wide, say seven characters, then only seven characters will be allowed to be entered in the gap. This, plus a little bit of Basic, effectively formats your data fields for you because once the program is running, the cursor only appears in these windows and can be moved from window to window by use of the TAB key. Only when ENTER is pressed will the data be committed to the rest of the program and hence alterations to the data can be very easily handled with the minimum of fuss and bother. Yet another advantage of the protected field is that when you retrieve a long string of data from the disk and print it to the screen, the OIM automatically puts the correct number of characters into each window for you — which again is very convenient.

Screen layouts can either be effected from Basic statements or generated by a utility program called FORMGEN which allows you to 'draw' the screen layout in free-form and then to save it away to disk for use by other programs. These facilities are usually enabled
by outputting a non-printing control character before the word or character to be highlighted; this can be a problem because one character slot is used for the control character. Usually this is effectively hidden by a space but should not be possible, the 7120 provides the facility whereby special bytes can be poked into the highlight positions. Characters can be highlighted — or not — by the setting of their respective most significant bits, another example of the flexibility built into this system.

Graphics are supported and although limited in their capability to producing box outlines, vertical and horizontal lines, they are nevertheless very useful aids in producing a decent screen layout. These graphics are contiguous in a 10 x 12 character slot although the normal letters etc are displayed in a 7 x 11 format. Both upper and lower case characters are available and are very well formed. The screen itself is 12", green and of high-resolution; the format of 80 x 24 characters gives a rock steady, crisp display.

Storage

Three 5" disk drives (two on the 7110) provide the on-line storage. They are, not surprisingly, made by BASF, single-sided/double density and offer approx 162 kbytes per drive. The maximum capacity of this system is therefore limited to a little under 500 kbytes — which for some applications won't be enough and is therefore rather disappointing. The catalog function of the BOS is therefore limited to some 315 kbytes onto their single sided/double density drives but whether or not they are any more or less reliable than BASF drives, I wouldn't like to say. The capacity growth with the 7120 is that a 5 Mbyte hard disk drive will soon replace two of the floppies; that'll leave the third, suitably upgraded to 318 kcapacity, for backing up, which will then make the 7120 a very potent system. Further expansion is planned with a separate small box of twin 5 Mbyte fixed disks to increase the capacity even further.

System memory map

Because of the novel approach of the 7120, it's worth spending a bit of time looking at the memory map — see Figure 2. The bottom 40 kbytes of system RAM can be accessed by the disk system but not vice versa. System control and status words are passed between the two by a "mailbox" and I shall explain just how useful this is later. Special features are the communications emulators, multi-tasking executive and spooler program areas.

This particular multi-tasking executive should not be confused with multi-user systems (although BASF say that this is under development and that all future software and systems will be compatible with that currently available). The UTO concept is its own when the 7120 is being operated in a system for which it is especially suited — i.e., a terminal capability being easily connected to a main-frame type of computer but with extensive off-line computing powers of its own. Enter the spooler module and the communications emulators, for these mean that you can configure the MTX to keep the system on-line to your mainframe, while printing out address labels, in between interrogating the 7120 for your latest sales analysis. This concept should be attractive to a number of users and will probably give one or two other manufacturers some potentially nasty headaches. A real time clock facility is built into MTX together with protective time-out facilities that prevent the system from being 'hung' because of external events not happening. This still leaves quite a generous 35 kbytes of RAM for Basic program storage.

System utilities

Perhaps one of the most significant features is the fact that the 7120 supports ISAM. What, you may ask, is that? Well, ISAM or Indexed Sequential Access Method is a powerful way of accessing and manipulating data in files with the speed of random access but coupled with the space-saving features associated with sequential filing. There are many ways of implementing this idea but the way that the 7120 does it is essentially based on just one key (although with a bit of jiggery-pokery I guess that it should be possible to key across several fields). It may not be as powerful as some other ISAMs but let's face it, very few micros support ISAM at all so more power to BASF's elbow.

The other form of file handling is called sequential; really though, it's a form of random-access as the record length must be specified and individual records can be accessed. With ISAM, records cannot physically cross sector boundaries; with 'sequential' files this cannot happen. Since the sectors are 930 bytes long, this theoretically places an upper limit on the size of 'sequential' records. However, in practice this probably won't be a problem and I suspect that most applications will end up using ISAM. What's a little more disturbing about this 930 byte chunk is that the DOS will squeeze in as many records to a sector as possible; if your record size is 466 bytes, you'll effectively halve the available time and the other 464 bytes in each sector will be wasted.

The catalog function of the BOS (BASF Operating System) is an apology and, unfortunately, one of the worst that I've seen. The basic command is a bit cumbersome (you have to type in PRINT STATUS ("1:")) which will give you the catalog for drive 1. The catalog function can only take one path at a time and will overflow from one line to the next — even in the middle of a file name. No indication is provided as to whether files are programs, data or Jimmy Young recipes! I suppose we should be grateful that they let commas in between file names. True, you can ask for a PRINT STATUS on a specific file name, but it's all unnecessarily clumsy.

Another minor point that is new is that, as quotes are needed or not. For instance, they are used in the PRINT STATUS command but not in RUN UTILMENU: 1 — which conveniently brings me to a very nice package, for here lies all that is most useful to the serious programmer. The usual facilities such as delete files, copy disks and re-organise ISAM files are here and there are also other utilities that link two BASF machines together — for data transfer under MTX, for example. DINP is very useful for displaying more information about the specific files and DIG will let you display the true size of files. I particularly appreciated XREF which can print out all the line numbers in a Basic program that use GOTO and where each variable is used and where there are no other ISAMs but let's face it, very few micros support ISAM at all so more power to BASF's elbow.

Error handling is exceptional and can either be effectively carried out at the system level or from the Basic interpreter. SYS.TRACE can be carried out at eight different levels of complexity, and even goes right down to machine code level.

The sheer number of facilities in the 7120 are almost mind-blowing in their flexibility and versatility and I've only really just scratched the surface. I haven't even begun to discuss the absolute disk operators that allow manipulation of the track and sector level because, unfortunately, that would take too long.

TECHNICAL SPECIFICATION

CPU: Z80A running at 4 MHz; real time clock
Memory: 64k dynamic RAM
Keyboard: 60 keys. Qwerty, 14 edit/cursor, numeric keypad, mode switches, function keys.
Screen: 80 x 24 green 12" high-res screen
Cassette: n/a
Disks: Three 162 kbyte single-sided, double-density BASF 5" drives, ISAM and random access supported.
Disk controller: 4 MHz Z80A, 16k dynamic RAM, 8k ROM
Languages: Basic, Cobol, communication emulators, multi-tasking, spooler.
Ports: 1 parallel, 1 RS232 (+1 opt. extra)
Software

Two languages are supported at the moment. The first is CIS-Cobol from Micro-Focus and also included is an ingenious program suite called FORMS-2. Basically, this allows you to "draw" screen layouts, lines and headers etc. I think that the reason that you can see what the final result looks like on paper. Input fields can be defined and when you are happy with the result, FORMS-2 will generate all the necessary Cobol statements for you - and without any errors! This is a facility that most Cobol programmers should definitely find appealing.

The second permit me to delve too far into CIS-Cobol and so I pass onto the Basic interpreter.

Basic

Here again there are one or two surprises. The first thing you notice is a definite pause after hitting EOM while the interpreter checks your syntax. After a while, I began to get annoyed at the rather pedestrian rate of this procedure, although I'm not a trained typist I still found myself waiting for the machine, which is irritating to other people don't find this a problem and so maybe it's just me. Any errors found are reported with the appropriate error code and line number, although no indication is provided as to where along the line the error occurred. I counted nearly 100 available error codes, got most of them while I was familiarising myself with the machine, and although no indication is provided as to where along the line the error occurred.

Remember the "mail-box"? Well, if you make a Basic line 10 W$ = WRITE FILE etc... then W$ will return

from the BOS. Your Basic program can then interrogate W$ and you can therefore very easily route your error

handling routines as appropriate by simple "IF W$ < "TRIM"

"THEN"

Most Basic statements are present, with some exceptions and a few good additions. Missing is VAL and STR

because K$ = 1 (yes, no quotes) then K$ can be converted to K$ by using a bit of syntax that I personally found a little clummy. You can't have multi-dimensional arrays of any sort, which may be a disadvantage to some. Interesting additions are TRANSLATE which can, for example, effectively convert a mixture of lower and upper case letters to one or the other - very useful for fast handling; the DROP commands will lose the specified number of characters from the appropriate end, PAD will increase a string to a specified length with a specified character (e.g. space) and TRIM will remove extraneous spaces. All three can either be carried out from the left or the right. PEEK and POKE can be used to alter memory, and one extra handy feature is that POKE ("8000", "This is a string") will poke these letters into memory starting at address 0000.

Another string handling feature that I found this feature a little difficult at first, partly due to the lack of any documentation on ENTER will execute your wishes - certainly, one of the best listings I've seen. Full chaining is possible and no variables are cleared between chains unless the CLEAR statement is given. You can reset and begin to look quite favourable when compared with some of the competition. Before I started to use MATHLIB I had to load. This is usually a one-time exercise as it remains in memory unless CLEAR is executed. However, the execution time of BM8 with this package is excruciatingly slow and BASF is currently looking at ways of improving it.

Since the accuracy of the system can be altered with the SYSDIT command (it defaults to 12), execution time will depend on the figure selected. Unfortunately, increasing the number of digits didn't always improve the accuracy and so there isn't a real opportunity for a trade-off in speed versus accuracy. For example, sin(0.785398163) yields 0.707106776866 with 30 digit accuracy but 0.707106781187 with 12 digit accuracy. The true answer is 1/\sqrt{2} and the figure should be achieved with 12 digit accuracy is better than that achieved with 21000 digits. As far as businesses are concerned I doubt very much whether these fine distinctions will be of any great import but they may be to scientific circles or those with a mathematical bent. One additional feature of MATHLIB is that the three inverse trig functions (ARCSIN, ARCCOS and ARCTAN) are provided but all trig functions are available in radians only and there is no direct conversion.

Reading through Basic programs was a little difficult at first, partly due to the strangeness of some of the Basic commands and also because of the quite large number of CALLs to sub-routines within the system itself. This is quite a useful technique for designing programs. Write them in make sure that they debug them using Basic. Then, whenever possible and only if the system allows it, replace some of the Basic lines with equivalent machine code or assembler routines to speed things up. The sheer versatility of the 7120 makes it eminently suitable for this particular method of working. There are other useful little features such as the fact that you can't delete the whole program in one go but have to type CLEAR instead, which is a

---

**Prices**

**System**

| BASF 7120 with | £155 + VAT |
| 64K + 24K | BASF 7110 with | £4275 + VAT |
| 64K + 24K | 60P | £250 + VAT |
| 120 CRS Matrix Printer | £1671 + VAT |

**Software**

| BASF Extended | £150 per system |
| Business Basic | £110 per system |
| CMS | £50 per system |
| 2780 Emulator | £320 per system |
| 3275 Emulator | £540 per system |
| Formgen | £250 one payment only |

System prices include a range of utilities as well as a text editor, an assembler and a processor. The system is supported by a six month parts and labour guarantee.
This is a list of dealers participating in Associated Advertising and not a full list.
character within quotes. However, because there is no key on the keyboard that will generate these characters directly, you must press the escape key (taking you out of the mode in which control characters are normally displayed), then REVERSE, then the appropriate letter—which may be shifted. No doubt it will seem very natural after a few years, but it would be so much easier if Commodore had provided a control key.

Returning now to the subject of garbage collection—one characteristic of Microsoft Basic is its dynamic storage of strings. Each time a string variable is redefined it’s rewritten elsewhere in memory, the previous representation becoming redundant. When the garbage collection routine exhausts a ‘garbage collection’ routine disposes of the redundant strings and gathers together those that are still valid. At worst garbage collection now takes less than a second, against 20 minutes (in an extreme case) with earlier PET Basics. A slight disadvantage is that each string variable now takes up to half a second because two additional bytes are used for a vector pointing from the string storage area to the variable table. Each element in a string array now uses five bytes in addition to the length of the string and for string variables the overhead is nine bytes. Another disadvantage is that creating a new non-array variable now takes up to half a second because the whole of the array table must be moved up—the secret is to mention each variable before setting up the arrays. String operations seem to be slightly faster overall by about 10%. However Benchmark timings, which don’t test string handling, give identical timings to those for the new ROM PET.

Potential use
The CBM 8032 is a convenient computer, easily transportable and sturdy, the only essential add-on being the cassette deck or the disk drive. The Basic includes all the common mathematical functions and, while not as comprehensive as most disk Basics it is faster than average. The 80-column screen is ideal for business use and, though the 8032 may be more difficult to program than many machines, this will not affect the vast majority of business users as there are sure to be plenty of packages available.

Whether this new model will be bought for use in schools, colleges and the home is more questionable. The screen handling functions are impressive, but hard to use, and most of the graphics characters are inaccessible from the keyboard. The recommended price is £200 more than that of the 32k PET and more than twice that of an 8k machine with a built-in cassette. Commodore has aimed the 8000 series at the business market and it looks to have a good chance of achieving its objective. Because the 8032 is this year’s model, a particular sector of the personal market will rush to buy but, at present prices, the existing range should have plenty of mileage left in it yet.

Compatibility
If you are thinking of upgrading from your existing PET, it won’t be too difficult to modify existing software. Most of page zero is virtually unchan-
ged and, while routines in ROM have been shuffled around, the majority perform exactly the same functions. Games programmers should note that the values stored in locations 151 and 166 have changed—they are no longer keyboard values, but garbled ASCII. The ‘window’ facility makes it easy to simulate a 40-column screen, although programs that poke the screen will need changes as it now occupies RAM addresses 32768 to 34767.

Machine code programs that call Basic routines or use the second cassette buffer will need rewriting but most others will run without modification. The ‘merge’ technique can still be used to load subroutines or utility programs, although it founders if a line which lists more than 80 characters (including line number) is included.

To summarise, conversion of new ROM programs for the 8032 will be fairly easy, in many cases easier than converting between old and new ROM PETs.

Documentation
Two manuals were supplied with the review machine—a Users’ Guide and a preliminary Basic/DOS manual. The users’ guide is a good introduction to the mysteries of computer operation; as well as covering the physical controls, it describes all the command functions necessary for successful machine operation. The preliminary manual was exactly that. Essentially written for Commodore dealers, it assumes a fair degree of prior knowledge. We hope that the version supplied to users of the 8032 is more comprehensive, though in this respect Commodore’s track record is not enviable. Even this dealer’s manual leaves out such useful information as the fact that auto-repeat can be disabled and that the length of the keyboard buffer can be altered. A good start, but serious programmers will need more, much more.

Conclusions
Commodore set out to widen its influence on the business market and without doubt it will succeed with the model 8032 which looks, feels and behaves like a business computer. Programmers used to the PET will find the 8032 an irritating machine to work with but no doubt they’ll learn to love it. Let’s face it—they’ll have to.

The gaps in the memory map give hints of greater things to come—we hope it’s not too long before Commodore extends the system software to make up for the odd weaknesses in the present version.

Finally, whether or not you’re a businessman, if you require a display of more than 40 columns then you must put the 8032 on your shortlist of possible machines.

Memory map

<table>
<thead>
<tr>
<th>Buffer</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFFF</td>
<td>Basic + OS</td>
</tr>
<tr>
<td>8000</td>
<td>ROM expansion</td>
</tr>
<tr>
<td>9000</td>
<td>Unused</td>
</tr>
<tr>
<td>8800</td>
<td>Screen RAM</td>
</tr>
<tr>
<td>8000</td>
<td>User RAM</td>
</tr>
<tr>
<td>0400</td>
<td>Basic RAM</td>
</tr>
</tbody>
</table>

Benchtest timings (in seconds)

- BM1: 1.7
- BM2: 10.0
- BM3: 18.4
- BM4: 20.3
- BM5: 21.9
- BM6: 32.4
- BM7: 51.0
- BM8: 11.9

At a glance

** FIRST IMPRESSIONS
** Looks
** Setting up
** Ease of use

** HIGH LEVEL LANGUAGES
** Basic

** PACKAGES **
<table>
<thead>
<tr>
<th>Software</th>
<th>Being planned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>***</td>
</tr>
<tr>
<td>Cassette</td>
<td>****</td>
</tr>
<tr>
<td>Disk</td>
<td>****</td>
</tr>
</tbody>
</table>

** EXPANSION **
| Memory   | *            |
| Cassettes| ****         |
| Disk     | **           |
| Bus      | ****         |

** COMPATIBILITY **
| Hardware | *            |
| Software | **           |

** DOCUMENTATION **
<table>
<thead>
<tr>
<th>VALUE FOR MONEY</th>
</tr>
</thead>
<tbody>
<tr>
<td>**** excellent</td>
</tr>
</tbody>
</table>
| **** v. good   | *
| *** good       | **
| ** fair        | **
| * poor         | **

PCW 53
Welcome to the world of 'Microsoft' Basic! On flicking through the pages of PCW you’ve probably seen many systems which claim to run a version of Microsoft Basic — e.g. Tandy Level II, PET, UK 101, C2-4P, Apple, Nascom 2, RML 380Z and Sorcerer. You could be forgiven for thinking that programs are easily transferred between these machines. The fact is though that a considerable amount of rewriting may be required. For example:

```
10 IF A=B THEN X=INSTR(L$,"A")
```

will happily run on a Tandy but not, for example, on a PET. The latter machine cannot handle either the ELSE or the INSTR functions.

Bearing in mind that a PCW program might be typed in and edited by people as diverse as typists, businessmen or teachers then the problem of compatibility is a major one. There have been various approaches aimed at facilitating program 'portability', including the use of a 'universal' assembler-type language, which is easy to adapt for any machine, and even rigorous high-level language definition, such as Algol 68. It would be nice to say that Pascal allows machine-independent software but, even here, it seems that dialects are going to differ. Already we see Transam and UCSD compilers being based on different standards.

However, all is not lost — the different versions of Microsoft Basic are sufficiently similar to enable you, with a bit of care, to write programs that run on any system with little or no modification.

The problem with Basic is that there are so many mutually incompatible versions around that transferring a program from one machine to another can often be quite difficult. Mike Parr suggests a way of presenting programs so that they can be easily implemented by users of any machine.

There are four main areas where portability problems occur — statements, data types, functions and input/output. I shall now examine each of these in turn.

Statements

The following statements occur in almost all Microsoft implementations:

```
GOTO, IF. . . THEN, END, STOP, LET
```

As well, because some systems don’t have data files, and PEEK, POKE and USR are definitely out of the question as they are the very essence of machine dependency. Finally, CLEAR is similar on most machines but not identical, so it must also be banned.

Apart from the statements themselves there’s the question of line lengths. PET for example is 80 characters, while UK 101 is 71 (yes, 71!), and Altair is 255.

The moral is clear... when it comes to statements keep the lines short and work as far as possible within the subset.

Data types

The second aspect of portability concerns data types. Microsoft Basic includes floating point numbers, strings of up to 255 characters, arrays of either type with no limit on the number of elements or dimensions and where only the first two letters of a variable name are significant.

On some systems, other variable types are allowed. An integer, for example, is sometimes defined by following its name with a % character thus:

```
20 IF %I=1 THEN .
```

Tandy and Altair have a more powerful system, including a set of statements like DEFINT I—N, which automatically causes all variables starting with the letters I to N to be treated as integers. In many programs, leaving out any special integer use has no serious effect (unless memory happens to be very tight). Finally, I should mention accuracy. Most hobbyist programs don’t rely on high numerical accuracy, which is just as well since many systems have only 6 or 7 digits of precision. In general I would suggest that you stick to single precision floating point numbers unless memory size and arithmetic precision are particularly important to your application.

Input/Output

The remaining (and most involved) area deals with data file I/O and memory-mapped graphics. The suggested approach is to use subroutines for primitive functions, commented in such a way that the average user (given reasonable system documentation) can amend them to fit any computer. As an example, consider memory-mapped graphics, instead of just writing:

```
10 POKE 16300+Y*40+X , 65
```

you could write:

```
10 C=65 : GOSUB 2000
```

and, of course, mean that some of your routines may not be as elegant as you might like but then again it does ensure that your efforts reach as wide an audience as possible.

Before moving on to data types I shall illustrate a few of the more common Basic functions which I have had to leave out of the subset:

```
10 IF A=B THEN PRINT C ELSE STOP
```

Note: I've had to leave out many systems where the user only needs to alter the subroutine, not dozens of POKEs throughout the program. Ideally you would also incorporate checks on the ranges of X and Y, as screen sizes vary between machines.

and Tandy users may be amazed to learn that many systems have no provision for cassette data files, other than resorting to PEEK,POKE and USR facilities. On most disk systems however, typical statements are:

```
ASC, CHR$, LEFT$, LEN, MID$, RIGHT$, STR, VAL
```

The main omission here is the useful
**Standard Functions**

All Microsoft systems have these numeric functions: ABS, A$=?, EXP, INT, LOG, RND, SGN, SIN, SQR, TAN, TAN.

They also have the logical functions (actually operators) of AND, OR and NOT, with which they treat their operands as 16-bit two's complement integers. The 16-bit number, consisting of all ones, is regarded as logical TRUE, (its value being -1).

The only major difference between the built-in functions concerns RND. Most machines will produce a value between 0 and 1 whereas Tandy, for example, will give a value between 1 and n. unless the program more portable, you should only assume the presence of random numbers from 0 to 1, and modify the result using a scale factor and the INT function.

Character functions include:

- OPEN, CLOSE, PRINT#, INPUT1, LINEINPUT4
- together with the EOF(N) function, which returns a 'true' value if there is no more information in file number N. As an example, one could list a file on the VDU by:

  100 OPEN FILE CALLED JIM FOR INPUT AS UNIT 1  
  20 OPEN "JIM", 1, 1  
  30 IF EOF(1) THEN CLOSE 1:END  

- INSTR string searching function, which is missing from many systems. For complete compatibility, one can use a subroutine which performs a similar function (subsequently shown), but, if you must use it, avoid the nested form:  

  20 A$=LEFTS(L$, INSTR(L$, "\%"))

This being much easier to edit.

Finally, most systems include the FRE function, used with either a numeric or string argument. This is fine, but bear in mind that, with as CLEAR, certain assumptions about free space may be machine-dependent (for example, one might use FRE to determine the maximum subscript for a numeric array – however, don’t assume that all systems use the same number of bytes to store each array element).

**Conclusions**

With a little forethought and a bit more typing, portable software is possible. It must be admitted that some defy portability – some flashy graphics could give problems, and memory size may be significant in large programs. However, there’s no reason why the remainder should not see much wider use once a Microsoft subset has been followed.

**Example**

To illustrate what I mean here’s a useful example that conforms as near as possible to the ‘rules’ that I’ve proposed. The program is an interactive data-file editor for any single-cassette system, illustrating the use of a subset, and the file I/O routines. The data lines are read into a large text array T$(), and may then be edited by the following commands, typed in response to “EDIT”:

- Back – by a specified number of lines.
- Forward – by a specified number of lines.
- Line – as Forward, but display lines.
- Delete – delete current line, and move to next one.
- Insert – insert a new line after the current one.
- Replace – replace the current line by a new line.

To create a new file, type “N” instead of “Y”. The program occupies around 2200 bytes thus leaving, in an 8k system, some 6000 bytes for text (about 200 lines of 30 characters). On your system, alter line 20 to clear your maximum string space, estimate your average line length, and dimension T$() to the maximum possible number of lines.

For ‘rules’ that I’ve proposed. The program occupies around 2200 bytes thus leaving, in an 8k system, some 6000 bytes for text (about 200 lines of 30 characters). On your system, alter line 20 to clear your maximum string space, estimate your average line length, and dimension T$() to the maximum possible number of lines. If your data doesn’t have commas or leading spaces, INPUT#1 can be used in place of LINEINPUT4. For those with no cassette motor control, only a very short delay is needed in routine 8000, as the lines are rapidly read and saved in T$(). In fact, the cassette control on PET and Tandy, involving a delay of several seconds, is a disadvantage in this type of input.
The 3rd
Personal
Computer
World
Show

It’s the show you can’t afford to miss! The 3rd Personal Computer World show takes place on 4-6 September at the Cunard International Hotel, London. And what a show it’s going to be! A bumper collection of all the latest hardware, software, peripherals, accessories and special shows for parents and teachers interested in learning how to spread computer literacy among the young, one from a school and one from Young Computer World; MICRO UK, a three-day series of seminars, conferences and ‘meet the expert’ discussions; and the first official World Microcomputer Chess Championship.

