Australian Personal Computer

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AUSTRALIA'S TOP SELLING COMPUTER MAGAZINE

IBM's PC Junior — Exclusive Benchtest!

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Equation solving

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Robotics is here

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Australia is fortunate to be able to adopt the entire project without change — and to enjoy all the future developments. For the BBC Computer Literacy Project is ongoing. It will still be with us in the 21st century.

Of course, you are probably aware that Barson Computers were selected to distribute the BBC micro in Australia and New Zealand because they have the desired technical expertise, and are capable of giving BBC Microcomputer users a very high level of support indeed.

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When the BBC was assigned the task of producing a computer system for education, serious criteria were also established for the development of software which would form the basis of education today, and on into the 21st century.
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Computer Learning
First Fleet Database. Factfile. Databas. Tree of Knowledge Graphs and Charts. Utilities 1. Lisp. Forth. The Classroom Micro and You. Curriculum and the Micro. Building Ideas. Keeping Learning. Home is where the chip is. Peeko Computer. The Computer Programmes 1 and 2. Acornsoft BCPL. Microtext. Bas. Procvar/Proc Flush/Proc Aid Computer procedures. Sort M/C. Sort Bas. Tas Logo. Search Bas.

Games and Educational Games
Fun With Words. Doctor Who. Fun Games. Philosopher's Quest. Monsters. Sphinx. Superlife. Adventure. Games of Strategy. Pirates. Snapper. Planetoid. Katakombs. Rocket Raid. Meteors. Super Invaders. Arcadians. Arcade Action. Games of Logic. Sliding Block Puzzle. Missing Signs. Cube Master. Chess. Time. Sailing Ships/navigation. Campaign 1346. Disraeli 1875. Castle of Riddles. Starship command. Missile Base. Snooker. Draughts. Reversi. Superlife. Battle. Cards. Hangman. Banner. Distances. Flags. Statpak. Countdown to Doom.

Graphics and Graphics Teaching
Shape Maker. Graphs and Charts. Creative Graphics. Eureka. Bar Charts. Moving Modules. Technical Drawing. Picture. Creative Graphics on the BBC Microcomputer.

General Educational Subjects
Educational I, Educational II. Results Analyst. Home Finance. Record Keeper. Desk Diary. Motorway. Farm Resources. Hill Railway. Rice Farming. Water on the Land. Prospecting. Light. Speed and Light. Urban Growth Stimulation. Urban Welfare. Census Analysis. Population Dynamics Transport/Manufacturing Location. Police.Diet. Map Skills 1 & 2. Balance Your Diet. Density and Circuit. Electrical Circuit.
Symbols to Moles. Lenses. Approximation, Estimation and Standard Form. Longitudinal Waves. Climate. Compass and Bearings. Yacht Race.

French
Respondez. Comprenez.

Logical Thinking
Venman. Vennkid. Shape. Gate. Watchperson. Spanish Main. Cat and Mouse. Logic Games. Concentration.

Language Arts
Early Learning. Word Hunt. Word Sequence. Sentence Sequence. Unscramble Spell. Pattern Recognition. Quiz. Anagram. Box/Wordshape. Dictionary Game. Vocabulary Practice. Hang the Man. Spelling Test Creation. List of Spelling Tests. Vocabulary Tester.

Mathematics
Fractions. Tables. Number Balance. Number Sequence. Maths Topics 1. Ultracalc. Algebraic. Manipulation. Trains/Arithmetic. Snap/Fractions. Ergo/Arithmetic. Morless/Number Concept. Abacus. Moving Modules. Multiplication. Speed Drills: Addition, Subtraction, Multiplication and Division. Read Speed Drills. Clear Speed Drills. Dice Addition and Subtraction. Long Multiplication. Area and Perimeter. Factor and Base Games. Equations, Pythagoras and Directed Number Games. Pythagoras Rule. Processes. Skill Counter.

Music
Music. Advanced Music.

Sciences
Evolution and Natural Selection. Particle Scattering. Genetic Mapping. Enzyme Kinetics. Homogenous Equilibrium. Gas Chromatology. Organic Synthesis. Decomposition. Sulphuric Acid. Synthesis of Ammonia. Element. Formulae. Gas Laws. Rates of Reaction. Reaction Kinetics. Compound Identification. Diet Analysis. Organic Analysis. Plant Competition, Photoelectric Effect. Mass Spectrometer. Planetary Motion. Gravitational Fields. Capacitor Discharge. Gaseous Diffusion. Radioactive Decay. Electric Impedence. Acoustics. Collisions. Momentum. Alpha/Range/Fraun/Decay. Chemical Analysis. Chemical Structures. Chemical Simulations. Atomic Structure/Equilibrium. Projectiles. Satellite Orbits. Orbits and Alpha Scattering. Exponential Growth and Decay. Alphafoil. Nuclei. Gravity. Quantum Shuffle. Random Walk. Ampere. Millikan. Malthus. Watts in Your Home. Moving Molecules. Photosynthesis. Metabolic Pathways. Wave Motion. Transverse Waves. Interference and Diffraction of Waves.

Spatial Perception
Shape Builders. Shape Shooter. What Shape. Axes of Symmetry. Crash