For full details of the show’s opening hours and admission prices see page 82. For details of MICRO UK, see pages 12 and 13. And for an introduction to the chess contest by our resident microchess expert Kevin O’Connell, see page 60. Meanwhile, here’s our stand-by-stand guide to all exhibitors who had confirmed their bookings when we went to press.

Don’t forget to call in at the PCW stand where you can buy T-shirts, badges, back numbers and binders, and where, when they’re not bar-proping or hiding, the PCW editorial team will be on hand.

SEE YOU AT THE SHOW!

ACT
B30
66-68 Hagley Road
Edgbaston
Birmingham
B16 8PF
021-455 8585

Appleware
Britain's best range of Apple software is there for you to try on the Appleware stand, some of the products appearing for the first time. Look out for the latest version of the award-winning VisiCalc program, Tiny Pascal, Talking Disk and the amazing Apple Invaders program. They are on sale direct from the stand, some at specially reduced prices.

Petsoft
Petsoft are offering a new range of low-cost ready-to-run business programs covering ten key applications: Word Processing, Payroll, Ledgers, Stock Control and Mailing List packages will be on sale direct from the stand.

VisiCalc, the award winning forecasting package, and the superb Programmers Toolkit plug-in ROM chip are also there for you to try.

Petsoft also offer the widest range of Educational, Scientific and Games programs.

CCS MICROHIRE/
MICROSALES
B8
7 The Arcade
Letchworth
Herts
04626 73301

CCS will be launching its Data Manager package for the Apple II and PET. This is a modular data handling system for incorporation into programs, handling five files (can be expanded or reduced), and which takes care of all file processing including computer-guided definition and storage of file descriptions for as many files as the user requires.

The company will be demonstrating and selling its range of software and hardware packages, including stock account- ing, wage processing, modelling and scheduling for the ABC-80, Apple II and PET machines.

CHROMASONIC
B34
ELECTRONICS
56 Fortis Green Road
Muswell Hill
London N10 3HN
01-883 3705/2289

Details not known at time of going to press.

COMP SHOP
A3
14 Station Road
New Barnet
Herts EN5 1QW
01-441 2922

Comp Shop’s range of stock includes the TRS-80 Models I and II, Apple II, Compukit UK101 and PET, together with various peripherals. At the time of going to press, Comp Shop was promising unusually special offers on all its products, which carry a full one-year warranty.

COMPUTABITS LTD
B13
PO Box 13
Yeoal
Somerset
0935 26522

Nick Hampshire, writer of The Pet Revealed, will be at the show selling his book and his latest product – a library of PET subroutines. Routines include input validation, screen formatting, plotting, sorting, variable file access methods and a number of general utilities. All these are supplied on a 3040 format disk.

THE COMPUTER
BOOKSHOP
A14
Temple House
43-48 New Street
Birmingham B2 4LH
021-643 4577

Computer Bookshop is a trade distributor of books and training courses supporting the UK microelectronics and personal computer industries and is the sole UK distributor of Sybex books. New titles this summer include Programming the Z8000 and 6502 Games, both by Sybex. Among the 250 titles on display will be new books from well-known computer publishers such as Sams, Addison Wesley and Hayden, plus a Petsoft new to Computer Bookshop from TABS. Computer Bookshop also hopes to have some of the new books coming out from British publishing houses.

CREATIVE COMPUTING
B72
PO Box 789-M
Morristown NJ07960
USA
(201) 540 0445

Creative Computing is a leading US publisher of magazines, books and software for personal computers. Creative Computing magazine publishes practical applications for home, school and small businesses, evaluations of the newest computers, peripherals and software, games, book reviews and fiction. S-100 Microsystems magazine is designed for the serious user of $100 bus systems. Books from Creative Computing Press include the popular Basic Computer Games and More Basic Games, copies of which will be autographed by editor David Ahl at the show. The Sensational Software line includes cassettes and floppy disks for Apple, PET, TRS-80, Sol, Sorcerer and CP/M systems.

DATAC LTD
B36/B57
Tudor Road
Altrincham
Cheshire
WA14 5TN
061 941 2361/2

Datac Limited “The Printer People” will be showing a substantial part of their large range of digital printer units, including mechanisms, electronic interfaces, and complete packaged units. Also on display will be a new range of Philips high-resolution CRT monitors, which Datac are distributing in the U.K. Of particular interest will be the following brand-new printer products: The Centronics 737 80-132 column impact printer featuring 9-needle print-head and proportional spacing. The DMI-40P free-standing terminal version of the DMI-40 40-column impact matrix printer mechanism. A new serial input version of the well-established 20/40 column 410 serial printers.

See page 56 for the complete list of exhibitors.
3D DIGITAL DESIGN & DEVELOPMENT
43 Grafton Way
London W1F 5LA
01-397 7388

3D specialists in microprocessor interfacing for industrial, medical and educational applications and will quote for custom interfacing packages which include both hardware and software. On show will be some micros plus a fast data acquisition system (40,000 samples per second) and a 12-bit analogue-to-digital converter for the PET.

FACIT DATA PRODUCTS B58
Maidstone Road
Rochester
Kent
0634 401721

Data products will be showing an interesting and extensive range of printers. The new Facit 4520 is a low-cost, high quality matrix printer which prints bidirectionally, in a high-quality 9 x 7 matrix character font. The Facit IPS 5000, also brand new, has 150 cps 9 x 7 matrix character font. The Facit prints bidirectionally, in high-quality matrix printer which includes both hardware and software. On show will be some micros plus a fast data acquisition system (40,000 samples per second) and a 12-bit analogue-to-digital converter for the PET.

GALATREK ENGINEERING
Scotland Street
Llanrwst
Gwynedd LL26 0AL
North Wales
0492 640311

This company will be showing a new range of constant voltage transformers in ratings up to 5 kVA. Representing an innovative development based on the established ferro-resonant saturable reactor technique, they offer output stabilisation to ±1%, attenuation of high voltage transients and power back-up to 1 cycle duration in case of transient supply breaks. At the same time, size, weight and cost have all been reduced; they are thus well suited to providing the clean mains input necessary for maximum operating reliability of small computer systems. Other related devices will also be shown, and Galatrek will also be providing clean power supplies for contestants in the first World Microcomputer Chess Championship.

GRAHAM-DORIAN SOFTWARE SYSTEMS
17 The Gallop
Yateley
Hampshire
0252 874790

Terodec (Microsystems) Ltd has combined with Graham-Dorian Enterprises Inc to form Graham-Dorian Software Systems. Terodec’s range of microcomputers includes the TMZ-80 and the Delta Products DPS64 range. Both machines have hard disk/multi user expansion capability. Graham Dorian’s software products are amongst the most detailed packages on the market today. These are currently 15 packages each fully documented, including source code and easily understood operator instructions. GDSS is the European distributor for Compiler System’s CBASIC-2 and MicroPro’s WordStar, DataStar and MailMerge. Operating Systems Software include CP/M for the Tandy TRS-80 Models I and II.

A J HARDING B19
(OLIMERX)
28 Collington Avenue
Beachill-on-Sea
East Sussex
0242 220391

This company specialises in the supply of software for the TRS-80, both Model I and Model II. Mr Harding and his staff will be available to demonstrate any of the Model I software, including the new range of microsoft utilities such as the Basic compiler and the Editor/Assembler Plus. A broad selection of other utilities, business software and games will also be available. You will be able to buy software at the stand, together with the line of accessories which Molimerx carries, such as disks, special formula tapes for the TRS-80, its well-known green screen and books.

HOUGHTON COUNTY PRIMARY SCHOOL
Houghton
Huntingdon
Cambs
0480 63398

Houghton County Primary School, Huntingdon, Cambridgeshire was one of the first schools in the country to buy a microcomputer of its own. Since January 1980, Don Walton has been developing software for computer assisted learning in a wide range of subjects, with children aged 4½ to 11 years old. Every child and teacher in the school is an enthusiastic user of their Commodore PET and although most of them are not able to program, Don Walton has implemented a pilot project to teach the elements of Basic to his top class of 11 year old children with some success.

As a result of this experience Don and the headmaster of the school Keith Lutton are well able to answer questions on the problems facing a primary school wishing to introduce a microcomputer.

INTERACTIVE DATA SYSTEMS
14 Buckman Close
Greenleys
Milton Keynes MK12 6AB
0908 313997

Interactive Data Systems will exhibit its range of UK-made S100 boards, including Z80-based CPU boards, memory boards, double-density floppy disk controllers and analogue and parallel I/O boards, together with motherboards, power supplies and Saracen mainframes. Also on show will be the first showing of ID’s’ new low-cost VDU. A full, professional standard VDU housed in a very attractive structural foam case. The unit features 24 rows of 80 characters, 96-character ASCII set plus 128 graphics characters, reverse video, underlining, flashing characters and half-tone background.

INTEX DATALOG LTD B67-B50
Eaglescliffe Industrial Estate
Eaglescliffe
Stockton-on-Tees
Cleveland
0642 781193

Datalog is primarily a shop window for a range of popular microcomputers and accessories, being an authorised dealer for the PET, Apple and Nascom machines and a main dealer for Computhink products. The company also handles a range of printers and sundry items such as cassette tapes, diskettes, paper and dustcovers. Datalog intends to expand its activities, keeping abreast of current developments in the microcomputer field to consolidate its already established position.

KANSAS CITY SYSTEMS B6
Unit 3
Sutton Spring Wood
Chesterfield
0246 850357

KCS specialises in quality software for the Tandy TRS-80 and the comparable Video Genie. The introduction this year of Level IV Basic resulted in "virtually a new computer", such is its extra exclusive facilities, commands and utilities. The company also sells Video Genie hardware at a discount price.

KINGSTON COMPUTERS B45/24
Sloborough House
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Brighidling
North Yorkshire
0262 730356

Details not known at time of going to press.
A new low cost multiuser system for the Commodore PET will be demonstrated by Kobra Microsystems, a subsidiary of Adda Computers. Called MU-PET, it allows up to eight PETs to access one Commodore disk and share a printer. The hardware connects via the PET IEEE bus and has been designed so that each PET thinks that the disk is its own and no program changes are necessary. MU-PET costs £595 + VAT for a three-user system and has been officially approved as a PET peripheral by Commodore UK.

L P ENTERPRISES A1
8-11 Cambridge House
Cambridge Road
Barking, Essex IG11 8NT
01-591 6511

L P Enterprises is the longest-established UK company selling microcomputer books, magazines and software to the public, dealers and OEMs. It imports the best available from the USA and will be showing the bulk of its product ranges, most of which will be on sale at the show. Software demonstrations will take place at regular intervals and professional help will be available for business and educational users as well as for hobbyists.

LITTLE GENIUS B4
Suite 504
Albany House
324 Regent Street
London, W1
01-380 6361

Details not known at time of going to press.

LONDON COMPUTER A11
CENTRE LTD
43 Grafton Way
London W1P 5LA
01-388 5721

London Computer Centre specialises in daisy wheel and dot matrix printers and will launch a new, full-width daisy wheel printer for under £1000. Also on display will be TRS-80 Models I and II and SuperBrain computers. Word processing, accounts, ledgers, payroll and other software will be demonstrated to support the above hardware.

LOWE ELECTRONICS A18
LTD
Bentley Bridge
Chesterfield Road
Matlock
Derbyshire DE4 5LE
0629 2817

Lowe Electronics distributes the Video Genie and will be exhibiting the system together with its new range of peripherals which includes an expansion box, disk drives, RAM card, sound box and various interfaces, all as competitively priced as the system itself. With these peripherals, the Video Genie 'comes of age'.

MICROMARK B62
Publicity House
Ravenscroft Road
Henley on Thames
Oxon, RG9 2DH
04912 77926

Details not known at time of going to press.

MICROTREND B21/B2
PO Box 51
Patley Bridge
Harrogate
N. Yorkshire
HG3 5DP
0423 711878

Microtrend will demonstrate packages from its Professional Software range and 'work station' products to run under CP/M on 8080/8085/280-based systems; these latter include word-processing and inter-system communications packages. Microtrend will also exhibit additions to its Popular Software range, including the new chess program 'Gembit/80' which will compete in the first world Microcomputer Chess Championship.

MIND YOUR OWN BUSINESS B70
106 Church Road
London SE19 2UB
01-771 3614

Mind Your Own Business is a monthly magazine read by 40,000 businessmen which explains in a practical and non-technical manner how to choose and use modern office equipment to improve business efficiency and manage information. Subjects covered include word processing, small business systems, facsimile, microfilm, telex, speech and digital exchange systems, communications, dictation, copying and many other subjects of importance to those responsible for the efficient running of both large and small businesses.

MINE OF INFORMATION B61
LTD
1 Francis Avenue
St Albans AL3 6BL
0727 52801

The company was formed in 1977 as consultants, publishers and booksellers in the microcomputing field. Today MoI is one of Britain's foremost microcomputer booksellers. The emphasis is on quality: books are selected by an experienced computer consultant on the basis of accuracy, relevance and value for money. MoI will exhibit the latest selection of microcomputer books for perusal and purchase. MoI is independent of any other organisation and is therefore free to choose or reject each title from each publisher, depending solely on the merits of the book itself.
demonstrate the Apple graphics tablet and the well-received plotter and plotting software. The Sharp MZ-80K will be on display with its recently announced disks and printer.

PLC BUSINESS SYSTEMS A9
88 High Street
Slough
Berk
Slough 38319

Details not known at time of going to press.

RESEARCH MACHINES LTD
Mill Street
Botley Road
Oxford
0965 49791

RML will display its Z80A-based 3802 microcomputer in various configurations. Disk systems include dual double-sided mini drives and twin 8" double-sided drives. One system will display the RML High Resolution Colour Graphics option. Recent and future developments include a 16-channel, 10-bit A/D board, a full IEEE 488 implementation for scientific users, a 40/80 character VDU board and a multi-access system.

SCIENCE OF CAMBRIDGE LTD
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Cambridge
Cambs CB2 1SN
0223 311488

The highly acclaimed Sinclair ZX80 will be featured on the company's stand. Extremely portable, measuring 8 x 6 x 1½ inches, and weighing 12 ounces, the ZX80 is intended for use at home, work, college or school. To ensure maximum flexibility of use, the ZX80 may be plugged directly into the aerial socket of any domestic colour or black and white TV. A conventional home cassette player is used to store programs.

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ST COMMERCIAL SYSTEMS LTD B12
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01-840 1926

STCS specialises in the sale and support of systems based on the Intertec Super-Brain with the OKI Microline 80 for normal printing and the NEC Spinwriter for letter-quality printing at 55 cps. Application packages include word processing, interactive data entry and full accounting systems.

VERO ELECTRONICS LTD
Industrial Estate
Chandlers Ford
Hampshire
04215 62829

Having been in electronics for the last 20 years, Vero now boasts a wide range of products for both the electronics hobbyist and the more serious-minded engineer involved with microelectronics. They have products ranging from solderless breadboards (Vero bloc) to complete 19" rack systems.

VLA SAK ELECTRONICS LTD
Thames Building
Bedlem Road
Marlow, Bucks SL7 1PB
06284 74789

An new item on show on the Vlasak stand will be a large-capacity disk drive unit for the Apple II, offering one megabyte of plug-in-and-go on-line storage. Vlasak's range of Apple II software will be demonstrated, including a fully integrated ledger system and a payroll package. Vlasak will also show items from its range of computer accessories, including customised stationery and an inexpensive word processing printer.

JOHN WILEY AND SONS LTD
A7
Baffins Lane
Chichester
West Sussex PO19 1UD
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The company is a major publisher in the applied science and technology field, with a range of quality books — written by leading figures in the industry — covering computer and electronic techniques which caters for the requirements of the data processing professional. The special demands of people wishing to become familiar for the first time with the many aspects of personal computing are met by carefully written texts covering most of the major systems, programs and equipment in use today.

ZENITH DATA SYSTEMS LTD B43
Bristol Road
Gloucester GL2 6EE
0452 29451

Following the success of last year's PCW show, Zenith Data Systems is exhibiting its comprehensive range of computing hardware. Zenith is one of the largest producers of micro-based equipment in the world; its stand is must for the more serious-minded distributor/OEM. Backed by a billion-dollar company, Zenith's continued success is assured with a forward development programme second to none in the industry today.

PCW 59
WORLD MICROCOMPUTER CHESS CHAMPIONSHIP

To set the scene for the first World Microcomputer Chess Championship at the 3rd Personal Computer World Show, Kevin O'Connell takes a light-hearted look at chess and computers.

In the beginning

Man's dreams of flying not only anticipated the aeroplane, they also predated his dreams of chess computers. However, as early as 1770 a chess machine had appeared. That was The Turk — a life-sized figure, dressed as a Turk, seated behind a chest that was about four feet long, two feet wide and three feet high. It was one of the sensations of the day, for it played very good chess and defeated all comers.

Even IBM was a somewhat unknown quantity in the late eighteenth century and The Turk's audience naturally suspected that a man, or perhaps a child prodigy, was concealed in the contraption. When confronted with such natural scepticism, the gifted inventor, Baron von Kempelen, would open the front of the cabinet to reveal a mass of cogs and levers. He would repeat the process at the back and hold up a lighted candle so that the audience could see right through the machinery. A door in the back of the human figure would also be opened, revealing still more machinery. The only conclusion left to the spectators was that the machine was genuine or, like the reaction which computers elicit from so many people today, that it was all done by magic. But of course the cabinet had been constructed in such a way that a man could be hidden inside it. The machine's various owners, including Johan Maelzel, better known as purveyor of ear trumpets to Beethoven, took care to employ some of the strongest (and smallest!) chess players of the day and The Turk was rarely defeated.

Other chess automata followed, most of them straight copies of The Turk, until the first genuine chess playing machine appeared at the turn of the nineteenth and twentieth centuries. This apparatus was rather limited and could play only with king and rook against king, a mere three pieces out of the full complement of 32. But this ingenious invention of Torres y Quevedo, head of the Laboratorio de Automatica in Madrid, naturally excited great interest when exhibited in Spain and France in the early years of this century. This fascinating precursor of today's computer chess machines can be seen in the museum at the Polytechnic in Madrid.

The last decade

The image of chess among the general public has changed. Once it used to be regarded as a slow-moving game, played by grey-bearded men at cobweb-covered tables. However, photographs, news reports and TV programmes showing top players in track-suits doing weight-training to build up their stamina, big money prizes and the advent of computer chess machines have changed all that. The cognoscenti have always known, that chess, despite its deceptive outward appearance, is a game of great tension and enormous speed. The Germans call it a Denksport (thinking sport) and it's rapidly coming to be regarded as just that by more and more people around the world!

To master chess completely is an exceptionally difficult task and only a handful of humans have ever gained such proficiency. As programming skills improve and programs get closer to the goal of joining that select band of chess players who can claim such a degree of mastery, so the world gets nearer to the point of being able to use computer power to solve other, more pressing, problems — such long-range planning and, perhaps, the creation of real artificial intelligence.

The first World Microcomputer Chess Championship this month ushers in a new decade that follows ten years of often frantic progress in the field of computer chess.

There followed Zuse, Shannon et al. To avoid unnecessary duplication, I refer you, for the early development of computer chess, to my article in the July issue of PCW.
If you have any good ideas about how to improve chess programs, drop me a line, or come and discuss them at the show. I'll be able to spread the glad tidings to those who are chasing after the $50,000 offered by the Dutch software house of Volmac for a program to beat the 79-year-old former world champion Dr Max Euwe, and the $100,000 Fredkin Foundation prize to the first program to gain the title of World Chess Champion.

It's only to be expected that these tempting cash prizes will lead to increased effort on the part of programmers. They may also have an even more important benefit—that of increasing the already considerable prestige attached to computer chess. Recognition is probably a prerequisite of prestige and it's therefore especially important that the World Chess Federation (FIDE) has this year recognised and granted its auspices to the two most important computer chess competitions: the World Computer Championship and the World Microcomputer Championship. As 'real' chess players are likely to take a greater and greater interest in computer chess, we can expect two benefits to accrue: top-class players will become increasingly available for tournament—which should help programmers to increase greatly the sophistication of their evaluation functions—and the wider recognition, implying greater prestige, should help to increase still further the cash incentives being offered to anyone who can make a breakthrough in the field.

Boos and giggles not out of place in normally silent game

Thus ran the headline to a recent magazine article about a chess game in which costumed actors took the place of wooden chessmen.

At most chess tournaments silence is the rule because the players have to concentrate. Obviously no amount of talking, giggling or even cat-calling is likely to disturb the players if they are all machines. That is one of the best things about a computer chess tournament—everyone is free to chat, laugh and generally enjoy themselves.

Come along to the tournament on Thursday, Friday and Saturday. If it will be fun. You can delight in the anguished looks on the faces of the programmers whose programs stumble into disaster all the time. You may chuckle at any machine failures, although this is not recommended procedure if you happen to be in the immediate vicinity of the aggrieved owner. Chess is a game to enjoy and you will be able to revel in it at the first World Microcomputer Chess Championship.

Maelzel's Exhibition

No. 29, St. James's Street.

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Being returned from Edinburgh and Liverpool, where (giving the Pawn and Move) it baffled all competitors in upwards of 900 games, although opposed by all the best players.

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The Morning Exhibitions begin at 1 and 3 O'clock, and the Evening Exhibition at 8, precisely. The Games will be played against any opponent, to whom the double Advantage of a Pawn and the Move will be Given.

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While you're waiting for your catalogue just browse through the tiny fraction of what is available listed below. Now that Keenstar's arrived you can really let your imagination loose.
Hi-tech's S100 colour VDU board in front of the display it produces.

Introduction
The Hi-tech VDU board is a memory-mapped device which generates a colour display when used with a colour TV or monitor. Since it's teletext compatible it produces 24 rows of 40 characters and has a limited graphics capability. It's designed for use in S100 systems and is available in three versions - giving the choice of UHF, video or RGB outputs. This Checkout describes the UHF version, although most of the comments made will apply equally to the other two.

Hardware
All the circuitry is socketed and mounted on a single fibreglass PCB. It appears to have been carefully designed with no sign of the bodges that are to be seen on some circuit boards. Figure 1 is a block diagram of the circuit's functions.

To the processor the VDU board appears as a chunk of RAM plus an output port. As the display shows 24x40 characters, you might expect the board to occupy the best part of a 1k block of memory -- if you did, wrong again! For 'historical reasons' (that's the history of teletext) it takes up 2k, the difference being made up of 24 unused locations at the end of each screen row, plus a further 512 after the bottom row. Figure 2 makes this arrangement clearer. Apart from the 'wasted' kilobyte of memory space, the non-contiguous mapping used means the driver software must be more complicated to achieve a given result.

DIL switches are provided to locate the board on any 2k boundary in the processor's address space, a much neater method than soldered jumpers. The same method is used to select the output port, which is used to control the mode of output to the TV; the red, green and blue outputs may be independently inhibited or the display may be switched to double height, with either the top or bottom 12 lines being shown, or in single height mode it's possible to display background colours.
only.

Since switching between these modes is instantaneous, the way is clear for a wide range of displays. For instance, in double height mode, alternative frames of an animated display could be written into the two halves of the screen, with a switch to one frame to the next.

The display uses the ISO-7 character set, which is basically ASCII with a few modifications, such as the provision of an extra symbol and the fractions 1/4, 1/2, 3/4.

In graphics mode there are 64 symbols on a 2 by 3 grid. This makes it possible to plot a resolution of 78 by 72—not 80 by 72, as one character position will be occupied by the 'bold graphics' control character. This is probably the greatest limitation of the teletext format: each mode change, such as specifying a new colour or flashing characters, takes up a character position and is only effective for that line.

Take a look at a Prestel frame and you'll see what I mean.

All in all, I calculate that there are over 215,000 combinations of symbol, colour, size and 'flashiness'. If you are still unsatisfied, I give up!

**Software**

Listings are provided of four Basic programs which exercise the board in various ways. For example, one displays horizontal bars in randomly selected colours. A 'proper' VDU driver (DRIV 6.7) is supplied; this sets the VDU board as the main console output device and offers most of the features of a conventional VDU—including erase page, cursor up, down, left, and right, and scroll or page mode.

The hex listing of DRIV 6.7 is of limited usefulness as it's been assembled for use with the Exidy Sorcerer, but other versions are available for the North Star Horizon and the Vector MZ. The availability of limited usefulness as it's been assembled for use with the Exidy Sorcerer, but other versions are available for the North Star Horizon and the Vector MZ. The availability
of the source code on CP/M disk caters for other machines.

Since our board was purchased for use as an auxiliary output device for a North Star Horizon, I wrote a driver routine which was compatible with CP/M Fortran (currently the most frequently used language on the machine). The basic function of any such driver is to keep track of the memory location corresponding to the current screen position, and then stuff the ISO-7 code of the next character into that location. Of course, it’s not quite that simple - certain control characters need special handling (e.g. carriage return), and many of these characters are needed to control the mode of display. It’s probably best to follow the example of DRIV 6.7 and prefix control characters that must be passed to the board with ESCAPE.

You’ll certainly need some kind of driver, as the alternative is to POKE everything into place, which is not very elegant, and leads to confusion. If you plan to make extensive use of the graphics characters, it would make life very much easier if you wrote a driver which would plot points on ‘graphics’ coordinates, and perhaps draw the best line between two specified points. If you do, why not share it with the rest of us? (I plan to offer my Fortran driver to the UK CP/M Users’ Group.)

Hi-tech also sells a program which facilitates the use of a computer fitted with one of its VDU boards as an in-house viewdata system. This allows the storage of 170 frames, complete with routing information, on a single North Star diskette. If a suitable modem is available, Prestel pages may be captured, stored and edited locally for future use. The system may also be used as an editing terminal for information providers.

**Documentation**

A 32-page manual is supplied with the device. Installation is one of the first topics covered - very sensible, as few of us have the patience to wade through reams of paper having received a new toy! The booklet then goes on to explain some of the theory behind the workings of the device, and how to adjust the TV and the board for optimum performance - although our board needed no adjustment.

Appendices include tables of the character set and details of the control characters, decimal/hex/binary conversion, the $100 pin definition and the 5100 pin definition.

**Use of the spare bit generates these non-standard colours.**

My main reservation is the £295 + VAT price. There seem to be few functional differences between this product and the Acorn VDU board (for instance they both use the SAA 5050 character generator), yet the latter is less than half the price of Hi-tech’s offering. I must admit that I’ve not seen the Acorn in action so perhaps this comparison is slightly unfair. In any case the ‘overhead’ of the S100 system must be considered (size of PCB, the voltage regulators, etc.).

If you own an S100 system and want colour output, then apart from using an expensive colour terminal you have a choice between the Hi-tech VDU and the Cromemco Dazzler (which is also cheaper than the Hi-tech board, but I have heard conflicting reports as to its suitability for use with PAL TV sets). The big advantages of Hi-tech’s product are that it may be used in conjunction with an in-house viewdata system software; it will be compatible with the Hi-tech Teletext Acquisition Unit (currently under development); and that it’s made in Britain.

**Conclusions**

The Hi-tech colour VDU board works well if you are prepared to accept the limitations of the teletext format. I’ve seen the video output version connected to a Barco colour monitor, and the result was absolutely beautiful. The TV version, though naturally less spectacular, is capable of giving good results when the set is correctly adjusted. The availability of viewdata software is a strong selling point.
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PART 1: IN THE BEGINNING

Whether or not you find the following series of articles relevant will depend primarily on why you are interested in micros. The pure hobbyist who just wants to try things out on the machine, or the electronics wizard whose delight is in soldering bits of equipment together, may feel it covers an area too far removed from their own. They may reason, in particular, that systems analysis is work, not pleasure, and would not be moved by any tale I might tell them about the intellectual satisfaction to be derived from designing and implementing a system that actually does something that needs to be done. They probably haven't read beyond the title anyway!

At the other end of the spectrum from the hobbyist there's the person using the micro because he has to. He might find it a chore — or even a nightmare — but he has a problem which can only be solved with the aid of a micro; he must therefore come to terms with the machine. For such a reader, the series should act as a guide through the stages of implementation of a computer system — from the definition of the problem in the first place to the monitoring of the working solution.

Most readers of the magazine would probably place themselves somewhere in the middle ground, using a micro for both profit and pleasure. They will, I hope, find some things of interest and use to them in the series. Teachers and students should note that, although I shall not be covering an entire conventional systems analysis syllabus — because not all is appropriate to micros — nevertheless I shall be taking in a very good part of it.

I'm using the term 'Systems Analysis' in its broadest sense, to cover the whole area of activity between the user on the one side and the manufacturer, salesman and programmer on the other. (Sometimes the title is restricted to the investigation of the needs of the user, excluding the aspects of systems design and implementation.) The main areas to be covered are:

- Definition of the user's requirements
- The design of a computerised solution
- Selection of hardware and program packages
- Getting someone to write programs for you
- Testing a system
- Getting a system running
- Maintenance of a system

As the series is aimed at the user with little knowledge of computers, I have tried to avoid jargon. However, after many years of dealing with users in other professions and trades it has become clear to me that we are all aware of other people's jargon, though seldom of our own... and that there is no such thing as plain English. Not that I think
As a motor accessory retailer we first considered the idea of using a computer to control our stock two years ago. This was because we had approximately three thousand different lines, many of which were valued at one-off purchases. We thought that if we introduced the computer whilst having only the one outlet, by the time we expanded the system it would be streamlined.

Our stock control system was rather irregular in that it required each item to be noted down at the point of sale. Needless to say, we didn’t always have time to make a note of the item sold thus the item would be permanently out of stock. With stock such as oil filters it required two or three hours work to total up actual quantities against an ideal stock level book, the differences being the order for the following day. Stock orders were done in a way too unwieldy! We thought that by using a computer we could cut out a great deal of this type of laborious work.

The original concept was to code all the stock. At the point of sale the assistant would key into the cash register the item code and the price. Then when a stock order was needed the item code and price would be automatically recorded on the audit roll. The computer would then analyse the information and produce an order sheet for each supplier. These could then be despatched by post or taken to the cash and carry. As goods were received they would be entered into the computer to keep quantities in stock up to date. At the same time the cost price of the goods would be keyed in if different from that held in the record. The computer would automatically calculate the new retail and trade price, producing a list of all such amendments. Meanwhile stocks would be sold at the last price until the amended sheet was inputted.

With these ideas in mind we purchased a TRS-80 Level I. We were told that the Tandy would do everything we wanted it to but that we would have to purchase additional equipment at a further cost of approximately one thousand pounds. If we found that the Tandy was incapable of doing what we required we could return it up to a period of three months. We were lead to believe that by using the instruction manual we would be able to program the computer ourselves within the same period.

"...when tested, the program failed to work."

Eight weeks later we were still only half way through the manual when we realised that we wouldn’t be able to write the program ourselves. Hence we contacted a chap who wanted to write programs for the Tandy machine.

He had not yet bought his own computer so we purchased the rest of the equipment, costing approximately three thousand pounds.

After several weeks the programmer said that he had finished but, when tested, the program failed to work. After repeated attempts to correct the faults and many weeks later we were still no nearer to having the system installed. We took a copy to Tandy to ask them if it would work. They said yes and were trying to correct the faults further errors were being created and that it would be best for us if we found someone who was more familiar with the TRS-80.

We then contacted a software house which dealt specifically with the Tandy but they were unable to help us as they were busy for several months. They put us in touch with a gentleman who agreed to write the program for us with a few modifications. Instead of using a conventional cash register and then having the information manually into the computer from the audit roll, he suggested we use the computer in the first instance. Thus the information would be stored on a disk until run against the main program which would analyse the data and clear the disk at the same time.

He then wrote a program which kept track of sales. Each sale would be registered under an operator key, a V.A.T. category, and whether it was a cash or cheque sale. Refunds were to be dealt with in the same way but amount would be deducted from the corresponding V.A.T. category. The program allowed us to keep records of deposits, surcharges and monies paid out of the cash register. At the end of the day an X total or Z total could be used to cash up and the system would be ready for the next day. The disk would store all the information so, when fed through the master program, would produce stock orders etc. This first part of the system worked very well.

We found after an extensive period of use that the staff were unhappy with the system. The main reason for this was that the computer was not fast enough for them, much faster than the operator could key it in. Speed is essential when serving customers especially on our busiest days when customers are in a hurry to get away. We imagined that they were having to concentrate on what they were keying into the computer than on the parts they were supplying. Instead of speeding up the process at the point of sale the computer was causing confusion. This was especially noticeable when a deposit or surcharge was being taken as it required details to be keyed in as opposed to a cash register. It was also difficult to prevent having to write out the details on paper and then register it in the till as we had previously been completely satisfied. Basically, after modifying our procedures it made them overly complicated. This, combined with a cash flow problem, decided us on selling what we considered to be our only expendable asset. Now all experimentation with computers has ceased we cannot say whether or not the system as a whole would have worked being as we never had chance to test the stock control side of the system. We have, however, come to the conclusion that using the computer in the manner as described above is far too complicated for our needs and that the experimentation with computers had been an invaluable asset. Now all electronic equipment is cut down to its bare essentials.

Part of the reason is that I’m not really all that ignorant about cars — I see them going past me every day, I’ve driven thousands of miles in them, and I’m bombarded with advertisements and press and TV articles concerning their various parts. One final answer is that I know how to use a car.

I’ve had more lessons than I care to count, and learnt from my husband’s criticisms of my own driving. My performance. The final part of the answer is that cars all perform the same function (i.e., they get you from one place to another) the only difference being the speed at which they get you there, the amount of luggage they permit you to take with you, the likelihood of your breaking down en route. . . or the envy others have when they see you in it. When you buy a car, you are only really choosing between the attributes of the various models. The same applies to
almost every gadget you ever buy – they all have fixed functions. A computer, on the other hand, offers a totally new experience in that you are also able to use the functions that it is to perform.

So the first difficulty that confronts the potential user is that of defining exactly the function(s) the micro is to perform. In the case of the garage owner communicating these requirements to the salesman who supplies the hardware (the machinery), or the programmer who writes the software (the machine's instructions). Already therefore we have two distinct stages in the system analysis – deciding what is to be done, and specifying it in a way that others can follow.

Was Mr Bloggs deliberately misled by the salesman into believing that he would be able to write his own programs after studying the manuals, or was he over-confident of his abilities and under-appreciative of the problems that lie ahead? Just as there are people who regularly spend time doing their own car servicing, so there are also people, most of us lack the skill or experience or time or interest and simply take our cars to the garage. We pay more, and are never quite sure how well the work has been done, but we learn to live with the situation.

It's a useful analogy, for the level of skill required to get a micro to perform a specific function is broadly comparable to that required for servicing a car. Some car jobs are more complex than others as are some programs. A person lacking in experience can only find and correct errors in the program; he's trying to solve simple or complex problems. He'll know it's complex when he fails to solve it! Had the programs Mr Bloggs required turned out to be simple ones, he might well have succeeded in programming them himself, as he might also have done if he had had the time and interest to play around with the machine before getting down to business.

There are plenty of horror stories about 'cowboys' in the motor trade, and micro programming must also have its share. But the best programmer in the world will still be unable to present the customer with a useful application. But the best programmer in the world will still be unable to present the customer with a useful application. The average user has no real idea what is involved in systems analysis.

It's conventional to start teaching the subject of systems analysis with an overview of the various stages in the implementation of a computer system – feasibility study, analysis, design, purchase of equipment, programming, testing, changeover and maintenance. This is basically the path the series will be following. The general approach remains the same whether you are dealing with a PET or an IBM 370. The differences lie in the relative complexity caused by the number of jobs and people involved (and the communication problem that may ensue) and the degree of specialisation called for. Systems analysis on a micro is likely to be much less formal than on a main-frame and so, perhaps, much more fun.

I would like to complete this introduction by covering one of the stages in an implementation which is frequently skipped over by teachers and practitioners alike – the stage of reference'. A large company with its own DP department will be quite careful, when setting up major projects, to spend in advance on analysing what jobs should be computerised, and how much they are willing to spend. Unfortunately, as Mr Bloggs found out, it's easy to approach a problem with a strong idea that 'it ought to be computerised' without really knowing what 'it is', or how much money is available.

To illustrate, another true story, or at least the gist of it, as told to me by the first concern's chief computer engineer, I'll call it Smiths, had just been taken over by a larger firm who were very enthusiastic about computers. They saw that Smiths' books were in a bit of a muddle, and decided that the remedy would be a particular ledger posting package; Smiths' only book-keeper was therefore sent on a training course. As a consequence, the person responsible in an analyst to help them through the changeover. The analyst observed the piles of unposted bills etc., but refrained from commenting. He asked the supervisor to show him how each type of bill/payment was processed from the time it was received. The system seemed to be thorough and well thought out, and he was puzzled as to why it failed to work in practice. They had a standard NCR accounting machine which was slow and noisy, but quite adequate for the volumes being dealt with. It was only when he tried to see that actual posting process that he got a clue as to the real problem. The book-keeper was away on the course and no-one else knew how to work the machine. It turned out that she also doubled as relief telephonist and general dog and body, and often had to leave the posting on one side where it inevitably got out of a muddle. The supervisor, and everyone else in the office, knew that this was the problem – but no-one had felt brave enough to point this out to the boss, let alone to the firm who had taken them over.

So there was the answer. They didn't need a swish new microcomputer system; they needed a book-keeper who was allowed to concentrate on keeping the books! Unfortunately, there was nothing the analyst could do about it. The decision to buy the new system had been made before he was even called in. His terms of reference had been to help Smiths change over to the new system, and this he went on to do to the best of his ability. Of course if the bills were still left lying on the NCR machine the operator had to jump up and man the switchboard, then they wouldn't get posted to the micro any more than they would have been to the NCR machine, and all that money and effort would appear to have been wasted. The analyst had been given the wrong terms of reference.

Goto page 124
### Documentation
- ALJ001A: APPLE II REFERENCE MANUAL
  - Price: 11.00
- ALJ001B: APPLE II BASIC TUTORIAL MANUAL
  - Price: 6.00
- ALJ001C: DISC DRIVE WITHOUT CONTROLLER
  - Price: 32.40
- ALJ2009: MICROSOFT ACCESSORIES
  - Price: 148.00

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**Touchy technology**

I know that mainframe computer installations are always air-conditioned. Would this also benefit my micro? Are there any other similar special conditions that are desirable for microcomputers?

K McGregor, Dundee.

Your question reminds me of the (true) story of one of the smaller mini-computers. Being aware of the air-conditioning of all your company’s computer rooms, the manufacturer was asked if its machine needed any special conditions or surroundings.

"Just a normal office environment" was the answer. Came the day that the Installation Engineer arrived to size up the computer’s future location, prior to delivery. "You can’t run these things here!" he said, "With a South aspect."

"And where’s the air-conditioning?"

When they thrust the bit about "just a normal office environment" in front of him, he said: "but you must realise that we are an American Company!"

A happy ending, for it turned out that the air-conditioning was only partly for temperature control, it’s other main function was to hold down dust levels. The machine was put in a room on the other side of the building — with a North aspect — the carpet was removed and all was well.

Now all this has two lessons for us microcomputer users.

Firstly, that precise temperature control is not vital. What is important is to make sure that all the parts of the system are at the same temperature before use; that not only means not placing a fan heater at the keyboard and expecting it to warm through instantly, it also includes all other parts of the system — tapes, disks, etc. Preferably, they should all have been in place for at least half an hour before use… longer if possible.

The other thing about temperature is the need to stop parts of the system suffering from their own manufacture defects. Heat, if the unit incorporates a cooling fan you should have no trouble (except during heat-waves!) if it does not, then over-heating — especially during long sessions — may account for excess errors or 'hangovers'. The answer is to provide some kind of cooling fan yourself.

Why was the carpet taken up? Well, that particular system had hard disks (the removable type), and these are very sensitive to dust. Floppy disks are not so affected, while tape will probably be quite happy in the average home environment. Also, carpet may well be worry about electricity and that's something which will cause serious problems if it gets near any sensitive equipment. One solution is to have a special 'anti-static' mat by the machine. Another is to have an air purifier or other electrical 'earth' by your computer (don't use the earth pin of a plug), that touches this as you come up to your machine, and most static problems will be rectified.

Probably the biggest environmental problem with microcomputers is interference with electricity. This takes two common forms.

Firstly, there can be voltage fluctuations, not only due to variations in the supply voltage (these are usually small, and slow to change), but also because some fairly large unit on the same circuit has just switched itself on or off. These are also often caused by equipment being turned on, or more often, off. Fluorescent lamps are one of the main sources. Not only can this kind of interference make the mains lead noisy, it can also travel short distances through the air — as a static charge. Build up your equipment away from sources of 'spikes', and fit 'noises' or 'spikes' into the mains lead. Over long distances through the air — as a static charge. Build up your equipment away from sources of 'spikes', and fit 'noises' or 'spikes' into the mains lead. Over long distances through the air — as a static charge.

Secondly, the power supply units in the power lead if you are still troubled by them. Differing microcomputers are detectable to varying extents, depending on the amount of built-in mains filtering they have. Overhauling all your tapes and disks well away out of the way of magnetic fields will help, as will using a built-in mains filtering they have. Overhauling all your tapes and disks well away out of the way of magnetic fields will help, as will using a built-in mains filtering they have.
weights!). But give one to the right person, and it will be kept really busy. Just think through some of the fairly recent questions that have been answered in this column: an application in timing orienteering contests, keeping track of the competitors in pony trials, 'number crunching' for scientific work, and word processing, as well as the more usual book-keeping, invoicing, and stock control. Perhaps too, the best solution would be the Post Office postcode system. It's come in for a lot of stick over the years, but it's bound to succeed in an age of computing sorting. It has numerous advantages for large and small businesses, and from what I can see it has few, if any, disadvantages. Here are some advantages:

1. Every address in the UK is postcode, and all addresses are quickly added. Sets of directories are given free to businesses and reference is therefore easy.
2. Postcode boundaries are based on ease of access and distribution, rather than by other more arbitrary means.
3. Different sized reference units are available, from small areas right down to a few addresses.

4. It's meaningful to other organisations, and two-way exchange is made easier between them using the postcode system.
5. Space is at a premium in computers and postcodes are compact. They are quicker and more precise than most existing references and can be used as a key to generate full addresses.
6. As the system already exists you are saving the cost of devising your own in-house alternative.

The postcode system is being used by such large companies as Schweppes Ltd and Cadbury Typhoo Ltd. The Post Office offers many services, booklets and maps — they also offer micro-fiche and magnetic tape filing for a lot of stick over the years, but it's bound to succeed in an age of computing sorting. It has numerous advantages for large and small businesses, and from what I can see it has few, if any, disadvantages. Here are some advantages:

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for example the code MK42 9WA is broken down as follows: MK refers to one of 120 post-code areas (Milton Keynes in this case) MK42 is also divided by carefully chosen units called districts (there are 2700 districts); each district is divided into smaller areas (MK42 9) called sectors — there are 8900 sectors of the complete postcode pinpoints or part of a street, or in some cases a whole company. The Z80 does not. That is the point.

I've referenced a good deal of this information from the booklet Using Postcodes in Business Systems. This and further details can be obtained from Cledwyn Davies or Kathy Buckley, Postcode Marketing Section, Postal Headquarters, St Martin's-le-Grand, London EC1A 1HQ Tel: 01-432 1620.

**Into the unknown**

With regard to the Sinclair ZX80 and the Acorn Atom: (1) Would it be possible for a user to construct an interface for the ZX80 that's currently on the market? Which printers would be suitable?

(2) What is the significance of the statement that the Acorn Atom is much more powerful than the Z80? This consists of a 6522 and a pair of LS244 buffers? Which printers would be suitable?

(3) Would the fact that the ZX80 has a Z80 type CPU make interfacing a range of computers using 6502s and those using Z80s in speed of that order is significant to the typical amateur user?

On your third question once again the answer really hinges around 'who is the user'. If you are only working in Basic (or some other high-level language) then there is really no noticeable difference in principle. But between machines using 6502s and those using Z80s. In fact, other things, such as the particular implementation of Basic used with your machine, will cause the most marked differences. The one that might show up is in machine code, or assembler language programming. Even then, while the Z80 has a more powerful instruction set, there are those programmers who prefer to work with 6800 assembler language. So, to sum up, the type of microprocessor used is unlikely to be significant in choosing between the Acorn Atom and the ZX80.

**Routine suggestion**

Can you suggest a routine for calculating the number of days between two given dates, either in the same year, or more cleverly, between different years?

N Parlett, Bridport

The following program works, but you have previously validated the dates; so, provided they are legal, this will work for any two dates between 1/3/1901 and 28/2/2400. (Can you see why it won't work outside this range?)

The year should be input in full. Some versions of Basic support the logical 'true' as a -1, some as 1. If you try PRINT 23 in direct mode and get -1 printed, use the bottom symbols; if you get 1 then use the top ones.

**PETdisplay link**

We have an 8k and a 32k PET and would like to link one of them to a large television set for classroom display. Can you please tell me what equipment is needed and how the connection is made.

G Cattanch, Tyne and Wear.

It's easy to attach an extra screen to the PET and I'm sure that your physics department will be able to make up the following circuit.

The following program works, but you have previously validated the dates; so, provided they are legal, this will work for any two dates between 1/3/1901 and 28/2/2400. (Can you see why it won't work outside this range?)

The year should be input in full. Some versions of Basic support the logical 'true' as a -1, some as 1. If you try PRINT 23 in direct mode and get -1 printed, use the bottom symbols; if you get 1 then use the top ones.

**Program puzzle**

I've seen expressions like X=A AND 127 in programs and I can't work out what they mean. Can you help?

H Elliott, London.

You will need to know a little about binary and machine code to actually understand their purpose rather than just what it is they do. Essentially the statement above chops off the left-most bit of an 8-bit byte. The operators AND, OR and NOT are called logical operators. If 0 represents 'false' and 1 (on some Basics -1) represents 'true' then here is a table for the most commonly used operators:

<table>
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<th>A</th>
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There are others like NAND, NOR and IMP, but not many Basics support these. So, to answer your question; 127 in 8-bit binary is 01111111 and, if A has the value 10001111, then X=00001111.

The expression you gave could be replaced by IF A>127 THEN A=A-128. You can try PRINT 143 AND 127 in the direct mode. Be warned, however, some Basics do not support logical operators in arithmetic expressions.

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In a letter printed in the May issue of PCW readers were asked to submit Z80 general purpose routines to defined standards - for critical scrutiny and comparison with work done by others. The aim was to finish up with a valuable set of top quality routines that anyone could use. Several people said they liked the idea, even more important, some actually wrote in with suggestions. So the idea still lives and Alan Toothill tells how it has been shaped and where it moves on from here.

8080 Compatibility

There was quite some support for forcing Z80 routines to be compatible with the 8080 and 8085 processors. No IX and IY registers! No relative jumps! No alternate register set! No block moves! Let's just collect the best routines the Z80 can execute, they said, and if they happen to be 8080 compatible, simply mention the fact in the documentation. Your Z80 routines may be changed and offered separately that can be made compatible with the 8080, by changing a few instructions, may be changed and offered separately as 8080 datasheets.

Passing parameters

The original rules suggested that registers HL, DE, IX and IY be used as parameters. Wilson: I liked the idea, especially when the called routine was resumed. Using the stack as a way of passing parameters, I liked this one, adapted from the method used by PL/M, sent over from Holland by Ian Wilson:

- A single parameter is passed in BC (word) or C (byte).
- Two parameters are passed in BC (first) and DE (second) or C and E for bytes.
- A single result is returned in HL (word) or A (byte).
- Where a result may or may not be returned, the carry flag may be used as a status indicator.
- If more than two input parameters are passed, these are pushed onto the stack.

On balance, it's best to have no rules about passing parameters but rather to ensure that the documentation clearly shows what is done about this. Those with a system of their own can then adapt the routines to conform to their own standards.

Ian Wilson is against parameters embedded in the main program, following the CALL. Since he does show how we can access them, I quote him again:

Accessing these parameters is messy and inefficient with the 8080 architecture, especially when the called routine has no 'free' registers. The best I can do is something like this:

UGH: EX (SP),HL ; save HL & get
    ; argument list
    ; address in HL
PUSH HL ; save that, too
INC HL ; point HL past...
INC HL ; end of arguments

EX (SP),HL ; return address
onto stack
arg list address to
HL

EXIT: POP HL

PUSH HL ; return address
HL
RET

You must admit that the extra coding needed in the routine is a bit much for the average byte-miser to stomach. The suggestion that the stack be used as a way of passing parameters following the CALL can be easy to use. Those who rate ease of use higher than memory space will stick with them.

Routines with or without parameters after the CALL will be accepted. If the system you don't like is presented, you can have fun converting it to the other.

Local RAM

The suggestion that the stack be used for any local RAM needed was not so well received.

Before we consider this, here is an important point about its use, put by R. J. Chance of Birmingham University:

If the stack pointer does not delimit the used RAM area, data could be overwritten by interrupt return addresses etc. Thus:

PUSH HL
LD HL, -2
ADD HL, SP ;(HL), (HL+1) - SCATCH

is not allowed.

The system might go:

PUSH HL
LD HL, -2
ADD HL, SP
LD SP, HL ;(HL). (HL+1) - SCATCH
; rest of
; subroutine
LD HL, 2
ADD HL, SP
LD SP, HL
POP HL
RET

This clearly illustrates the penalty, in extra bytes of code, for having this system of allocating RAM only as needed and releasing it when it's no longer required. The penalty might seem excessive if only small areas of work space have to be provided.

An alternative is to dedicate to the routine an area in RAM not accessible by any other code. This might well take less RAM than the extra code (ROM?) needed to handle the stack; however, these dedicated areas would need careful mapping or labelling.

Re-entrant code

Having an area of RAM reserved exclusively for a particular routine wouldn't do if the routine were to be interrupted by some other code that called the same routine. In this case, the second time the routine was called it would also use the reserved RAM area and corrupt it for when execution of the original routine was resumed. Using the stack as local RAM avoids this problem.

Many of you might not be at the stage yet of switching control between programs running, in different time slots, over the same period. But some are doing this now and everyone is likely to want to do this some time in the future. So general purpose routines should allow for re-entrant code where possible.

Relocatable code

How much we want code that will function in any location without re-assembly, depends on whether or not we have an assembler.

With an assembler that requires a displacement with a relative jump, there's a case for absolute jumps. They are less error prone and the labels they use are unaffected by the deletion and insertion of code.

Even so, there's something very satisfying about code that functions regardless of where it's placed and, because it fits everybody's circumstances, must be preferred for general purpose routines.

New recommendations

Having been fairly taken to task for trying to impose rigid rules, we've now chosen to have two classes of routine, the class to be declared in the documentation.

Class 1 routines will be re-entrant, relocatable and will not be self-modifying.

The recommendations for these have been put most succinctly by R J
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78 PCW
The purpose of such recommendations is to enable programmers to use package subroutines "blind" or modify with least trouble for their own purposes. How about:

a) Promable code:
Routine should not alter their own op-codes.

b) Re-entrant code:
No explicit RAM addresses — supply data following subroutine call or in registers — use stack as scratch pad.

c) Blind use:
Save and restore registers not used for data transfer.

d) Interruption:
Addresses below the stack pointer (SP) must be unused. Do not use alternate register set.

e) Position independent code:
No absolute jumps or calls except to general routine area.

All "rules" are breakable with justification, understanding and documentation. For example, routines that don't use the alternate register set may not be interruptable through time restrictions and may be degraded without the alternate register set.

The question of relative calls on the Z80 will be dealt with next month.

Routines not conforming to these recommendations will be in Class 2. They can either be incorporated with care into one's own system or after conversion into Class 1 routines.

Locating the routines
We can't give addresses for the general purpose routines, as different users will have already committed different areas of memory for various purposes.

It's worth adopting the suggestion of one reader that other routines in the library may be called by their labels in the mnemonic listing and the memory address in the machine code will be represented by the dummy symbols 'YY YY'. Should it be necessary (against standard practice) to make an absolute jump or call within the current routine, the address in the machine code listing will be represented by the symbols 'YY YY'.

Time critical routines
It was thought that time critical routines, such as DL1S given as an example in May, should be declared as such and documented down to the T states per instruction. There's now a section, inserted after the name in the second part of the documentation, to declare whether or not the routine is time critical.

DL1S was also criticised, by more than one reader, for not defining the number of repetitions of the loop, at the head of the listing:

Section 11 gives any I/O interfaces, peripherals or local RAM areas needed. Section 12 states whether or not the machine code is 8080 compatible.

3. The third part is a complete listing of the routine, with assembler mnemonics, comments (including T states if applicable) and machine code.

---

Revised documentation

1. The first part of the documentation, marked `; /', contains a header name of the routine.

2. The second part, marked `; /', contains a brief description, from which the routine could be used in a system, without necessarily understanding the code:

Section 1 gives the name, level and class of the routine. Routines that call no other routine are level 0; others are level 1. Routines that follow the recommendations are class 1; others are class 2. Section 2 declares whether or not the routine is time critical.

Section 3 gives a brief description. Section 4 gives the main actions carried out by the routine.

Section 5 specifies flags, registers, parameters, stack or other areas assumed to have meaningful values when the routine is called.

Section 6 specifies flags, registers and other areas containing results when the routine returns.

Section 7 gives the registers disturbed by use of the routine.

Section 8 gives the maximum number of bytes that could be added to the stack.

This includes growth from the routine calling other routines but excludes the two bytes used by the main program call for its return address.

Section 9 gives the memory size of the routine.

Section 10 lists any monitor or general purpose routines on which the routine depends.

Section 11 gives any I/O interfaces, peripherals or local RAM areas needed. Section 12 states whether or not the machine code is 8080 compatible.

---

Datasheet

Roger Hargrave of Crawley sent this routine. He uses it to convert validated ASCII digits (from where he has entered them in video RAM) to a packed BCD field for processing elsewhere in RAM.

I would like to see in how few bytes readers can write a conversion routine, BFSN, which will convert a packed BCD field (and leave it unchanged) to an ASCII field with leading zeroes, but not the least significant of an all zero field, suppressed.

---

PCW '79
Getting down to Basics

Basic is a two-edged weapon. Its well-honed educational edge may slice through the 'mysteries' of software, but its jagged other-side could seriously wound some users relying on it to solve their business problems.

There are many experienced computing professionals who feel that the time cannot come quickly enough when Basic is at last relegated to a footnote in history—a bright comet which illuminated the world for a generation but whose jagged other-side could reveal the 'mysteries' of software, but Basic is a two-edged weapon.

Getting down to Basics

Level Languages for Microprocessors

The book's authors, David Taylor and Lyndon Morgan, don't themselves make a full-frontal assault on Basic, although they clearly point out its limitations. The most direct criticism comes in an Appendix written by R. J. Griggs of Software Architects Ltd (SAL) which explains why Cobol is preferred to Basic for an accounting package that was being developed.

Cobol was preferred on virtually every factor evaluated—efficiency of program execution and memory usage, reliability, flexibility, portability and data handling. Even when looking at the speed of implementation—one of Basic's strong points—SAL concluded that, in practice, "there is no difference in development effort (between Basic and Cobol) given a competent programmer in either language." As Griggs points out, program design and structure should involve about 60% of total development effort; therefore Basic's efficient interactive programming feature is outweighed by other considerations, particularly as interactive Cobol compilers, such as Microfocus' C8 Cobol, are now available on micros.

For the Zilog MCZ systems being used by SAL, it was found that the available Basic interpreter was twice as large as the Cobol one and that, on execution, Cobol code proved to be three times as fast as Basic. On memory optimisation, Griggs comments, "Basic allows little or no programmer control over how much memory variable data will occupy. Cobol, on the other hand, has quite extensive facilities to describe both size and format of memory storage locations. Furthermore, Cobol provides control over memory into which data received from peripheral devices will be stored. Again Basic is sadly lacking in this respect: other reasons we found that the intermediate code produced by Basic was less compact than Cobol." Further comments from Griggs could stand as an all-round attack:

"Cobol is certainly more self-documenting (than Basic) and lends itself to clear, orderly structures (which) are a considerable guarantee to a correct functioning system..."

Basic proved incapable of providing the type of flexibility needed to create a system which could run in various modules with various extensions being added as required..."

"Basic suffers from a lack of any accepted industry standard and rewriting source code may be the price of adopting a new machine..."

"In short, there is no doubt that Cobol provides by far the most comprehensive facilities for data management (compared to Basic)..."

"With reviews like this, even the most optimistic enthusiast would have difficulty in claiming that "Basic will run and run..." But it will, primarily for those historical reasons which hitched Basic to the personal computing bandwagon..."

In the main body of the book, the authors (Taylor and Morgan) place Basic and Cobol into a wider perspective by examining the general reasons why high level languages should be used on micros, the criteria that can be used to judge a 'good' program and the factors that should be taken into account when choosing a language for a particular application.

On Basic, they comment, "Basic is an enigma. Anyone approaching a microcomputer must know Basic because it is so universal. However, they must be aware of its limitations and the variety of implementations." They confirm Griggs' comments to its lack of standardisation and portability and its unsuitability for use in a structured approach to program design are serious drawbacks.

Taylor and Morgan's comments on Basic come in one of the most valuable parts of the book, a summary of the attributes of 17 high level languages available on micros. They are each considered under a similar set of headings such as history and background, implementation in together with a summary of the main features. Although there is too much variation in the depth of information and analysis given to different languages, these succinct descriptions are useful for gaining an insight into the qualities and disadvantages of each language.

A minor irritation, however, is the strange way in which the languages are ordered, which makes quick reference troublesome. I can detect little logic behind arranging the language summaries in the sequence: Ada, PL/0, Pascal, PL/I/SYS/SD, PLM, PML, Coral 66, RTL/2, Fortran, Basic, Cobol, APL, PROLOG, Ada, BCPL, LISP, Pilot and PL/1, particularly as an earlier summary in the book placed them in alphabetical order.

The number of languages included surprised even the authors; they started out imagining that the choice would be limited, given the initial orientation of the microprocessor industry towards low level assembler languages. In order to decide on which languages to include, they conducted a survey of manufacturers towards the end of 1979, which resulted in the 17 included.

Throughout the book, Taylor and Morgan rightly stress that the selection of an appropriate language is not the be-all and end-all of software development. Two chapters focus on the importance of using structured software design methodologies and implementing installation and international software standards in order to produce programs that meet their GRADES criteria, for good programming—Generality, Reliability, Adaptability, Portability, Efficiency and Simplicity.

Although they point out that good programming techniques are independent of any particular language, it's clear that Basic fails on some of the major criteria. Some language purists have also argued as vehemently as the anti-Basic brigade against such popular languages as Cobol—on the grounds that they were cobbled together from ad hoc standards and lack the elegance and coherence of the Algol-based languages which includes Pascal and Ada. Over the last few decades however, sufficient support has been given to Cobol to overcome many of the criticisms. Taylor and Morgan quite rightly separate general language considerations from any particular language and software engineering techniques. To those Basic freaks who are bitten by the Cobol bug, Structured Cobol Programming by Nancy and Robert A Stern, now in its third edition, is a good training guide. It will also be of interest to those computing professionals who are sceptical about Cobol's suitability for structured techniques. The Sterns have written the latest edition by assum-
Understanding roadblocks!

At the recording studio I happened to me on my way to the interview at Broadhust on Radio Wales which we heard about six months ago. "Now, how do these robots differ from the silicon chips?" asked the interviewer. "And game playing applications will be foolish to ignore us for more than educational purposes, do you feel drawn to this type of thorough-going approach to the technology, you might as well take a look at this (for me, boring) example of one school of intro books.

Freeplug

One of Malcolm's many hats is that of Chairman of the British Computer Society's Computers and Employment Group. Using that as an excuse, he's slipped us its annotated bibliography Computers and Employment and asked us to mention it — review it even.

As I have written before in PCW, there are two types of 'Intro to Mini/Micro' books. There are those which begin with binary numbers and other nitty gritty (sic) details — which are suitable for potential computer scientists, perhaps — and there are those which start from the perspective of the user which usually offer a more effective insight into the nature of the technology for the average, non-specialist reader.

Introduction to Microcomputers and Microcomputers by M E Sloan stands firmly in the binary-oriented camp. As such, it contains the technical details of the processor, and moving from binary representations, through flowcharts programming on minis and micros, systems software to data structures, high level languages and so on.

It has almost 500 pages and never stints on going into detail. It's workmanlike in its presentation, without showing any particular communicative flair. But if you feel drawn to this type of thorough-going approach to the technology, you might as well take a look at this (for me, boring) example of one school of intro books.

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*£55 plus VAT + £1.00 P & P
WHO'S KING?

The strongest chess playing program currently on the market is that produced by Dan and Kathe Spracklen. The program is 'Sargon 2.5' or, alternatively, 'Boris 2.5'; they're identical except that Sargon is manufactured by Applied Concepts/Chafitz Modular Game Systems and marketed by Chafitz Inc of Maryland, while Boris is both manufactured and marketed by Applied Concepts. A little disagreement between the two companies has given rise to the two names and at least one lawsuit that’s reputed to involve around 12 megabucks.

Applied Concepts, who have registered 'Boris' as their trademark, use the advertising slogan 'Boris is King', while 'Sargon', for those of you who have forgotten more Assyrian and Babylonian than you ever learned, means 'Declared King'. The original company name, incidentally, is: Sargon I (ca 3000 BC), Sargon II (722–705 BC) and Sargon 2.5 (1979 – ). One more juicy palace intrigue before looking at the program: the Boris programs were made available as a rather tempting offer by Fidelity Electronics (manufacturers of the Chess Challenger range) to commit infanticide and join the forces of the vociferous young pretender to the throne.

Boris 2.5/Sargon 2.5 usually comes in the form of a module for the Applied Concepts/Chafitz Modular Game System. However, there were quite a few other people along the somewhat treacherous path I propose to adopt the following terminology: Sargon for the program and Applied Concepts for the manufacturer/marketer.

The concept of a modular system is basically a good one. The idea is that when the program is improved, you can simply buy a new module rather than a whole new machine. However, it's somewhat doubtful whether any significant increase in playing strength can be effected with 8k of ROM and 1k of RAM. If you increase the amount of RAM you can certainly achieve more.

Sargon is one of the very few machines to have established a significant track record in competitions. Way back in March 1978 an early version won the first ever microcomputer chess tournament in San Jose, California, with a clean score and placed 7th equal in the North American Computer Championship. That same year it also played in a tournament that was basically for humans in the Paul Masson vineyards in California. The program, unaffected by the invidious surroundings, made a plus score and achieved an official rating of 1641 (playing on its level 4).

There is a worldwide rating system for chess players: Here are a few figures to help put Sargon in perspective. The reigning world champions are: Anatoly Karpov (human) 2725, Maya Chiburdanidze (human, female) 2400, Yasser Seirawan (human, junior) 2510, Chess 4.6 (computer) 2100. A rating of 2200 indicates master level. Sargon currently rates about the same as a moderately good club player.

Sargon has seven levels of play, five of which have a reasonable average response time: level 0 (instant response), level 1 (10 seconds), level 2 (20 seconds), level 3 (45 seconds), level 4 (2 minutes). In play it can seem to respond even more quickly because the program, having played its move, continues to analyse a tree based on what it considers to be the most likely reply by the opponent.

Sargon's playing strength vis-a-vis the other good chess machines on the market can be judged from its 10–7 victory over Chess Champion System III (reviewed last month), which in turn defeated the Voice Challenger by 10–7. If you are one of the very few thousand serious chess players in this country, playing regularly in club and tournament competition, then at the moment Sargon may be the only program to offer you stiff enough opposition.

The basic operation of Sargon is easy enough in its game playing mode and setting up a position is also quite straightforward. There is a 'restore' key which enables you to take back up to six ply (three moves for each side), two ply at a time, but you can never restore back to the original position. Thus, if you are anxious to play a particular opening, you have to run through the laborious process of switching the machine off and on, each time waiting while 'Sargon awaits your move' scrolls across the display and hoping all the while to achieve the opening of your choice.

There is one thing about Sargon 2.5 which I hate — the 60-odd (or 60 odd) messages which appear on the display from time to time. They range from the sublime ('woops') to the ridiculous ('are there ladies present?'). Apparently customers are about equally divided in liking or disliking them. However, it seems to me to be simply a waste of about 1k of ROM and an unforgivable mistake on the designer's part that you cannot exclude them, even if you want to.

You can find Sargon in most department stores or mail order firms such as AJD Direct Supplies, 102 Bellegrove Road, Welling, Kent DA16 3QD, whom I have to thank for the loan of my review copy. It will cost you in the region of £270-280. As an alternative, you can get a slightly weaker version of the program, for about £8.90, in the form of Sargon, A Computer Chess Program by Dan and Kathe Spracklen, published by Hayden (UK distributor — Butterworth). Of course, for this version you will need a few other things: some time, a steady typing speed and a system that uses Z80 assembler, (minimum 8k RAM). Preferably your Reset button will be safely mounted at the back of your system, if not then allow lots of time for keying in!

There is also a more expensive ready-made version, with an 'auto response board', which sells at £695. If money means nothing to you, then take a look at it; the craftsmanship of the inlaid wooden board is superb. This version has another great asset: since it has no display (moves are indicated by LEDs inset into the 64 squares) the comments have been excluded and replaced, I am told, by extra openings.

MICRO CHESS

Our resident micro chess expert Kevin O'Connell reports on an interesting chess contest with a difference — it's one that's being fought out in the law courts.

GOTO page 123

Sargon 2.5, showing the board, set (provided), storage space and, on the right-hand side (from top to bottom): plug-in module, display, clip-on keyboard.
Some call it the Jumbo, others refer to the SuperPET, but image-conscious Commodore has christened its 80-column PET the CBM Model 8032. It no doubt feels that PET is a bit of a silly name for a machine so clearly aimed at the business market. This month PET wizard Peter Calver of Supersoft and our own David Tebbutt put the system through its paces and assess its chances of success.

Commodore's long-awaited new computer comes as welcome news to all those who want a PET but feel it's not quite 'grown-up' enough for them. Mainly businessmen, they will find the 80-column screen and full keyboard overcome most of the earlier machine's limitations. Programmers used to the PET will find the new computer a bit annoying at first but they'll soon get over that.

Only one model will be offered — the 8032 with 32k of RAM of which 1k is reserved for system use; the rest is available to the user. As with PET, the Basic interpreter and the monitor are safely tucked away in ROM.

Apart from one or two problems when the machine was delivered (it was 'dead on arrival') it performed well during the review period. The faults were identified as a disconnected video cable and a cramped-through keyboard wire. Our thanks to Cream Microcomputer Shop and Commodore for the swift diagnosis and repair.

Hardware

The 8032 retains many of the features of its illustrious predecessors. The integral 12" 'green screen' monitor is fixed to the main unit which incorporates a standard typewriter keyboard, numeric keypad and half a dozen control keys. With its metal casing it weighs in at around 50 lbs (for the benefit of younger readers, that's about 22 kilograms) and the whole unit fits adequately into the passenger seat of
Technical Data

CPU: 6502
Memory: 32k (31k user) RAM
Keyboard: Full ASCII, numeric pad, full cursor controls
Screen: 25 lines x 80 characters, green, memory mapped
Disk Drive: Twin cassette (8050 offering 950k)
Bus: IEEE-488
Ports: Cassette, memory expansion, parallel
System Software: DOS and Monitor
Languages: Basic

The 8032 comes with Basic 4.0 in ROM. Existings PET owners will be pleased to know that the garbage collection problem is responding to treatment, though it has unpleasant side effects - more erratic, ranging from the sublime to the ridiculous, where numbers stored on disk take up one byte per digit plus one for the decimal point, if any. (In RAM, integers are stored in two bytes while floats use four unless used for floating-point numbers. Unfortunately, there is no easy way of writing data to disk in this form.)

There are two basic methods of inputting data from a disk record: GET$ which fetches one character and INPUT$ which reads until it reaches a carriage return - more than 80 characters in a field will give a 'string too long' error.

The good news for machine code freaks is that the 'TIM' monitor is unchanged; the bad news is that the second cassette buffer is no longer freely available. It appears that 40 bytes at the bottom of the ROM/PROM disk commands, and 20 bytes just below the start of Basic are used for tabs and other, unidentified, purposes. Up to 80 horizontal tabs may be defined, with pressing shift-tab, but the same key combination is also used to clear them, so you must be careful. Unfortunately tabs do not affect a printer and pressing the tab key when past the last line or position takes you to the end of that line, not to the first tab position on the next.

The most exciting new function must be the auto repeat on the cursor movement. INS/DEL and SPACE key and all other keys will repeat when pressed in conjunction with the REPEAT key. Other screen handling functions allow you to insert or delete a line at the current cursor position, or to move the current line up to or from the cursor and even scroll the screen up or down irrespec- tive of the cursor position. Text editing is an obvious application of the new features, but no doubt programmers up and down the country will be franticly searching for others.

The facility that sets the 8032 apart from many other micros is its ability to restrict scrolling and all other screen functions to a rectangular 'window', the size and position of which is set by the user. Four locations in page zero are taken. Given that the 8000 series is at home with the commands.

An interesting feature of the CBM range is that only the most rudimentary disk handling is carried out by the main processor. Most of the work is carried out by another 6502 housed in the disk unit, and therefore many functions such as writing to 8032's provisioned for time.

The disk unit tested was fitted with DOS 2.1 ROMs which are free of most of the bugs which plagued earlier versions. However, the use of DLOAD to chain from one program to a larger one results in the second program being corrupted although this would prove a slight problem for those writing large systems. Although CBM's relative (le random) file handing is somewhat esoteric, after a few hours we felt quite at home with the commands.

Data storage efficiency is somewhat erratic, ranging from the sublime, in which records are allowed to cross physical sector boundaries, to the ridiculous, where numbers stored on disk take up one byte per digit plus one for the decimal point, if any. (In RAM, integers are stored in two bytes while floats use four unless used for floating-point numbers. Unfortunately, there is no easy way of writing data to disk in this form.) There are two basic methods of inputting data from a disk record: GET$ which fetches one character and INPUT$ which reads until it reaches a carriage return - more than 80 characters in a field will give a 'string too long' error.

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VDA Each additional user ........................................... £500
GR1 Prestel graphic tablet ........................................... £800

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CD1 S100 Colour vdu card, memory mapped, PAL or UHF  £295
CD2 S100 Colour vdu card, memory mapped, RGB ........... £310
PR1 S100 Prestel Display Card, PAL or UHF ................... £295
PR2 S100 Prestel Display Card, RGB ........................... £310

UK CUSTOMERS PLEASE ADD 15% VAT
different and definite command; that’s something that should help to minimise accidental loss of programs. Dotted throughout the 7120 are little attentions to detail like this and while some grate a bit, many others are well worth while.

**Documentation**

In a word – poor - but BASF is rewriting it and the new issues should be out soon. I don’t know quite how it got as bad as it has for essentially it lacks any structure whatsoever and flits from talking about the BOS to Basic to machine code routines willy-nilly. I suspect that it may have originated from the US as I have yet to see any consistently good documentation from over there that can be read through and understood in one go – in fairness I’d very much like to see the documentation from over there that can be read through and understood in one go -

Potential users

Clearly, the 7120 has been designed with the business market in mind and in particular those areas where communication to other computers etc is important. Applications software is rather scarce at the moment but BASF is building up a library of suitable programs that will be circulated among its dealers.

The poor accuracy of the MATHLIB package, lack of multi-dimensional arrays, and the apparent lack of facilities for connecting up scientific paraphernalia directly to the bus would seem to rule the 7120 out from this area. Likewise, its high price may exclusively exclude it from all but the richest educational establishments.

**Conclusion**

The 7120 is an extremely well integrated system that possesses many extensive extra facilities built-in. It has definitely been designed to be used in conjunction with other computers via its comprehensive communications and multi-tasking routines and I regret to say that I’ve only had the time to scratch at the surface of all the possibilities; I’ve probably left out many features that others might consider to be more important than the ones that I’ve chosen to mention. There are some other systems around that possess some similar facilities — although not necessarily all that the 7120 offers. These systems tend to compare more favourably on cost... I feel the price of the 7120 is a shade high, even with all its facilities. To some, the current storage capacity may not be enough — particularly as right now further expansion is limited. However, when the fixed disk is added next year, these problems will disappear, although that’ll possibly leave behind the question of ease of back up with the remaining floppy drive.

The catalog is poor, as is the documentation, but steps are in hand to improve the latter. The maths handling — particularly the trig functions — are slow and don’t always reflect the system’s intended precision (although in practical terms this is of little consequence for most application programs). Again, BASF is aware of this and is taking steps to remedy it.

Once the user has got used to the SOM/EOM operation the on-screen editing leaps out at you and is a joy to use. So too is the machine in general, it’s very user friendly once you’ve got used to some of its little quirks. The system utilities are generally very good although their ease of operation could be improved and the very minor bugs that I found ought to be removed. The 7120 wins hands down on the sheer versatility and number of facilities offered — albeit at a high price. It was a brave move of BASF to avoid the S100 CP/M bandwagon and, providing enough application software comes along, then this decision should prove to be the right one.

**Acknowledgement**

My thanks to go Paul Raggett and Gordon Hughes of BASF for patiently answering my many questions.

**At a glance**

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</table>

| **excellent** |       |       |       |       |
| **** v. good  |       |       |       |       |
| **good**      |       |       |       |       |
| **fair**      |       |       |       |       |
| * poor        |       |       |       |       |

NOTE: System Z80 can not access any of the disk Z80 memory

Figure 2 BASF 7120 Memory Map

PCW 87
Dialogue styles fall into two very broad categories, free-format and formatted (or structured).

We will consider the latter next month and in this article I shall concentrate on free-format interactions between user and system. Most commercial dialogues tend to be highly structured, using formatted screens for data-entry, multi-choice menus, query-by-example and so on. The general view seems to be that the structured approach increases the ease with which the dialogue can be learned and used in practice.

There are no clear definitions which could help us to differentiate between the two categories; the boundary is very fuzzy. But essentially ‘free-format’ dialogues are those relatively free of syntax and formatting rules. The use of the word ‘relatively’ is important — nothing can be entirely free of restrictions. Perhaps the key concept is concerned with providing the maximum amount of flexibility in the way in which data can be presented by the user to the system (and vice versa). This contrasts with the structured approach which aims at restricting possibilities.

So different dialogue styles offer users varying degrees of freedom. To appreciate this is important; a dialogue has to be designed to offer its most likely users the level of flexibility with which they feel most comfortable. To provide a user with too many possibilities can be as disconcerting for him as which they feel most comfortable. To provide a user with too many possibilities can be as disconcerting for him as he is making use of a special-purpose system (and vice versa). This contrasts with the structured approach to the system (and vice versa). This means that data can be presented by the user to the system (and vice versa).

What are the various elements we need to consider in designing a free-format dialogue? These are shown schematically in Figure 2. Each is discussed individually below.

**Delimiters**

Because free-format input messages are entered as a character string, some convention needs to be employed in order to mark the beginning of one item (or field) and the end of the previous one. In many dialogues, a space may be employed for this purpose but this will obviously be ambiguous when text is being entered. Popular characters for use as delimiters are:

- hyphen
- colon
- oblique stroke
- left and right brackets
- equals
- point
- comma
- and so on.

A number of factors condition the choice of delimiters:
- avoidance of ambiguity
- ease of location on the keyboard
- special usage (e.g. the comma used to separate items entered to a Basic INPUT statement).

In many cases, a delimiter can be implied. For example, the 15th August 1980 may be entered as:

```
15.8.80
```

using the point as a delimiter or as

```
15 AUG80
```

using the changes from numeric to alphabetic and back again to differentiate the various sub-items. In some cases, a choice delimiter (e.g. ‘,’ ‘/’ or ‘.’ in dates) might serve to make the dialogue more user-friendly.

**Items**

The items which the delimiters frame may be employed for a number of purposes according to the function of the dialogue. Items usually contain:
- commands
- command parameters or, more usually,
- data.

Some examples will serve to illustrate this:

```
PIP:PROG1.BAS=A:PROG2.BAS
```

This is a CP/M PIP utility input line which means “Copy the Basic program file called PROG2 on diskette drive A to diskette drive B and rename it as PROG1.” A space delimits the PIP activation command from the rest of the text. Colon (:) prevents the drive designators from being confused with the file names and the point (.) separates the file type subscript from the name. The equals sign (=) is more of a parameter than a delimiter and is best remembered as having the same functional meaning as in a Basic program.

Another interesting feature in this context is that the parameters at each side of the equals sign have positional significance; they will not do the same thing if they were the other way around (quite the opposite!) If it is thought that the positional significance could be a problem, a solution could be the use of ‘keywords’.

For example,

```
PIP FROM=FILE2 TO=FILE1
```

would mean the same as
The use of keywords obviously requires more key depressions (and you have to remember the words) but where a large number of items have to be entered and only a small number are in practice, then the technique might prove to be more economic and reliable in practice. It is also a relatively simple matter to write programs for such formats (especially if the Basic interpreter has an INSTR function).

Free format dialogues can be very economical for simple data entry. For example, to add a new book to a library catalogue file one might type:

```
0-87626-345-7/GILB & WEINBERG/ HUMANISED INPUT/WINTHROP/ 1978
```

In this case, the only 'overhead' characters are the ' / ' delimiters and no coding is employed at all. Another possibility is to type:

```
ADD NEW BOOK TO CATALOGUE. ISBN IS 0-87626-345-7, AUTHORS ARE GILB & WEINBERG, TITLE IS HUMANISED INPUT, PUBLISHER IS WINTHROP, YEAR OF PUBLICATION IS 1978.
```

This is an example of a natural language dialogue all of which are 'free format'. Many system designers set out with the good intention of making their dialogues as much like English (or French, Dutch, etc.) as possible. This however is much easier said than done; the programming problems alone are enormous. I shall therefore devote a special article to this subject.

A programming technique called 'Finite State Automata' is very appropriate to handling free-format input data and I will write a special article on that topic. In the meantime, here is a checklist of points to keep in mind when designing free-format dialogues:

1. Choose delimiters which are easy to locate on the keyboard (i.e. not in upper case).
2. Avoid possible conflicts in the choice of delimiters.
3. If there are any length limits on items, use prompts of some kind to guide the user.
4. Place optional and/or least used items at the end of the message (so they can be 'dropped off')
5. If the total number of items in an input message is low, use a key word technique or split into a selection of shortened messages.
6. Avoid formats which require awkward keying sequences for non-typists; try typical messages before finalisation.
7. Keep the item sequence as close as possible to that in any related input documents.
8. Minimize the 'overhead' characters and get the computer to use as many cursor/print head functions as possible.

Next month I shall look at structured dialogues.

---

**NETWORKNOTES**

I recently got my first opportunity to have a serious 'hands-on' session with a TRS-80 and all my original misconceptions of the system were confirmed. (Make what you like of that!)

So I am not a great TRS-80 specialist and that was made quite clear by the way in which I mangled the machine's communications features in the last Network Notes. By way of defence, I should add that my local Tandy Micro shop helped ably in this plot to mislead you all! I was soon put straight by Derrick Rowe and I can do no better than quote extensively from his letter:

> "Following close on a previous PCW reviewer's 'discovery' of the Model II's missing PEEKS & POKES, I now find that the Tandy RS232C board which I have been using for over 12 months has become a much-awaited communications adapter. No excuse for you Mr. Hebdtich as it is clearly listed in their parts list.

> "In fact there is a large amount of communications software available for this machine. Tandy provides some useful terminal software together with a package which allows the TRS-80 to be run from any terminal, and I have run a TRS-80 from an HP 2647 intelligent graphics VDU. It certainly improves the display and keyboard but is a somewhat expensive exercise.

> "In the independent market there are a number of offerings. Lance Micklus of PROG 80 fame has written two assembler level utilities, ST80D and KVP. ST80D provides a smart terminal capability allowing the transfer of data/programs from the TRS-80's disks to a remote computer. In addition, there are user definable tables which allow the TRS-80 to be configured for those odd little ASCII characters such as character delete and clear screen. This allows the software to operate on a number of different systems and in different environments. In fact I have used ST80D to achieve a Model 1 to Model II conversation at 9600 baud.

> "KVP provides a different approach in that under INPUT, LIST or LLIST can be optionally directed at the RS232C channel. While it is only practical to operate up to 30 cps, it allow the programmer to write some quite useful communications routines and it is quite possible to use the TRS-80 to run a remote computer even to the extent of re-transmitting when transmission errors occur.

> "Both the popular word processing programs - Scriptsit and the Electric Pencil support output through the RS232 which may have some interesting implications for telex!

> "As usual the USA is well ahead of the UK and I understand that the Source and Micronet are already used by TRS-80 enthusiasts for electronic mail and telesoftware.

> "The Model II has two built-in RS232 channels and a sophisticated terminal program is provided as a DOS utility.

> "Poor old Tandy seems to be getting a rough ride in the press so it would make a change for the machine to be given credit for software capabilities probably some way ahead or at least at the top of the field."

> "Well thank you Derrick - I look forward to an opportunity to try some of these good things myself."

> "Now I've done my good turn, I want to find some micro manufacturers, distributors or dealers to do a good turn for the disabled. Local area networks (LANs) are this year's 'hot topic'. There is a strong case for suggesting that microcomputers do not reach maturity when they become multi-user systems but I suggest you consider multiple single-user systems to become a coherent co-operative - this could change.

> "Chris Bennett is Withernsea's big specialist in chips and his fish come highly recommended, too... Chris read my 'On the Line' series and called me to get some ideas about low-cost techniques for inter-connecting rooms full of micros. His idea was to combine LANs with aids for the disabled to facilitate teaching, communications and so on. I have to admit that not only was I a bit short on constructive suggestions but there was a bit of a push to use the cassette I/O ports as the basis for a bus configuration.

> "The next time Chris telephoned me was to tell me that he had successfully linked up an Apple II and a Research Machine 380Z using a bus originating from the cassette ports at speeds of up to 4-8 kbits/s! He had also simulated a third device on the bus.

> "Chris needs the loan of more micros, particularly a PET, Sinclair ZX80, TRS-80 and so on. The project is private and non-commercial; Chris' motives are genuine and he has a personal interest in the success of the project. Companies who want to support this innovative work should contact me (c/o The Editor, PCW) and I will put them directly in touch with Chris."

> "Response to the first 'Network Notes' about the Personal Computer Network was good and I will give you an update as soon as possible."

Next month David will do a special review of the proposed relaxation in the Post Office monopoly and its implication for the microcomputer world,
CHAPTER 3: HOW COMPUTERS THINK

Derrick Daines continues his unique guide to teaching others the basics of microcomputing.

Number sentence cubes

Time and again in computing we come across conditional jumps. So far I have confined myself to the IF A THEN B variety, but the 'A' part can and does take a wide variety of forms. An excellent aid to conditional jumps, in number work especially, is the type of dice sold under the name of Number Sentence Cubes. (See Appendix for suppliers.)

Five dice make up a usable set, although frequently two sets are sold together in one box. The plastic type is best, although wooden ones will serve quite well, especially if their edges and corners are sanded round to give a better roll. Readers will find different ways to use them, but my method is as follows:

The five dice are rolled together and then sorted to make a sensible number sentence. One number die begins the number sentence; next there's an operation die that has its faces printed with the four operations symbols +, –, x and ÷. Another number die follows and then the one that we are particularly interested in, the resultant die. Finally another number die finishes off the sentence.

Notice that although the sentence may or may not be true, it does make sense -- it is understandable.

The resultant die has its six faces inscribed as follows:

- (is equal to)
≠ (is not equal to)
> (is greater than)
≥ (is not greater than)
< (is less than)
≤ (is not less than)

The student copies down the number sentence and then has to decide whether it is true or false, writing the appropriate word after it. Unfortunately for teachers, this exercise is difficult to mark. Obviously there's no answer book to work from and having done the first 10 or 12 -- continually asking oneself questions like, "Is it correct that that statement is false?" -- one begins to tick things that should have been marked wrong, and vice-versa. Luckily, a great deal of practice is not normally necessary. Twenty or thirty examples are usually sufficient for anyone (Fig 1).

Other conditional jumps are sometimes encountered, and the teacher may wish to adapt a spare dice for them:

≥ (is greater than or equal to)
≤ (is not greater than or equal to)
< (is less than or equal to)
≤ (is equivalent to)

One manufacturer supplies his number sentence cube with 'empty set' symbols, ∅ and ⊂, which can be used in the following ways. (i) A special value is set aside for each, such as ½, 50, 100, zero, infinity; (ii) two or three times the four roll, (iii) the next roll is negative, (iv) the student may freely choose any number, (v) the number is unknown.

Other dice recommended for this work have 4, 8, 10, 12, or 20 faces. They are available commercially (see Appendix), or else they can be made in school in conjunction with work on three-dimensional solids. (Cundy & Rollett, Mathematical Models)

Every computer program save only the very simplest contains numerous examples of conditional jumps, and readers may rest assured that the practice I've outlined is well worth the time and effort devoted to it. For examples of conditional jumps, the reader might like to turn to Figs 2, 6, 9 and 10.

Hexadecimal

It's a simple fact that when a human being works in binary (0s and 1s), (s)he is very prone to error. However, the computer can only work in binary ... the first computers relied entirely on an input of binary, and also gave out only binary. Not only was this error-prone, it was also excruciatingly slow to execute. Early 'Computer Man' needed some method of working that would cut down on human error and if possible speed up the operation of putting binary information into the computer.

Various methods have been tried over the years, but of all these middle-level computer languages (as they are called), hexadecimal seems to have gained the most adherents -- particularly following the advent of the relatively cheap home computer. The reasons are worth going into.

A computer word in binary comprises a certain number of bits. This is the number of binary bits that the computer can hold in any one memory cell. In large (or 'main frame') computers, a memory may hold 16, or even 32, bits; for home computers this is quite excessive ... they don't normally need to handle numbers of that size or accuracy and on the odd occasion that they do, the work can still be carried out at the expense of a little time.

Some home computers use a four-bit word, but the majority use 8. For the time being, we'll take an 8-bit word as standard.

1 WORD  = 8 BITS = 1 BYTE

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TABLE 1

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In devices that use the hexadecimal input method, there's a clever little silicon chip that converts the hex into binary format, so don't let a hex input blind you to the fact that the microprocessor is still working in binary output from the micro into hex for the human to read.

Children in particular grasp the idea very quickly -- even at the age of 8 or 9.
No remainder, so we put a placeholder value 1 in the second column. There’s than this fashion.

For example, to change 4A0F to decimal, we look up the value of the 4, (16384), the A (2560) and the F (15) in the appropriate columns, and add them together to make 18959.

**Flowcharts**

A flowchart consists of a series of boxes — instructions and condition tests — linked by arrows in such a way that following it leads inevitably to the correct outcome. Note the word inextricable'. A flowchart must be free of ambiguity and have no room for error of any kind if it is to work properly.

The attainment of this aim is not necessarily as easy as it might seem at first sight. Most computer programs are drawn out in flowchart form first and even then it’s astonishing how even the most experienced programmer will find unforeseen and unwanted results occurring when the program is run.

For most students, a good start is to flowchart a well-understood and familiar sequence of events — such as getting up in the morning, getting a book out of the library, or making a cup of tea. (Fig 3). As the chart is developed, the students’ suggestions can be guided by such leading questions as, “What if I don’t want sugar?” or “Who likes cold tea?” This process can continue until the teacher is satisfied that the flowchart is detailed enough.

It’s a fact quickly determined by experiment that any flowchart can be made more and more detailed — a process that can continue almost ad infinitum. Judgement is therefore needed to determine the optimum amount of detail in a flowchart, but as a rule of thumb it’s wise to assume that too much is better than too little. For tuition purposes, even the simplest flowcharts should contain at least one of the differently-shaped boxes of Figures 4 and 5.

Having created a sample flowchart, students should be urged to create their own. Plastic stencils are available (see Appendix), but those generally available are made for professional draughtsmen and are rather expensive. On the other hand, those issued by the Open University are simple and cheap and will

---

**HEX DECISION TABLE**

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<td>546912</td>
<td>8</td>
<td>384</td>
</tr>
<tr>
<td>9</td>
<td>9437184</td>
<td>11</td>
<td>690624</td>
<td>9</td>
<td>256</td>
</tr>
<tr>
<td>A</td>
<td>10485760</td>
<td>12</td>
<td>81920</td>
<td>A</td>
<td>8192</td>
</tr>
<tr>
<td>B</td>
<td>11579264</td>
<td>13</td>
<td>104800</td>
<td>B</td>
<td>5120</td>
</tr>
<tr>
<td>C</td>
<td>12676896</td>
<td>14</td>
<td>128000</td>
<td>C</td>
<td>3200</td>
</tr>
<tr>
<td>D</td>
<td>13774512</td>
<td>15</td>
<td>153600</td>
<td>D</td>
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</tr>
<tr>
<td>E</td>
<td>14872128</td>
<td>16</td>
<td>179200</td>
<td>E</td>
<td>1280</td>
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<tr>
<td>F</td>
<td>15970736</td>
<td>17</td>
<td>204800</td>
<td>F</td>
<td>1024</td>
</tr>
</tbody>
</table>

**Table 2**

There is one reservation people have about hex, however: "If we’re counting in 16s, they ask, "why is that we haven’t got 16 numbers?"

Oh — haven’t we?"

"No. We go up to 9, then A, B, C, D, E, F — that’s 15."

What about 0?" I ask.

A puzzled frown crosses the face and they go away to count all over again.

I hear the same thing for binary. "We’re counting in 2’s, so why can’t we use a 2?"

If such a misunderstanding has arisen, the solution lies in pointing out that although we talk about counting in tens, we have no special symbol for the value ten. We use a 1 in the next column and a 0. People forget that zero has a place value, even though it has no numeric value.

It’s worth devoting considerable practice to converting decimal to hex and vice-versa before going on to addition and subtraction. It’s best not to use this sort of ‘hand’ work on numbers above 50 or so; for them, Table 2 should help.

**Decimal to Hex conversion**

Find the number on the table that is the highest possible but is not greater than the decimal number to be converted. Note its hex equivalent. Find the number on the table that is greater than the decimal number to be converted. Continue in the same fashion.

For example, to change 3600 to hex, the largest number on the Table less than this is 3584, hex value E. The remainder (3600 — 3584) is 16, hex value 1 in the second column. There’s no remainder, so we put a place holder 0 in the last column. The hex value of 3600 is E10.

To change 9999 to hex — the largest number less than 9999 is 8192, hex value 2 in the fourth column; the remainder is 1807. The largest number less than this is 1792 in the third column, hex value 7; the remainder 15. This is worth hex F in the last column.

Since we have had no value from the second column, we insert a 0 place holder. The hex value of 9999 is 270F.

**Hex to Decimal conversion**

Find each hex digit in the appropriate column and add together their decimal equivalents.

For example, to change 4A0F to decimal, we look up the value of the 4, (16384), the A (2560) and the F (15) in the appropriate columns, and add them together to make 18959.
It's The Mu-pet Show!

Multi-User PET (Mu-pet) links 3-8 PET computers to one Commodore disc drive and a printer.

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If you've three or more PETS, then you need a Mu-pet to make the most of them.
serve admirably — providing supplies remain available. As a last resort card
stencils may be made very cheaply.

One last thing; I find it a good plan to
tell Fred to buzz loudly when he fails
understand an instruction, or to put one foot forward.

The fault is, or even to self-repair — see

CHILD: Fred — put one foot forward.
FRED: Buzzzzz.

CHILD: Fred — move your left foot forward.
FRED: Buzzzzz.

CHILD: Fred — move your left foot forward a little bit.
FRED sways slightly.

CHILD: Sir — he's being awkward!

TEACHER: Not at all — he's doing exactly what I told him
to do. He also did what you told him to do,
didn't you, Fred?

CHILD: Yes sir — I moved it one millimetre.

CHILD (grimly): Move your left foot forward six inches.

TEACHER: You've forgotten again.

CHILD: Oh! — Fred — move your left foot six inches.

Blimey — now he's gone and moved backwards!

(Instructions must be
be precise and unequivocal at all times.
Obviously, the game becomes a battle of
wits between Fred and the rest of the class,
but they are learning some important
lessons. More and more
machines are being designed with a
fail-safe mode of operation. Simply
put this means that, in the event of
ambiguity, the machine will adopt one
particular mode of operation that the
designer considered to be the safest.
Usually this is interpreted as doing
nothing.)

CHILD: Step on the chair. Er —

sorry. Fred — step on the chair.

(Newcomers to
computing and other forms of artificial
ingelligence are frequently to be
observed apologising to machines. This
is probably a confusion between
intelligence and sentence, allied to a
sort of personality that all machinery
exhibits to a greater or lesser extent.)
economic to devise other methods of locomotion and, for instance, robotic machines may well end up being tripodal.)

CHILD: Fred — get up.
FRED: Buzzzzz.

(The chaos ensuing is better imagined than described since the act of rising to an upright position is even more complicated than walking. It seems likely that computers and robotic machines will always require the intervention of a human agency at some time or other, for the simple reason that every possible contingency cannot be foreseen and/or catered for — unless the application is relatively simple. The more versatile a machine is then, by a curious paradox, the more likely it is to break down... or to find itself in situations with which it cannot cope.)

Later, when Fred has regained an upright position:

CHILD: Fred — raise your right foot eighteen inches.
FRED does so.

Fig 8

Study the TRS-80 in Cambridge

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FRED does so.

TEACHER: Fred – has your right foot encountered a solid surface?

FRED: No sir.

TEACHER: Fred – lower your right foot one inch.

FRED does so.

TEACHER: Fred – has your right foot encountered a solid surface?

(This is known as a reiteration loop – a very powerful tool in the hands of the programmer since it results in a great saving of instructions. The slight cost is the conditional test which offers the machine its only way out of the loop. Conditional tests have already been met in connection with number sentence cubes. Here the important point is being made that tests can be carried out on anything within the environment of the machine or on any condition existing within the machine itself – analogous to the feeling of hunger in the human.)

Probably enough has been written about this particular exercise to demonstrate a number of points.

(1) The lesson provides rich information on robots, in addition it dispels many of the myths that, generated by writers of science fiction, continue to be perpetuated by films and television.

(2) From robots in particular we may draw lessons about all artificial intelligence and all machines in general – whether electronic, mechanical or a combination of both.

(3) Flowcharting is still further understood since we can draw flow-charts incorporating the successful instructions.

(4) Students are better able to understand the step-by-excruciating-step nature of computer and robotic instructions. They begin to ask the question, “What can go wrong?” Remember Murphy’s Law – what can go wrong, will.

**Do-while**

Because of the lightning-fast speed at which computers function, most of their operating time is simply wasted. For example, it’s common for the computer to have finished a computation and be ready with the answer before the human operator has removed his/her finger from the GO button. Time is wasted (a) because of the relatively slow print-out of results and (b) because of the extremely long delay (so far as the machine is concerned) before the human requires to make any further computation. This last delay can range in seconds to perhaps days, but of course in computer terms even a second is a very long time. When a
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computer is capable of making a million operations a second, there isn't much point in having it hanging around doing nothing.

The answer lies in giving the computer more to do. Some computers can, with the addition of a little hardware, be utilised by four or more people at once, or be engaged in a long printout between bouts of game-playing with the operator. The point can be made by means of a little play. In school I pick the brightest and nippiest child to be the 'messenger' and arrange for four or more other children to play the part of stupid giants; they have the task of writing to each other via the nippy messenger.

The giants must write in their very best handwriting and rather slowly, but their notes may be as brief as they wish. Verbal communication is forbidden. The sort of note that's suitable is, "What did you watch on television last night?" to which the first might reply, "I watched Match of the Day. What did you watch?"

Desks may be arranged so that the messenger is in the centre of a square. (S)he buzzes about actively, looking for more messages to deliver. As soon as one arrives it's delivered to its destination — and the messenger continues his/her search. If two stopwatches are available, it's useful to have onlookers check the time spent in actually delivering messages in comparison with the time spent in looking for another message to deliver.

A variation of this play is for the teacher to increase the number of slow stupid giants. A rule is made that no-one may write a second note until they have received a reply to their first. The result will be that the poor messenger never stops running and the giants may begin to wait some time for replies. This gives the opportunity to introduce two other concepts — queuing and priority interrupts. Queuing is already well understood. Priority interrupts can be illustrated by having one child, chosen for top priority, who is permitted to bawl out, "Message!" whenever (s)he has one for delivery. The messenger must complete the task at hand then go and fetch the priority message.

It's important the teacher points out that the play is a model of computer operations slowed down millions of times, so that although a giant may have to wait, say, five minutes between messages, in real terms a computer user should not have to wait more than a millisecond — even if the computer is overloaded.

Readers with experience of computers may protest that they have had to wait for considerably longer than a fraction of a second, but of course this is because priority users have given the computer not one but many millions of operations to perform. Further, in practice there are often many levels of priority, with top priority going to those matters dealing with the safety of the machine itself and its installation, second priority going to housekeeping matters and maintenance of programs, third priority going to extremely urgent programs, fourth to not-so-urgent programs and so on, down to eighth, ninth or tenth priority. Seen in these terms, the delay is understandable.

The analogy between the play and computer operations is clear. The slow giants are the peripheral devices, while the nippy messenger is the computer itself — or more precisely, that part of it called the Central Processing Unit. Other plays of this type may be devised to emulate various functions of the computer and a good source of ideas is "Computer Science — a First Course", a slim volume obtainable from the Open University Press.

**Cardboard computer**

There are various models of computer operation and this one, from 'Man Uses the Computer' (Blackie, 1977) is as good as any. Give students each a sheet of cardboard some 6" square and have them cut two parallel slots (Fig 8). The name Central Processing Unit is printed boldly across the top and then, if they feel like adding a little realism, the cards can be decorated with rivets, nuts, bolts, handles and dials. Each student is then given a strip of adding-machine paper, about a yard long, which is threaded through the slots so that only an inch or so of paper is revealed at any one time. Draw lines on the paper, top and bottom of the frame, and then pull the paper up so that the bottom line is now at the top. Draw another bottom line. Repeat in this way until all the strip of paper has been marked off in standard-size frames. Pull back to the beginning.

This first step may have seemed superfluous, but experience has shown it to be very desirable; frames drawn at the same time as they are written often turn out to be non-standard in size... leading to great confusion later.

The flowchart of Figure 9 can now be displayed and discussed. It could hardly be simpler for it just multiplies 3 x 4 using the technique mentioned earlier of repeat addition. The next step is to translate the flowchart into a listing, as per Figure 10; the students should copy this onto their strips of paper, one instruction per frame (Fig 11). The frames are of course numbered. A separate sheet is needed for temporary stores A and B (Fig 12), and maybe another for output of results. All is now ready.

With the long strip of paper pulled down so that the instruction START is displayed, the user pulls the strip up to the next frame and obeys the instruction on it before moving on to the next. Temporary stores A and B are written in PENCIL, any previous entries being erased. Instructions to jump are of course obeyed by pulling the strip through until the correctly-numbered frame has been found. This is a salutary exercise and one that's thoroughly recommended. Students soon begin to appreciate how much the computer has to 'whizz backwards and forwards' in order to produce an answer to even the simplest of programs.

Another lesson learned is irretrievable loss of information. Once data has been erased from the temporary stores A and B, there's simply no way of getting it back; indeed the only way of obtaining it in the first place would be to alter the program so that it prints it out.

Students can now be instructed to alter the program so as to produce an answer to a different problem — for example 4 times 5 — and then run it to check that the answer obtained is the one expected. Once this has been mastered, try altering the structure of the program so that they have to program simple division or even to combine operations. It's also useful to
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Index to current volume, up to, and including, last month.

Back Issues 2-5 to 2-8

Hardware Projects

280 Homebrew
Selective PROM copier
TV to Monitor conversion
MK-14 Expansion
Teleprinter conversion
Adding a Z80 to a 6800 system
VCR to PET interface

Adding a Z80 to a Teleprinter conversion

Pascal Part 10 - David Levy's Games 3-1, 2, 3

Pascal Series

SuperBrain

TRS-80 Model II Benchmark Timings

Hewlett Packard HP-85
Texas TI 99/4
Panasonic JD 8000-2
Hitachi HS-1000 HP-85
Benchmark Timings summary

TI-99/4A
Sintron Periflex 630/48
Acom Atom
D7E
Superbrain

Series

PASCAL 3-1, 2, 3, 4, 5
David Levy's Games 3-1, 2, 3, 4, 5, 6, 7, 8

On the line

Viewdata 3-1, 2, 3

Pascal Part 10 - Concluded 3-1

IEEE interface - Part 2 3-3

Chess 3-3

Gateway to Logic 3-3

Face to face 3-3

the man/machine interface

Network Notes 3-3

Fact Sheets (Fax) 3-3

6800 opcodes 3-3

6502 opcodes 3-4

Personal Opinion (Interrupt) 3-4

The end of work? Lord Avebury 3-4

Protest against technological determinism 3-4

Who needs the CRA? 3-4

Schools computing 3-4

David Finberg

Stating the obvious 3-4

Micros in big businesses 3-4

Animistics 3-4

a look at 'friendly' computers 3-4

Computer/Information technology & the law 3-4

Evaluations (Checkout) 3-4

Video Genie 3-4

Vector Graphic

Flashwriter II 3-4

Apple II: 11 Simm light pen 3-4

Microdata UV8

EPROM eraser

Softly intelligent EPROM

Programming

Exatron stringy floppy

380Z High Resolution Graphics

RROMPLUS+ for Apple II

Calculator Corner

TI 68/9/80 Pseudo opcodes

Casio Fx 502P Brag

MK-14 scrolled messages

6800 Keyword retrieval system

PET Kaleidoscope

Efficient character storage

Z80 Assembler

UK101 Dodgems

TRS-80 Fox and hounds

MZ 80K Sine wave

E-Bonion

PET Backgammon

UK101 Nudge

PET Horse race

 BASIC Renumber

Naming Namcos files

380Z Pictures

Fuel cell calculations - PET

PET large numeral

Volume 1 No. 1 May 1978

Nascom 1/77-68: The Mighty Micromite/A charity system

Volume 1 No. 2 June 1978

Research Machines 380Z/ Computer in the classroom/ The Europa Bus.

Volume 1 No. 3 July 1978

Buzzwords - A to Z of computer terms/ Pattern recognition/Micro music

Volume 1 No. 4 August 1978

Computers and Art /3-D Noughts and Crosses/Mickie - the interviewing micro.

Volume 1 No. 5 September 1978

1979 Review - the Attache/Universal VDU in Tandy Level II

Volume 1 No. 6 October 1978

Review - the Attache/ Word on word processing/ Micro assembler for the 6800/Sinclair to MPU interface

Volume 1 No. 7 November 1978

Nascom 2 - Word Processing.

Volume 1 No. 8 December 1978

Computer term/Pattern recognition/Micro music/Systems - stock control/Benchtest - the Challenger C3

Volume 2 No. 1 January 1979


Volume 2 No. 2 June 1979

MSI 6800/Withit - disassemble your programs/The Multilingual Machine/Polytechnical Processing

Volume 2 No. 3 July 1979

Vision link: Interfacing and Software for the Supercass VDU/Pet Preening/Extended cursor graphics for the TRS-80

Volume 2 No. 4 August 1979

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There are many ways of reaching the objective of a larger display. Thus various circuits were designed and tested with reliability and display intensity the factors that decided the final arrangement. The circuit described here gives an acceptable LED brilliance with a red filter fitted over the completed assembly.

The common emitter arrangement is the general way of using a transistor as a switch, since high gain current allows large collector current to be controlled by means of a relatively small base current. First examination of the circuit diagram appears to show that the base resistor alone limits the amount of current available for activating the appropriate LED anode, but a small amount of power is also absorbed by the switching transistors embodied in the 7445 IC which completes the circuits to earth. (The manufacturer’s specification for the 7445 IC notes that each of the high breakdown (30 volt) output transistors will sink up to 80 mA.)

**Construction Notes**

The LED sockets should first be soldered onto the stripboard. All the related anodes are connected together, i.e. all 'a' together, all 'b' together... etc, and then connected to their common switching transistor. Note that only 'a' & 'd' are shown connected in the circuit diagram, to simplify the drawing.

The copper strip on the stripboard must be cut at the appropriate points and 22 SWG wire should be used to make the necessary common connecting links for the anodes. IC 14 & 15 on the Mk14 PCB — originally two 7408s are replaced by two 7400s, because a zero signal is required to actuate the BC477 switching transistors. I used a ‘D’ type plug and socket for connecting the LED assembly to the MK14 PCB. This is an optional arrangement although I found it a useful way of proving the circuit. The original small LED assembly was connected to a similar plug and could be easily inserted back into the circuit if suspected 7400 IC malfunction or overload occurred.

If this article is used as the starting point for further experiments with display circuits, one must be aware that 'ringing' in switching circuits produces extra pulses which the microprocessor accepts as normal pulses. If the value of the base resistor of the BC477 in the circuit illustrated is too low 'ringing' will occur with resultant 'keying in' problems.

Finally, a software checkout is listed. This test program illuminates all display LEDs, showing figure eight and decimal point.

**Hardware required**

LEDs: 0.3 inch seven-segment common cathode, 8-off.
Filter strip: for red LEDs, 1-off
Transistors: BC477, 8-off.
Resistors: 220 ohms, 8-off.
ICs: 7445, 2-off.
Stripboard: 0.1 inch pitch holes
'D' connectors (optional): plugs, 2-off; socket, 1-off.
Misc: 22 SWG tinned copper wire; other connecting wire.

**LED connections (front view, pins at rear).**

---

**MK 14 DISPLAY CONNECTIONS TOP OF BOARD**

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- Ready-moulded case.
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Chess

Of all the games that have attracted the attention of computer programmers, chess must surely rank at the top of the list. This is partly because chess is considered by many to be the intellectual game, par excellence, and therefore the creation of a strong chess program can be equated with the creation of an artificial intellect. Another reason is that the writing of a chess program is itself a great challenge.

A measure of the popularity of computer chess programming may be judged from the history of computer chess contests. In 1970, in New York, there was a tournament in which all six of the contestants were computer programs. The event proved so popular that it has been repeated each subsequent year, at the annual conference of the Association for Computing Machinery, and by the end of the 1970s there were usually between 12 and 20 applications for places in the tournament. Now that micros are available in large numbers, chess contests are springing up specifically for microcomputers. Personal Computer World is organizing its third such tournament in London on September 4th-6th this year, and this event has the status of World Championship - an indication that "real" chess players are now beginning to take computers seriously. Other microcomputer chess tournaments are being held in the USA, France and Germany. Probably there will be a dozen such events in the calendar by the end of 1981.

Because of the enormous interest in computer chess, a lot has been written on the subject. I have decided that this article and the following one will provide a history of the most important milestones in the field, and I shall discuss how the ideas employed in main-frame programs may be applied to micros. In a third article I shall discuss the current state of the art of microcomputer chess programming, with many examples taken from actual games.

In the beginning

On March 9th 1949, the American mathematician Claude Shannon delivered a paper at a New York conference. The paper was called Programming a Computer for Playing Chess, and it is remarkable that many of Shannon’s original ideas have permeated through to the programs of today. He pointed out that there are some $10^{12}$ possible games of 40 moves (the average length of a master game), and that analysing to this depth at the rate of one game per microsecond would take a computer $10^{12}$ years to make its first move! A similar, though even more emphatic argument, is that the number of possible chess games so far exceeds the number of atoms in the universe, that even were each atom to be replaced by a Cray 1 computer, it would take the whole system rather a long time to make the first move in a perfect game of chess.

Having dispensed with the notion of perfect play through exhaustive search, Shannon set about defining an evaluation function which would give a reasonably reliable estimate of which side would hold the advantage in a position, and by how much. His example of a crude evaluation function was:

$$5 \times (K_w - K_b) + 9 \times (Q_w - Q_b)$$

$$+ 5 \times (R_w - R_b) + 3 \times (B_w - B_b)$$

$$+ (N_w - N_b) + (P_w - P_b) - 0.5 \times (D_w - D_b) + 9 \times (S_w - S_b) + 4 \times (Q_w - Q_b) - 0.5 \times (D_b - D_w)$$

$$+ (S_b - S_w) + (I_w - I_b) + 0.1 \times (D_b - D_w)$$

where $K, Q, R, B, N$ and $P$ represent the number of pieces of each type (king, queen, rook, bishop, knight and pawn), and the subscripts w and b refer to white and black, $D$ is the number of doubled pawns (pawns of the same colour on the same file); $S$ is the number of backward pawns (pawns that cannot be defended by a pawn); $I$ is the number of isolated pawns (pawns with no neighbour pawns of the same colour); $M$ is the measure of mobility (the number of legal moves at a player’s disposal).

The King is given an arbitrary high value because loss of the king means loss of the game. The values of 9, 5, 3, 3 and 1 for the other pieces are the rule-of-thumb values which chess players learn early in their careers, though bishops are usually regarded as being more valuable than knights so in your chess program you might experiment with values of $3\frac{1}{2}$, $3\frac{3}{2}$ or even $3\frac{3}{4}$ for a bishop.

Shannon's evaluation function is sufficient to provide a reasonable level of performance in a microcomputer chess program. Chess, however, is a complex game, and Shannon recognized the need for the use of many other features if the evaluation function were to result in a strong program, and he suggested the following additional features:

1. Relative control of the centre by pawns (white pawns at c4, d4, e4 and f4; black pawns at c5, d5, e5 and f5).

2. Weakness of pawns near your own king (e.g. advanced pawns in front of the king after castling).

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allow the bishops greater freedom of movement.

4. Passed pawns (i.e. pawns which have no enemy pawns in front of them, either on the same file or on adjacent files). These pawns can often become queens by the 8th rank. That is, they do not need to be not blocked in order to be promoted to queens.

5. Advanced knights (white knight at c5, d5, e5, f5, c6, d6, e6; black knights at c4 etc.), especially if protected by a pawn and free from attack. 6. Threats on open or semi-open files (an open file is one with no pawns; a semi-open file has one pawn belonging to the opponent).

7. Threats on the seventh rank. (A white rook on a7, b7, . . . or a black rook on a2, b2, . . . , etc., can wreak havoc in the endgame by picking off the opponent's pawns).

8. Doubled rooks (two rooks of the same colour on the same file).

9. Pieces which are required for guarding functions and, therefore, committed and with limited mobility.

10. Attacks on pieces which give one player the option of exchanging.

11. Attacks on squares adjacent to the enemy king.

12. Pins. (A pin is a setup in which one piece has no square to move because of the loss of a piece which it is shielding, e.g. white bishop on g5, black knight on f6, black queen on e7. Black may not move his knight or queen, it is pinned. The knight is said to be pinned by the bishop). The addition of these features would provide a richer sophisticated evaluation function for middle game play, though as Shannon himself pointed out, different factors apply in the opening and (to a lesser extent) in the endgame.

When and how to use the evaluation function

Shannon understood that it is only safe to use this type of evaluation function in positions which are objectively winning or losing. If a move that is not a forced move capturing black's queen, it is not sensible to evaluate the resulting position without looking to see if black might be able to recapture and then decide whether he might be able to checkmate. In fact it is meaningless to evaluate a position during a series of exchanges, unless the evaluation mechanism allows for the fact that further meaningful exchanges are possible. Chess players recognize quiescent positions intuitively, but computer programs have more difficulty with them. Shannon suggested that the ability to determine which capturing moves and sequences are "obviously" wrong, in the way that a human chess master can.

Shannon called a fixed depth search strategy a "type A" strategy. He realized that in chess this type of strategy would lead to weak play, partly because of the possibility of quiescent positions once the fixed search depth had been reached, and partly because of the time required for an exhaustive search (the alpha-beta algorithm had yet to be invented). Approaches have led to the thought processes of chess masters, and in particular to the work of the Dutch psychologist De Groot, who recorded the spoken thoughts of chess masters as they analyzed a number of typical chess positions. Shannon commented that it would not be possible to improve the speed and strength of the program it would be necessary to:

1. Examine forceful variations as far as is humanly possible in quiescent or quasi-quiescent situations.

2. Select the variations to be examined by some process so that the program does not waste a lot of time in totally fruitless searches.

Shannon called this type of strategy a "type B" strategy, and it is the Shannon B strategy which is used in almost all the most successful programs of today. The key to the Shannon B strategy is the ability to determine which moves and variations are worth considering, a problem on which much has been written but which has not been little accomplished during the past three decades. When I examine a chess position I can usually make a reasonably good move after looking at only 50-100 nodes of the game tree. In order to play at the same level, the current world chess champion must examine over one million nodes. If it had the same ability to discern which variations are important it would be able to defeat Bobby Fisher.

In order to help decide whether a move is worth exploring, Shannon suggested a function which would return a large value for forcing moves (captures, checks and attacking moves), medium values for defensive moves, and low values for all other moves. As depth of search increased the requirements of this function would be set higher so that fewer and fewer subvariations would be examined. This approach has proved successful in a number of strong chess programs, and can easily be implemented on a microcomputer. One simple method of doing so would be to examine all moves at the root of the tree, then only the most important 90% of moves at ply-1 ("importance" being determined by Shannon's discrimination function), then only the most important moves at ply-2, 50% at ply-3, 30% at ply-4 and 20% at ply-5 and deeper, down to the limits imposed by search time restrictions or to quiescent positions. My method would be to rank for examination of fewer than 10% of the number of nodes normally examined in a 5-ply search, and the 90% saving could be used either to increase the sophistication of the evaluation function (which would also make it slower), or to increase the maximum depth of search in tactical situations.

Another idea suggested by Shannon was to use the impasse positions or fragments of positions, for which a particular move or sequence of moves is known to be effective. Chess masters use this type of information all the time. They recognize a situation and immediately start to examine a move which they know has often proved strong in similar situations. Of course one must guard against the case that exactly the same move is best in a slightly different situation, but as we have seen in previous articles it is extremely important to examine the most likely moves first in the search process. Unfortunately, the only substantial example of this approach was a dismal failure. A strong American chess master, Charles Kalme, implemented a method involving "snapshots" of chess situations. His work was discussed in a 1973 American Chess Bulletin article, and shortly thereafter his program fared dismally in the annual ACM computer chess tournament in Atlanta, and little more has been heard of the program since then. Perhaps this is one example of a technique used by humans which will be difficult to employ in a computer program. In any event, Kalme's failure should not worry the micro user, since the amount of memory required to use the snapshot approach would be prohibitive at today's prices.

The Bernstein program

Shannon's work was purely theoretical in nature. He did not write a chess program to test his ideas, though if he had done so I suspect that his program would have been stronger than some commercially available programs now on the market.

The first example of a program playing full games of chess was seen in the late 1950s. This program was written for the IBM 704 computer by Alex Bernstein of IBM, and three colleagues. Since your own machines will all be considerably more powerful than an IBM 704, any of you who write chess programs ought to be able to do at least as well.

Bernstein et al employed four features in their evaluation function: Mobility, area control, king defense and material. Area control was defined as the number of squares controlled completely by each side, while king defense counted the number of controlled squares around the king. Their material feature was weighted with the ratio of its own material to that of its opponent, in order to encourage the program to exchange material when ahead and to discourage it from exchanging when behind. This simple herusitic is extremely well known, but not all programmers consider it worthwhile to implement it, because they believe that programs play worse in the endgame than they do during the middle-game.

Moves were generated in response to the questions:
1. Is the king in check?
2. Can material be gained, lost or exchanged (i.e. can the program make an equal or advantageous capture, is it threatened with material loss)?
3. Is casting possible?
4. Can a minor piece be developed?
5. Can key squares be occupied? (Key squares are those squares controlled by pawns).
6. Can an open file be occupied?
7. Can any pawns be moved?
8. Can any pieces be taken or moved?

If the answer to question 1 is "yes", the program generates moves that reply to the check, and these moves are put into a "plausible move table". If the answer to question 2 is "no", and the answer to question 3 is also "no", and no moves can be made, it is important that no other moves except replies to check and material changing moves are of greater importance to the program.

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questions 4 and 7 put moves onto the plausible move list. After the opening stage, the other questions are employed in the move generation process, with questions 2, 5, and 6 being the most commonly used variables. Questions 5, 6, 7, and 8 during the endgame. Once there are seven moves in the plausible move table, no other moves are generated from that position. The reasons why the programmers felt it important to generate the moves in a particular order — they wished to prune off most of the legal moves in every position, and preferred to do so at the move generation stage rather than the modern approach of generating all the moves first and then sorting them before finally discarding some.

This simple approach was used to create a tree with a maximum depth of 4-ply, and therefore a maximum of 7 or 2401 terminal positions requiring evaluation. In fact a further pruning mechanism was employed: a move is only put on the plausible move list if it results in an increase in score, or at least a substantial increase. Chess Challenger machines do quite a good job of this kind of pruning before they move, so question 4 should have been split into (4a), can a knight be developed?, and (4b) can a bishop be developed.

Prompted by question 2, but in fact a wasted move. Firstly the bishop is more useful than Black's knight; secondly, the program ought to give more weight to developing pieces during the opening, and a move such as b1-c3 or g1-f3 is called for.

15 g1-f2
16 b8-c6
17 e3-f2+
18 f2-f3

An excellent example of why the search should not terminate at a fixed depth of 4-ply. White can win a pawn or at least a queen because Black recaptures with f6xe5 White will win the queen with 11 f1-e1, when Black must lose his queen for a rook. But the program would only see the variation 10 f3-d3 f6-e5 11 fl-e1+ and, since Black is well ahead in material at this point, the program would evaluate the position as being much better for White, ignoring the fact that White's next move (d1-e1) captures the black queen. Using Shannon's B strategy, accidents such as this just cannot happen.

10
11 b5-c6
12 d3-c4
13 f3-g5
14 g5-h6
15 f2-f3?

Here a strong move would be 15 h3-f4, attacking the black queen and preventing mate at g2, but again the program would only have examined to the end of the four-ply continuation 15 h3-f4 e3-f2+ 16 f1-f2 g6-e2 (or b7-g2), and seen that it had lost a pawn! 15...

16 f1-e1
17 e3-e2+ is a real threat.
17 b1-c3?

Which the program overlooks. There is a routine which asks "am I in check?", but none which asks "can I give check?", and there is no question of the form "can I attack a valuable enemy piece?". As a result of these deficiencies, the program would not have put black's next move in the top seven places on the plausible move list when considering the replies to 17 b1-c3.

18 h3-f2
19 g2-g3
20 e3-d1
21 b2-b3
22 h2-d4?

Of course the program is totally lost in any case, but this move is worthy of comment because it illustrates another deficiency of forward pruning. The answers to questions 1–6 were all natural and generated six legal pawn moves and question 8 generated piece moves, but the plausible move list was full after the first piece move was discovered, and so the program failed to spot the need to defend itself against the threat of d5–e4. Had it only put on the plausible move list if it had really been suggested, there would probably have played e1–f1, a move which requires a six-ply search to discover its refutation.

23 d8–d1

Resigns

So with a crude search strategy and crude forward pruning, the Bernstein program was able to play recognizable chess, but extremely weakly. One important lesson that can be learned about forward pruning from the last mistake, is that your program should look further afield if the first move that it comes up with is seen to be bad. In this case, after examining the 7 chosen moves from the root of the tree, the program could see that it was losing material to 22 c7–d8, but was powerless to stop it. Had it been permitted to continue its search it would have found a "better" move before too long. There is a parallel here between the forward pruning which was employed by Bernstein, and the iterative deepening approach used by many of today's programs. With iterative deepening, a program finds the best move it can after a 1-ply search, then it increases the depth to 2-ply and looks for a better move, then to 3-ply, and so on, until it runs out of time. Similarly, the forward pruning which was permitted to continue its search by relaxing the pruning requirements, if it cannot find a satisfactory move early on in its search. Instead of searching 7 moves at each level, Bernstein could have examined (say) 5 moves at each level in less than one-third of the time, then when the program discovered that 21...e4–d3 and 21...e4–d3 were clearly dreadful moves, it could have examined all the other moves from the root of the tree, and the best 5 successors to each of them. This would have resulted in only a slight increase in total computation time for the move, but it would have enabled the program to see the immediate tactical consequences overlooked by the "best seven" approach.

Bibliography

The bibliography of material on computer chess is enormous. I shall mention only a small number of particularly significant works. Further references will be given next month:


Once again, this month I’m turning the column over to a reader — in this case Mike O’Regan of Beeston, Notts. He’s produced an ingenious program which allows blind people to calculate on the Hewlett-Packard 41C by converting the display into an audible code. Although the 41C is not a cheap machine it’s probably cheaper and more flexible than the Braille-display desk top machines which are produced for the blind, and it’s programmable to boot.

Mike O’Regan

As you rattle off your routine number crunching on a calculator, has it crossed your mind to wonder how you ever managed without one? If you have, you probably remember doing your sums as far as your fingers allowed, or by using a slide-rule or, perhaps, log tables. How do you think you would have managed if even these aids were denied you? You may never have thought of the enormous problems encountered by blind people when faced with anything more than simple mental calculations.

Being a musician as well as a calculator fan, I was analysing the TONE function of my new Hewlett-Packard 41C when it suddenly struck me that I might be able to use audio signals as the basis for a program that would enable blind people to use the calculator!

It’s well known that not only have most blind persons an enhanced sense of sound but they can also quickly become adept at using keyboards by touch. So, working on the assumption that the actual keyboard operation was no problem, I concentrated on a program to read the display and convert this into audio signals.

The first step was to check with Hewlett-Packard that I was not about to ‘re-invent the wheel’, somewhat surprisingly. I found that, as far as they knew, nobody else was working along the same lines. I decided that, to be of optimum value, the program should:

- be easily understood by the user;
- read, translate to audio and return the number to the display;
- work with any number combination (ie integers, decimals, minus numbers and, if possible, with scientific and engineering notation);
- not interfere with normal calculator operations as far as possible;
- utilise rarely used storage registers without increasing SIZE too much.

The SIMAUD (SIMple AUDio) program is the first result. (see program listing and explanatory notes)

How far does SIMAUD go to meeting the requirements listed above? Well it is easily understood, and the original number is returned to the display unaltered (except that SCI and ENG displays are only returned unaltered when too big for normal FIX display). SCI and ENG displays are audio indicated but in long form (counting all zeroes). Normal calculations are not affected and the program utilises storage registers 10 - 14. The only slight drawback to the program was that execution turned out to be rather slow, especially with the higher digits, so another program was developed and named AUDIOP.

AUDIOP (AUDIO Operation) is basically the same as SIMAUD except that each digit is signalled by just one TONE (a different one for each, with low TONES for low digits and high TONES for high). Minus number and decimal indicators are the same as SIMAUD and are easily distinguished from digit TONES. AUDIOP is much faster, but a certain amount of training is needed in order to be able to link the TONES and digits (I estimate three to four hours for reasonably fluency). To make training more interesting I went on to develop a number guessing game (TRIOB). Luckily most of the TONES are widely spaced — being roughly equivalent to pentatonic intervals. Tones spaced closer, as in a diatonic scale, are more difficult to recognise.

Up to this stage the use of the programs had been just theoretical... it was high time I arranged a field test. All three programs were tried by blind people (contacted through the RMIB) and SIMAUD was an immediate success; the indications were that AUDIOP could also be readily used after a

```
01 LBL "SIM"
02 STO 10
03 0
04 STO 13
05 RCL 10
06 SF 00
07 RND
08 STO 10
09 STO 11
10 X=0?
11 GTO 04
12 STO 11
13 INT
14 X=0?
15 GTO 00
16 RCL 11
17 LBL 02
18 STO 11
19 INT
20 X=0?
21 GTO 03
22 INT
23 ST+ 13
24 CLX
25 RCL 11
26 10
27 ST- 13
28 GTO 02
29 RCL 03
30 RCL 11
31 10
32 *
33 INT
34 STO 14
35 X=0?
36 GTO 08
37 RCL 07
38 RCL 09
39 LASTX
40 FRC
41 STO 11
42 1
```

```
01 LBL "AUD"  
02 STO 10
03 0
04 STO 13
05 RCL 10
06 SF 00
07 RND
08 STO 10
09 STO 11
10 X=0?
11 GTO 04
12 STO 11
13 INT
14 X=0?
15 GTO 00
16 RCL 11
17 LBL 02
18 STO 11
19 INT
20 X=0?
21 GTO 03
22 1
23 ST+ 13
24 CLX
25 RCL 11
26 10
27 ST- 13
28 GTO 02
29 RCL 03
30 RCL 11
31 10
32 *
33 INT
34 STO 14
35 X=0?
36 GTO 08
37 RCL 07
38 RCL 09
39 LASTX
40 FRC
41 STO 11
42 1
```

```
43 ST- 13
44 RCL 13
45 X<0?
46 GTO 09
47 GTO 03
48 *LBL 04
49 TONE 2
50 TONE 0
51 CHS
52 STO 11
53 GTO 11
54 *LBL 05
55 RCL 11
56 X=0?
57 GTO 06
58 GTO 00
59 LBL 00
60 RCL 10
61 X=0?
62 GTO 06
63 FST 00
64 GTO 10
65 GTO 03
66 RCL 06
67 LBL 10
68 SF 00
69 RTN
70 *LBL 07
71 TONE 7
72 DSE 14
73 GTO 07
74 GTO 09
75 *LBL 08
76 TONE 6
77 CHS 00
78 *LBL 10
79 TONE 9
80 TONE 9
81 CF 00
82 GTO 03
83 END
```

110 PCW
suitable period of acclimatisation. Actually, there’s room in the CMOS memory of the basic HP 41C to hold both programs, so that one may be checked against the other — another form of training.

In conclusion, since developing these programs I’ve discovered there are about 15 calculators on the market, especially designed for the blind. However these are, almost without exception, large, mains operated, slow (usually using Braille as readout) and expensive.

**SIMAUD Explanatory Notes**

- Steps 3 & 4 zero the counter
- Step 6 decimal trace flag
- Step 8 store display number for ultimate recall
- Step 9 working register
- Step 10 minus number test
- Steps 13&14 decimal number test
- Steps 17-28 loop to ‘decimalise’ number (by repeated division by 10) and count the number of loops to complete ‘decimalisation’
- Steps 29-37 loop to reverse the process of the loop above, one digit at a time, storing each digit in register 4
- Step 35 test if digit is 0
- Steps 38-47 store for ‘remainder’ of decimalised number and countdown of counter
- Steps 48-53 routine to produce minus number audio signal (TONEs 2 & 0)
- Steps 54-56 check for end of number
- Steps 57-65 test for decimal part of integer -decimal number
- Steps 66-69 end of program
- Steps 70-74 routine to produce the correct number of TONE 7s for each digit using register 4 as control
- Steps 75-77 audio signal for 0 (TONE 6)
- Steps 78-83 audio signal for decimal point (TONEs 9,9)

**AUDIOP Explanatory Notes**

See SIMAUD Notes for all except:

- Step 34 produces individual TONE for each digit

**TRILOB Explanatory Notes**

- Steps 4&5 zero ‘guess’ counter
- Steps 8-18 random number generator
- Step 27 uses AUDIOP as sub-routine to produce audio indication of number
- Step 28 STOP for player to key in ‘guess’
- Step 29 test for correct ‘guess’
- Step 31 test for ‘guess’ too high
- Step 33 audio indication that ‘guess’ is too low
- Steps 36-41 audio indication of right guess and recall guess counter
- Step 43 number TONEs signifying number of guesses
- Step 46 audio indication that ‘guess’ is too high

**SIMAUD/AUDIOP User Instructions**

1. STATUS: minimum SIZE 015*
2. Key in program from listing*
3. Assign SIMAUD and/or AUDIOP to free keys (e.g. LOG, LN)*
4. Test for POWER ON by pressing SHIFT 4 (BEEPs if power on)
5. Test for USER Mode On by pressing any number key(s) (except 0) and assigned key. (If no signal, switch USER on.)
6. FIX number of decimal places, as required
7. Do calculations in normal way, pressing SIMAUD/AUDIOP assigned key to check intermediate or final totals, as required.

**TRILOB**

1. Ensure that AUDIOP is in program memory*
2. Key in program from listing*
3. Assign TRILOB to free key*
4,5. As for SIMAUD/AUDIOP
6. Start game by pressing TRILOB assigned key
7. ‘Secret’ number signalled by TONEs
8. Key in ‘guess’ — press R/S
9. Low guess signalled by low TONE (TONE 3). High guess signalled by high TONE (TONE 9). Right guess signalled by BEEP, number repeated as TONEs, pause, then ‘number of guesses’ signalled by appropriate TONE.
10. Program loops to 7 above.

**NOTE:** Instructions marked* will require sighted assistance — others can be carried out by the blind person.
THE SHARP MZ-80 COMPUTER SYSTEM

The Sharp MZ-80 System is a new approach to computer applications and their efficient use. Our aim is to make computers relatively simple and therefore better understood and better used by those they are designed to serve. Take a look at the Sharp range— it will change the way you think about computers.
The bottom line

There's this podgy US general (well, an actor, really) pacing up and down the back lot at MGM studios. He wears his tin hat in the office andčews a cigar so savagely you'd think it was the enemy's lines. He has a couple of pearl-handled revolvers. Boy, is this guy tough!

He glares at the nearest plasterboard scenery and removes his mangled cigar long enough to bellow, "Lootenant — where's that report?"

A skinny nervous actor rushes in, carrying a bundle of papers. "Right here, General, sir!"

The 'General' explodes. "Goddamn it, Lootenant! I asked for a report, not the entire US Army Regulations! I gotta war to run — gimme the bottom line!"

The demand to "gimme the bottom line" is not confined to American actors or their scriptwriters. All of us show exactly the same desire at different times. For example, none of us asks a friend what (s)he watched on TV last night, expecting a half-hour blow-by-blow account! We expect a short answer — a Workman, the big match or whatever. If that arouses our interest, we may then ask for more details, but initially we mean, "Gimme the bottom line."

People who write computer programs are very prone to overdo it. (I know I am!) We start off with an idea and quickly get it working and debugged, but then come the ideas for improvements. Sometimes these are real improvements, but more often they are simply unnecessary elaborations on the original theme.

For example, I recently wrote a program to count the vowels and words in my passage of text. Before I knew what I was doing, I had the thing elaborated to count each different vowel separately, calculate the vowel per word ratio, the average length of each word, the number of punctuation characters, and so on. This process is sometimes called 'gilding the lily' and it's an awfully easy trap to fall into.

You may protest that elaborations really do make the program better, but I counter in two ways: (1) What exactly do you mean by 'better'? (2) Are you really doing it to make the program better, but it's an awfully easy trap to fall into.

Sometimes we write such elaborated programs simply to exercise our skills. I suspect that more often we get carried away by exuberance. There's no harm in that as such ... just don't expect others to share the flights of fancy. If you'd like someone to actually USE your program, as distinct from just talking about it or congratulating you on it, then there's no doubt that simpler is better.

If for example your version of Star-wars allows the user 25 different commands, you'd be far better advised to forget the majority of them — the user will never use them. What am I getting around to in my elephantine manner? to try and encourage those readers who may have small programs to submit, but aren't a bit shy about it. There may be more merit in a small program than in the longest printout you ever saw. Elaboration is not hard. What is really difficult is to devise a new program — a totally new game or new application for a home computer. That is what everybody is interested in.

Gimme the bottom line! Better yet, gimme something new! There must be a handful 'shooting' programs about and more come in every week, many sophisticated indeed. But I have a thousand times more delight in a new application, even if it isn't quite right yet.

I am prompted in the above remarks by the receipt of what was for me a totally new type of program — from a reader in Shropshire. This lad thought of having a compiler for graphics, so you play about animating all sorts of things and the program remembers what you have done. At command, it will play back or store it on disk for later use. Great! That's innovation for you.

I've suggested one or two minor alterations to him and with any luck we will all in due course see the results of his labours.

Programs received

Graphics Plotter by N. Smith of Tel-ford; Hangman by Neil Sleightholm (17) of Billericay; Clear the Screen, Fruit Machine, Speed and Acceleration and Shoot & Save by Janine Booth (13) of Peterborough; Mastermind by David McKeran (16) of Sunderland; Cow? to Basic Converter by G. Staples (17) of Beckenham; Two Astronomy Programs, Square Roots and Nim by Gary Nugent of Dublin; Lunar Lander by Graham Kirby (14) of Pitlochry; Anagrams by Andre Cockburn (9) of Bracknell; Space Taxi by Torstein Kongsheim (17) of Odoo; Basic Renumber by Colin Hughes (13) of Luton; Baricade by Robert Nichols (14) of Cardiff; Space Target by J. Adams (16) of Ledbury; Graphics Multiplier by Mark Wylkie (16) of Hertford.

This is getting better and better! Notice that girl's name in there? Thanks Janine — you're the first girl to send me a program. (What am I saying? I've got the sent in four!) And how about young Andre? Not only is he just 9 years old, he's also severely handicapped and types laboriously with only one finger. (So do I — and I'm not handicapped!)

I forgot to mention last month how impressed I was with D Tate's presentation of his program material. It was real 6th Form stuff — neat folder, local presentation — wow!

Competition

We had a great time sorting through the entries for our logo competition. In the end — who do you know? — the winning entry was sent in by Abigail McElhan of Middlesborough, who is 10 years old! Well done, Abigail! When I can prise the safe keys out of the editor's clutching hand, there'll be a prize on its way to you. Thanks to all those who sent in entries. Our artist has redrew the design and I reckon it looks pretty good at the top of the page — a worthy winner.

- Speed and Acceleration by Janine Booth
- Fallin' PCW 113
- Compiled and presented by Derrick Daines
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Tel. 01-636 0647
Welcome to the confusing world of the microcomputer. For many of us, this is our first exposure — there’s nothing complicated about this business, it’s just that we’re surrounded by an intimidating array of technical jargon. Imagine if we had to continually say “number system” every time we referred to something written in which the letters A to F represent the values 10 to 15 when instead we could simply say “hex”. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, PCW will be publishing this guide—every month.

We’ll start by considering a microcomputer’s operations and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, processing it, storing the results, or sending them somewhere else. All this information comprises numbers, letters, and special symbols which can be converted into digits. Although the data are (yes, it’s plural) accepted and output by the computer in “human” form, inside it’s a different story — they must be held in the form of an electronic code. This code is called binary — a system of numbering which uses only 0s and 1s. It also uses a base or a radix of two. Each character, number or symbol is represented by eight binary digits, or the equivalent of 0,000,000 to 11111111.

To simplify communication, 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 01010101 — complicated for humans, but easy for the computer! This 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 representation called hexadecimal. In this system, the equivalent of a byte is obtained by giving each one a single character, either a number or a symbol. The machine detects complicated collections of Os and 1s. The machine detects complicated collections of Os and 1s. Thus in most micros the electronic code. This code is called binary—a system of numbers, letters, and special symbols which can be input into a byte or hex (machine code programming) the usual method to have a special program which translates English or near-English into machine code. This speeds programming considerably — the nearer the programming language is to English, the faster the translation time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is Basic. Program instructions are typed in the computer, to be coded and stored in the computer’s memory. To run such a program, the computer uses an interpreter which picks up each English-type instruction, translates it 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 strange words you will hear in connection with Basic are PEEK and POKE. They give the programmer access to each of the computer’s registers, to be coded and stored in the computer’s memory. To run such a program, the computer uses an interpreter which picks up each English-type instruction, translates it 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.

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Mary Knight of Mike Rose Micros presents our guide to widely-available software packages. This will be appearing bi-monthly from now on, alternating with our In Store hardware guide.

<table>
<thead>
<tr>
<th>ARDEN DATA PROCESSING</th>
<th>B+B COMPUTERS LTD</th>
<th>BEAM BUSINESS CENTRE</th>
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<th>Stock Control/Recording</th>
<th>PET</th>
<th>Apple</th>
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<th>Altos (CP/MM)</th>
<th>PCC 2000 Simpelec, Triton 3</th>
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<th>Apple</th>
<th>North Star Horizon</th>
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<tr>
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| Sales Ledger | 300 | 350 | 250 |
| Purchase Ledger | 300 | 350 | 250 |
| General Ledger/NL | 300 | 350 | 250 |
| Integrated Accts | 300 | 300 | 950 |
| Word Processing | 75 | 450 |
| Mailing List | 300 | 75 | 75 |
| Invoicing | 25-50 | 100 |
| Database Management/Information Retrieval | 150 | 75 |
| Payroll | P.O.R. | 350 |
| Incomplete Records | 850 | 250 |
| Personnel Records | 850 | 250 |
| Estate Agent | 850 | 250 |
| Time/Cost Recording | 300 | 350 |
| Job Costing | 300 | 450 |
| Mail Shot | 300 |
| Credit Control | 300 |
| Cash Flow | 300 |

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116 PCW
## PACKAGES

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## LIFEBOAT ASSOCIATES 01-836 4663

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**VAT**
PACKAGES

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<th>TRIDATA MICRO LTD</th>
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<td>021-622 1754</td>
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<td>TRS 80II</td>
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Stock Control/Recording 375 285
Sales Ledger            375 315
Purchase Ledger         375 315
General Ledger/NL       425 225
Integrated Accs         855
Word Processing         120
Mailing List            125 140
Database Management/Information Retrieval 375 375
Payroll                375 375
Incomplete Records      375 375
Personnel Records       375 375
Estate Agent            375 375
Time/Cost Recording     375 375
Job Costing             375 375
Mail Shot               375 375
Credit Control          375 375
Cash Flow               375 375
Production Analysis     375 375

Key: POR Price on request
( ) Program used to link accounts packages.

“...This one is programmed to cheat so that you always have an excuse for losing.”

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* AUTO DIALLERS
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* PRESTEL
* HAND HELD GAMES

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RADOFIN TELETEXT ADAPTADOR
£199 + VAT

27 TUNE DOOR BELL £17.13 + VAT

Silica Shop
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We have comprehensive brochures on all products. Please let us know what you are interested in and we will send you detailed brochures AND our own 32 page catalogue covering most games on the market!
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80 COLUMN HIGH PERFORMANCE
IMPACT PRINTER
- suitable for most Micros.

JUST LOOK AT THESE STANDARD FEATURES:

* RS-232, 20mA, IEEE 488 and Centronics I/O
* 15 baud rates to 9,600 * 60 lines per minute -
  Bidirectional * 6 print densities 60, 72, 80, 96,
  120 or 132 Chr/line * Self test switch * 96 Chrs.
  ASCII II Standard * Auxiliary User Defined Ch.
  set * Tractor and fast paper feed/graphics
* 2k Buffer * Accepts 8½" max. paper pressure
  feed and 9½" max. paper tractor feed.

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80 COLUMN 32k Pet
ONLY £825 + VAT
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Keyboard
16k - £499 + VAT
32k - £599 + VAT
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Basic in ROM. Both models are
with new improved keyboard and all with
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Compukit
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DISC DRIVES
with up to 32k RAM expansion

EXATRON
TR580
COMBINES ECONOMY OF CASSETTE
WITH SPEED & RELIABILITY OF DISC
(TRS80 expansion interface not needed)
16k loads in approx. 24 secs. * Wafers to
75 ft (48k approx.)
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PSU
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BUS EX 2 for 1. Machine Lang. Monitor

Ohio Superboard II & Challenger 1P
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SUPERBOARD II...
SUPERBOARD II (48x32)...
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CASE...
CHALLENGER 1P...
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Ideal development tool can connect via
RS232 or connect into system in order and
assume transparent firmware space
ONLY £120 + VAT Built and tested
£100+ VAT Kit £20+VAT Built PowerSupply
Here are the details of additions and changes recently notified. If we have failed to include YOUR group (or have published incorrect information) either here or in the complete listing, then please address changes/additions to: PCW (User Groups Index), 14 Rathbone Place, London W1P 1DE. Finally, the next complete listing will appear in our November issue.

INTERNATIONAL

Tangerine Users Group (International). Recently formed for users of the Microtan 65, the TUG will act as a central information clearing house, including exchange of programs etc. Annual membership is £5.00. Details from TUG at 3/22 Donoughmore Road, Boscombe, Bournemouth, Dorset, UK.

USCD System User Society. Setup in San Diego in June for users of USCD Pascal, the society aims to establish a software library, promote regional and special interest group activities and liaise with USCD system distributor Softech on future development plans. Existing special interest groups include industrial application, word processing, real time, business applications and forward planning. UK contact: John Ash, Dicoll Data Systems Ltd., Bond Close, Kingsland Estate, Basingstoke, Hants RG24 0QG.

NATIONAL

National Personal Computer Users Association. Full membership now costs £8.00, but you'll receive a free datasheet of special routines for the UK101/Superboard on enrolment (routines include a fast Basic line renumberer only four lines long). For details send an SAE to: The Secretary, NPCUA, 11 Spratling Street, Manston, Ramsgate, Kent.

Powertran Users Club. Annual subscription £3.00, which includes a monthly newsletter. Contact Mr P L Prohetas, 50 Cromwell Road, Wimbledon, London SW19 8LZ.

LONDON

Southgate Computer Club. The club recently held its AGM and adopted a formal constitution. Annual subscription will be £2.50 from January 1981, including a club newsletter; full-time students under 18 pay half cost. The club now has 84 members. Contact: Panos Kounis, Southgate Computer Club, 33 Chandos Avenue, London N14.

ESSEX

South East Essex Computer Society. Meets monthly at the Southend-on-Sea College of Technology, has access to the college's micros, and is open to anyone over 14. Contact: R Knight, 126 Ll. Wakering Road, Ll. Wakering, Southend-on-Sea, Essex. Tel: Southend 218456.

"He processed his first word today"

DIARY DATA

Philadelphia, USA

Personal Computing 80 (America's largest East Coast micro show). Contact PCAF '80 c/o Philadelphia area Computer Society Box 1554, Philadelphia, Pa 19105.

Salford, England

1980 Salford Microprocessor and Microcomputer Exhibition. Contact Dr E A Flinn (Exhibition Director), 061-736 5843

London, England

(Cunard International Hotel) The 3rd Personal Computer World Show. Contact Montbuild Exhibitions Ltd., 01-486 1951

Stuttgart, W Germany

Hobby Electronics Exhibition. Contact CES (Overseas) Ltd., 01-236 0911

Paris, France

SICOB. Contact French Trade Exhibitions, 01-439 3964

Bristol, England

(Eurocrest Hotel) BIZTRONIC. Mini/Micro Computers, Word Processors and Business Machines Exhibition. Contact Groundrule Exhibition Co., 061-928 0406

Plymouth, England

BEX. Business Equipment Exhibition. Contact Douglas Temple Studios Ltd, Tel: 0202 20533

Melbourne, Australia

World Computer Exhibition. Contact Riddell Exhibition Promotions Pty. Ltd., 166 Albert Road, South Melbourne, Vic 3205.

Edinburgh, Scotland

(Ingliston Showground) BEXIBITION. Business Equipment Exhibition. Contact Douglas Temple Studios, 0202 20533

Doncaster, England

(Exhibition Centre) Business Efficiency and Office Equipment Exhibition. Contact Gwen Shillaber Designs, 0272 312850

Bradford, England

(Norfolk Gardens Hotel) Business Efficiency Exhibition. Contact Gwen Shillaber Design, 0272 312850

Manchester, England

(Forum) BIZTRONIC. Mini/Micro Computers, Word Processors and Business Machines Exhibition. Contact Groundrule Exhibition Co., 061-928 0406

London, England

(Olympia) COMPEC. Computer Peripheral & Small Computer Systems Exhibition and Conference. Contact IPC Exhibitions Ltd., 01-837 3636.

London, England

(West Centre Hotel) Professional Viewdata Exhibition. Contact IPC Exhibitions Ltd., 01-837 3636

Cardiff, England

(Sophia Gardens) BEX. Business Equipment Exhibition. Contact Douglas Temple Studios Ltd., 0202 20533

Birmingham, England

(NEC) Which Computer? Show. Contact Clapp & Poliak Europe Ltd., 01-995 4806

Aug 21 — Aug 24

Sept 2 — Sept 4

Sept 4 — Sept 6

Sept 10 — Sept 14

Sept 17 — Sept 26

Sept 23 — Sept 24

Oct 1 — Oct 2

Oct 14 — Oct 19

Oct 15 — Oct 16

Oct 15 — Oct 17

Oct 21 — Oct 23

Oct 21 — Oct 26

Oct 28 — Oct 30

Oct 28 — Oct 30

Nov 5 — Nov 6

Nov 25 — Nov 28
For sale

TR-80 Level II... 16k plus cassette, manual, video & TV adapter, £60. Tel: 01-769 2258.

Data Dynamics... KSR 390 terminal, ASCII code. RS232, 10 command and 40 data, paper good condition, £195 inc VAT. J. C. C. Williams, 44 Premier Ave, Graze, Essex.

Acorn System One... VGC with power adaptor, manuals, 64k RAM, factory built, £60. Tel: 01-769 4095 after 8pm.

SYM 1... 4k, £620. Tangerine 1648, 256k Star keyboard, £20, £45. VLA programmable interface card for Apple/ITT 2020 and TRS-80 Level II; & IV. £65. Tel: 01-769 4095.

PET 2001... 8k, excellent cond, refused. Tel: 0524 734470 (evenings). PET 32k... (large keyboard), power supply, manuals and some software, factory-built, £60. Tel: 01-769 2258.

Acorn System One... VGC with power adaptor, manuals, 64k RAM, factory-built, £60. Tel: 01-769 4095 after 8pm.

Cash crisis forces sale... static RAMs: 2141 4k x 1, 250 ns, £60; 2164 4k x 1, 450 ns: £46; 2114 16k, £53. 16k VLA PET 2001 3 rail & 2716 5v only, all new, full spec complete. Tel: 0252 34470 (evenings).

PET 2001... 8k, excellent cond, little used, program tapes & PET instructions. Tel: 01-6140 1501 (evenings).

TR-80 Level I... 4k, plus duo into programmable interface, 3 month old, £250 inc. software, ono. Wife wants deep freeze! Tel: Petersfield 68624 (evenings).

Apple hardware... (CPUs, peripherals, etc) also welcome. Tel: C Vuodin, Flat 5, 24 Windham Gdns, Brighton BN1 3AJ.

Wanted

Documentation... on any 2nd generation computer (op manuals, hard software etc) from early 1980s to mid-1986s. Specific documentation on obsolete hardware (CPUs, peripherals, etc) also welcome. Tel: C Vuodin, 24 Windham Gdns, Brighton BN1 3AJ.

“Can’t prevent him from looking but surely we can do something to stop him changing the channels”
Two human players of a specified skill computer -against -human program to win the world chess championship $100,000 prize for the first computer No, it has not happened yet, but the champion
Continued from page 83

same as his own last move — in this case 5. Whatever little card is on top of the pile inside is the computer's move. Let us suppose that it's 4. The player replies, then goes for his next move. The set of boxes for the computer's third move (following the same rules as before) and opens the box corresponding to his own last move. In the circumstances given this was probably 7.

Play proceeds in this way until a result is obtained — almost certainly a victory for the human player. Various conditions of play will arise. Firstly, the computer may attempt a move to a square already occupied, in which case the card with this move is placed at the bottom of the pile in the drawer and the next one taken. If a drawer opened has no cards in it, or if all squares indicated are occupied, the computer withdraws and concedes defeat.

Now for the learning process. When the human player wins a game, the card representing the computer's last move is taken out of the drawer and discarded; it won't make THAT error again. Finally, if discarding a card results in a drawer now becoming empty the previous move is discarded since all paths from it result in disaster. Options are re-opened by replacing all the cards for the subsequent drawer. For example, suppose that drawer 2, move 4 becomes empty. We must ask ourselves what led up to this situation? Suppose that it was a move to square 8 in move 3. We remove this card and replace all the cards in drawer 2, move 4.

You'll find that, over a number of games, the computer first loses all, then slowly begins to win; at the end it'll be very hard to beat — in fact, following the classic learning curve (Fig 16). Children with the stamina to play a lot of games, will be interested to watch the progress in operation. Other forms of teaching by games will be looked at later.

Perhaps the greatest single lesson to be learned from computer models is the absolute necessity to be accurate when programming. The computer is itself totally on the ball and logical but it relies ultimately on humans both to program it and to feed it with accurate information. There's an old saying in the computing world: 'That's well worth repeating, garbage in — garbage out.' It's fast becoming a necessity for the

GATEWAYS
to LOGIC

Continued from page 9

have them count the total number of operations involved.

Matchbox computer

Another variation on the same idea is to obtain a number of empty match-boxes — say a dozen — and bind them together with sticky tape (Fig 13). The boxes are numbered and, as an added touch, may have a tag of tape attached for easy pulling. To program the machine, slips of paper carrying the instructions or data are inserted into the appropriate drawers.

The method is only really suitable for children — adults find the drawers very fiddly — but a suitable alternative for us old 'uns is a set of those plastic drawers that are sold for the storage of bits and pieces.

Noughts and crosses is a simple game that lends itself admirably to demonstration on a computer and, as an added bonus, we can demonstrate the ability of the computer to learn by its mistakes — a concept that many people find disturbing.

Three sets of boxes are needed, with nine boxes to each set. They are bound together as before and the sets numbered 2 — 4 (Fig 14); set number 2 represents the computer's second move, number 3 its third move and number 4 its fourth move. We don't need a set for the computer's first move since, for the sake of simplicity, the computer always makes its first move as soon as it is switched on. Options are re-opened by replacing all the cards for the next move.

We offer a new 3K monitor, NASMON, for both NASCOM 1 and NASCOM 2 systems which gives you all the features of an 8K BASIC Ohm running under NASMON, this extended BASIC gives you all major PASCAL statements, — INTEGER, CHAR, BOOLEAN and enumerated-TYPE, many predefined functions e.g. SUCF, PRED, IF-THEN-ELSE. 11 significant figure arithemetic, - integer range - variables: 1024 registers, 16k memory, single command. a total of 24 commands available through the keyboard, fully recursive Procedures and Functions with value parameters.

PASCAL IN UNDER BK.

NAGS runs under NASHI and NAS8YS and offers — all major PASCAL statements, — INTEGER, CHAR, BOOLEAN and enumerated-TYPE, — NAGS runs under NASHI and NAS8YS with value parameters. many predefined functions e.g. SUCF, PRED, INTEGER, CHAR, BOOLEAN and

AT LAST, A 12K BASIC

Running under NASHI, this extended BASIC gives you all the features of an 8K BASIC plus 11 significant figure arithemetic, — INTEGER, CHAR, BOOLEAN and enumerated-TYPE, — NAGS runs under NASHI and NAS8YS with value parameters. many predefined functions e.g. SUCF, PRED, IF-THEN-ELSE, — integer range - variables: 1024 registers, 16k memory, single command. a total of 24 commands available through the keyboard, fully recursive Procedures and Functions with value parameters.

SOFTWARE

Britain's King? First Computer World Chess champion

No, it has not happened yet, but the Fredkin Foundation of Cambridge Massachusetts recently offered a $100,000 prize for the first computer program to win the world chess championship.

The 24 programmes to continue to strive for world-class chess skill in their programs, the Fredkin Foundation is offering a series of incentive prizes for computer-against-human competition. Two human players of a specified skill level will be selected each year to play the two top programs. Each will play a three-game match with the winner taking all. The first competition will take place this November at Carnegie-Mellon University; the prizes will be $1500 and $1000. In each succeeding year, stronger humans will be selected and the prizes will be increased.

When asked what English players should do, in general, to improve their play, the world champion, Anatoly Karpov, replied, "Endgames, study endgames." That is good advice for chess programmers too, but my advice to Karpov is — computers, study computers!

Next month I will be looking at the new Sensory Challengers. In the meantime, see you at the First World Microcomputer Chess Championship — at the PCW show!
public at large to have some knowledge of programming. I don't mean that all and sundry should be able to sit down and program a computer... more that they should know about the basic principles. I feel we must aim to build up a population that will not automatically genuflect when they hear that this or that data has been computerised.

Better than that, the public must begin to question computer results. This is done already to some extent, but the emphasis is in the wrong place, with the result that the computer stands in danger of derision. It's simply not good enough for commercial and industrial concerns to offer the limp excuse, "Sorry - our computer made a mistake." If a hapless pensioner receives a gas bill for £99999.99, then either it was programmed incorrectly or some human fed it with wrong information.

As computers find their way into more and more schools it'll become commonplace to hear adults who don't know any better castigate children as lazy - because they imagine that the computer will do all the child's work for him or her.

All such people overlook the simple fact that in order to use the machine, one must first control one's self. In order to drive a car, we must first learn to gain complete control over legs, arms, hand and eye. Similarly, in order to program a computer to fulfil a task, we must first know intimately what the job has to be approached. In order for our cardboard computer to multiply two numbers, we first had to know how to do it ourselves.

It's totally unacceptable that so many people - including the most articulate and intelligent - still approach me and say, "I'll tell you what you ought to get your computer to do...", then go on to describe something for which there is no known solution - like picking the Derby winner, eradicating poverty or banning wars. Their eyes glaze a little when one retorts, "OK, tell me how to do it and I'll shove it through the computer."

Appendix

Number Sentence Cubes may be obtained from Taskmaster Ltd., Morris Rd., Leicester, LE2 0BR. Flowcharting stencils from Open University or better class stationers and many-faced dice from some games shops.

Please note that Hestair Hope Ltd., mentioned in Chapter 1 of this series, no longer supplies binary selection boxes, although the logic blocks are still available.

SECRETS OF SYSTEMS ANALYSIS

Continued from page 71

So, to conclude this month, the first and perhaps the most important lesson to be learnt in this systems analysis course is... get the terms of reference right. Don't start your programmer writing programs for your solution and don't start buying hardware or programs not until you've had a jolly good look at what's really causing the problems.

Next month we will examine various ways of looking at and analysing these problems.

BASIC BASIC Continued from page 71
...together routines on the same subject.

response if not have to be brilliant (it could well
than we started with. Your code does
way we should all end up having more
gether what everyone has done.

Remember that the idea

Continued from page 79

Have ago
There's an intriguing game from one of
our regular program contributors. Full
instructions are included within the pro-
gram, so off you go.

We might do that although it depends on what you send. Here are some possible groups:
1. Multiplication and division of multiple-length signed binary fields and packed BCD fields.
2. ASCII/binary, ASCII/packed BCD, packed BCD/binary conversions.
4. Data (DDMMYY) to binary data conversions — for easy comparison and scheduling.
5. Error checking and correction on memory and peripheral transfers.
6. Random number generation.

PCWSUBSET

Continued from page 79

Have ago
Remember that the idea is to put to-
gether what everyone has done... that
way we should all end up having more
than we started with. Your code does
not have to be brilliant (it could well
prove a bigger and more informative
response if it is not) but it must work.

It has been suggested that we gather
together routines on the same subject.

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with minimal supervision. Processing will largely be decentralised
to local micro-computers running under CP/M, though interfacing
to the Dec-10 mainframe will also be important. Programming will
be in a variety of languages including CBASIC, COBOL and eventual-
ly PASCAL.

This is an excellent opportunity to

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WHILE ------DO------REPEAT------UNTIL

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Here's a fascinating — hypnotic, even — game for the PET. It includes instructions and details on converting it to run on old ROM machines.

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by Richard Warner

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2. Discussion: The Committee.

Evidence that the nominee is willing to serve on the Committee must be given either by post or by advertisement in two nominated journals. Nominations for the Committee must be in the hands of the Secretary not later than two days prior to the meeting. They must be signed by a proposer and seconder and accompanied by a 10-line print buffer. Automatic OCR-F or compatible computer output may be used.

Nominations will be held 15th Oct, 1980.

Mike Anthony Electronics, 46, Meredun Pk Gdns, Edinburgh, EH17 7JR.
384 IF B3 = 194 AND B4 = 194 THEN G = G + 1
215 T1$ = "000000", 0010440
179 DATA 127, 143, 164, 174, 177, 180, 188
155 IF N = -9 THEN 200
145 IF N = -3 THEN P = 95: 0070130
730 PRINT "AND THEN PRESS ANY KEY TO BEGIN"
710 PRINT "ONAME", "TIME (SECS.)"
590 PRINT "WOU’VE CRASHED!!!"
520 IF A$ = "8" THEN X = X - 40
410 GET C$, IF C$ = "" THEN 450
383 IF B1 = 194 AND B2 = 194 THEN G = G + 1
382 B3 = PEEK (O + X + 40), B4 = PEEK (O + X - 40)
210 GET C$, IF C$ = "" THEN 210
205 X = 123, POKE Q + X, 147: S = 400: G = 0
840 PRINT "TIMES ARE SHOWN AT THE END"
830 PRINT "ADDED FOR EACH GATE ‘r’OLI MISS. THE BEST"
750 FOR N = 1705000, NEXT: 007025
725 IFT(N) < 9999 THEN 750
720 FOR N = 17010
650 T(M) = T(M-1), N$(M) = N$(M-1)
640 FOR T = 10 TO N + 1 STEP -1
607 PRINT "YOUR TIME WAS", T
605 PRINT "YOU MISSED" - G; "OATES"
604 G = G - 33: T = 4: T = 03E107 / 100
603 PRINT "WELL DONE - YOU'VE COMPLETED THE COURSE"
592 T = 9999, 00T0700
530 IFA$ = "9" THEN X = XL39
500 IFFa = "6" THEN X = X + 1
480 IFFa$ = "3" THEN X = X + 41
470 IFFa$ = "2" THEN X = X - 40
455 PRINT "11" MID$(T1$, 3, 2)"'MID$(T1C5, 2)
450 POKE Q + X, 160
445 IFC$ = "S" THEN S = S + 25, 0070450
435 IF N = -5 THEN P = 194, GOT0 130
425 IF N = -4 THEN P = 105, 0070130
410 IF N = -2 THEN P = 233, GOT0 130
405 IF N = -1 THEN P = 223, 0070130
126 FORM = 01 - 03
124 FOR N = Q + 981 TO 00 + 984, POKE N, 32 NEXT
123 FOR N = Q + 821 TO 00 + 824: POKE N, 32 NEXT
122 NEXT M, N
121 POKEN + M, 32
120 FORM = 0T03
118 POKEN, 32, NEXT
117 FOR N = Q + 6431 TO 00 + 963
116 POKE Q + 794, 32: POKE Q + 876, 32
115 POKE Q + 946, 948, 955, 990, -9
114 POKE Q + 946, 489, 496, 502, 517, 519, 532, 534
104 FOR T1$ = "000", T1$ = "0010440"
900 PRINT ""
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1010 PRINT: TI$="000000":RETURN
1100 PRINT: FOR R=33729 TO 33766
1050 IF R>13 THEN R=0
1000 R=R+1: IF R>7 THEN 1050
120 GOT0 60
100 IF X=32846 THEN M=-1
12 FOR BB=1707 TO 32887
10 TI$="000000":T1=700:D=40:PRINT "101PICKM010101011,1"
12 PRINT "101PICKM010101011,1"
12 FOR BB=1707 TO 32887
10 TI$="000000":T1=700:D=40:PRINT "101PICKM010101011,1"
12 PRINT "101PICKM010101011,1"
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We also specialise in the repair of all makes of office equipment.
Apple Pascal provides routines to control all the standard Apple hardware but controlling additional devices can be a problem. For example, the communications card initializes to 300 baud but should you want to use a 110-baud Teletype then you'll have to load the POKE routine. It's then only logical to do just this, if you want the appropriate value. Instead of writing a routine to ACIA's control register with the appropriate value, you can use Apple Pascal's PEEK facility to complement this with a POKE facility.

Apple Pascal Editor allows such items to be copied into a program from a library listing: using macros in such a short piece of code is probably unnecessary but the editor allows such items to be copied into a program from a library file; if the value to be POKEd is higher than 255 then the high order byte is ignored; the printer used to produce the listing reproduces the character © as £.

**PEEK and POKE for Apple Pascal**

by Stephen Withers

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Submitting programs to PCW

Our programs section thrives on contributions from you, the readers. In particular, we're looking for original ideas (no more Nim, decimal-hex conversions, Masterminds, digital clocks, etc please!) and we're not just interested in games - if you've a handy business/scientific/educational program then we'd be interested to hear from you.

Once you've written and thoroughly debugged your program, send it to us on cassette or disk with, if possible, a clear printout made with a new ribbon on plain (not lined) paper. Write a covering letter stating briefly what the program is, exactly which machine it's for (ie old/new ROM PET, or TRS-80 Level I or II) and how much memory it requires. On a separate sheet list any special instructions which aren't included in the program and write your name and address on each piece of paper you send us as well as on the cassette/disk. If you'd like your cassette/disk returned then enclose a suitable SAE.

The fact that we publish so many PET programs merely reflects the market share of this machine - we're always happy to see programs for other machines. If your program does not use machine-dependent graphics and can therefore be used on other micros, try to keep it as "portable" as possible (see 'Basic Basic' this month). Don't purge your listing of unnecessary spaces unless you're really tight on memory as spaces improve program legibility and make it easier for others to key in.

Finally, we're not 100% biased in favour of Basic; we're always interested in short assembler programs and we're eagerly awaiting our first Pascal program!

Send your programs to: PCW Programs, Personal Computer World, 14 Rathbone Place, London W1P 1DE.

LEISURE LINES

with J J Clessa

Some of you have protested that I haven't been allowing enough time for you to work out your answers and get them to me! So last month I extended the deadline to 31 August, which means that I can't announce a winner now for Puzzle No 12.

Quickie

There are eight oranges in a box. How can you divide them between eight people so that each person gets one and one orange is still left in the box. The oranges must not be peeled or cut. As usual, no prizes for this one.

Prize puzzle

I've been told on numerous occasions that the problems aren't tough enough - well, here's one which should bend a few micros.

a. Which 10-digit perfect square contains the most zeros? b. Which 10-digit perfect square contains the most nines? c. Which 10-digit perfect square contains the most ones?

I want ten answers please, for the digits 0 through 9. If more than one perfect square is possible for an answer then any of the possibilities will be accepted. Your answers please on a postcard (letters are filed in the bin instantly) to Puzzle No. 13, PCW, 14 Rathbone Place, London W1P 1DE, to arrive by 30 September.

Prize of the month

Sorry to be so boring, but this month I'm giving away a book token.

BLUDNERS

Quite a few this month, starting with two algebraic errors in July's "Computer Games". Michie's formula for evaluating the discernability of a chess player should read:

$$d = (M+1)$$

and Box 3 should read:

Probability of opponent calling bet = p

Probability of opponent not calling bet = 1-p.

The address of acoustic-coupler supplier Anderson Jacobson Ltd., mentioned in last month's "Communications" has changed to 752 Deal Avenue, Slough, Bucks. And Peripheral Hardware is now at Armfield Close, West Molesey.

The suppliers of the Paper Tiger were accidentally omitted from our printer survey grid; they are Teleprinter Equipment Ltd of Tring and anyone wanting further details should contact Kaye Brooks on 044 282 4011.

Finally, our Stock Control packages review in July described Amplicon as originators of a package for the PET. In fact, although Amplicon sells the package, it originates from Anagram Systems, 9 Michell Close, Horsham, W Sussex, tel: 0403 68601.
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* FDM 180 Disk Unit. Micropolis Disk Drive, plugs directly into
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</tr>
</thead>
<tbody>
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<td>Nominal Ledger</td>
<td>CP/M</td>
</tr>
<tr>
<td>Sales Ledger</td>
<td>MP/M</td>
</tr>
<tr>
<td>Purchase Ledger</td>
<td>MBasic 5.0 (CP/M) Interpreter/Compiler</td>
</tr>
<tr>
<td>Payroll</td>
<td>CBasic (II) Interpreter/Compiler</td>
</tr>
<tr>
<td>Incomplete Records</td>
<td>Fortron 80 Compiler</td>
</tr>
<tr>
<td>Word Processing (Wordstar)</td>
<td>Cobol 80 Interpreter/Compiler</td>
</tr>
<tr>
<td>Mailing Address</td>
<td>Pascal 8 (UCDS) Interpreter</td>
</tr>
<tr>
<td>Etc.</td>
<td>Z80 Macro Assembler</td>
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<thead>
<tr>
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<th>RAM</th>
</tr>
</thead>
<tbody>
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<td>Z80 Starter Kit</td>
<td>Dynamic RAM 16K - 64K from £205</td>
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<tr>
<td>SBC100</td>
<td>Static RAM 8K - 64K   from £95</td>
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<tr>
<td>SBC200</td>
<td>Memory Manager        £52</td>
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<td>from £130</td>
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<table>
<thead>
<tr>
<th>EPROM</th>
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<tr>
<td>2708 EPROM (16K)</td>
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<tr>
<td>2708/2716 Programmers from</td>
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<td>IEEE 488 Interface</td>
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<th>DISC CONTROLLERS</th>
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<td>Versafloppy S/D</td>
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**CREATE**

KCS="CREATE O:MAILFILE.120.15.1: SYS 24600"

This example tells KRAM to create an indexed file called MAILFILE on the disk in drive zero, with a record length of 120 characters and a key length of 20 characters which starts at position 1 of the record. KRAM looks at the reserved KCS keys to identify the function and its parameters; the call tells KRAM to execute the function. The record length can be any value up to 254 characters and the key up to 48 characters, a total of 302, KRAM packs as many records into the 255 character disk block as necessary.

**OPEN**

KCS="OPEN O:MAILFILE": SYS 24579

This tells KRAM that we will want to make accesses to the file called MAILFILE on the disk in drive zero. KRAM returns in location zero (peek (0)) the file number by which this file can be accessed during the rest of the program.

**ADD**

KCS="ADD 1.NAS,ADS": SYS 24591

This tells KRAM to add to file number one the data in variable ADS whose key is NAS. For example in a mailing list, the key NAS might be the name 'SMITH A.J.' and ADS might be the address '120, HIGH STREET, ANYTOWN'. Any normal double character string variable can be used to denote the record.

**READ**

KCS="READ 1.NAS,ADS": SYS 24585

This tells KRAM to read the data belonging to the highest key following the name in NAS, and put it into variable ADS. In our example, a complete file of names and addresses could be read in alphabetical order, starting at any name in the file, simply by executing successive READ commands! For instance, having got Mr A. J. Smith from file, executing the READ command as above would get us say 'SMITH A.J.' in ADS together with his address in NAS.

**PUT**

KCS="PUT 1.NAS,ADS": SYS 24588

This tells KRAM to rewrite to file number one the data in variable ADS which belongs to key NAS. For instance, if we wanted to change Mr A. J. Smith's address, we would simply set NAS equal to 'SMITH A.J.' and ADS equal to his new address, and execute the PUT function.

**DELETE**

KCS="DELETE 1.NAS,ADS": SYS 24594

This tells KRAM to delete from file number one the key contained in NAS and its associated data contained in ADS. In our example, to delete Mr A. J. Smith from the file, we would simply set NAS equal to 'SMITH A.J.', ADS equal to his address, and execute the DELETE function. KRAM will release for further use the disk space made available by the deletion.

**CLOSE**

KCS="CLOSE 1": SYS 24597

This tells KRAM that file number one is finished with for now. KRAM updates the BAM on disk, but the file can still be used without another OPEN command.

**INITIALIZE**

SYS 24600

This function is used at the beginning of each program to clear KRAM's work areas and buffers.

The examples above illustrate the use of KRAM in a mailing list application, with disk access times from less than one second. KRAM can of course be used in any application program with the Commodore disk drive where programmer time, user time and disk space are at a premium.

Each KRAM package includes a ROM which plugs into the middle ROM socket of the 16K/32K PET, a demonstration disk with a mailing list program and a 40-page User Reference Manual. KRAM is available by post (cash with orders) at the reduced prices shown below. Also sold separately at the bracketed prices. Add 15% VAT. Modular and power supply kit £17-95 ($11). 4K extra RAM £20 ($24). Display expansion kit approx 30 lines x 54 characters £15 ($20). Case £25 ($32). Colour conversion board fully assembled £45 ($45). Cassette recorder £15 ($24). Superscript 800MST printer £599 ($599).

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This month's Interesting Idea: an ingenious use of a bar code reader for inputting Basic command words, speeding up program-ming immensely. If the pioneer would like to contact us, we'd most be interested... Who are Diego Rincon and Halina di-Lallo? Persons who exist at all and this scramble these anagrams? Who'll be the first to un-lock...? who, like he'd get on well with the HB supremo in this country is Steve Bernard, a one-time mobile disco DJ — sounds like he'd be on well with ex-DJ 'Spangles' Cary of Comp Shop...Talking of Comp Shop, have you noticed their ad for refurbished ZX80s? Already!?...
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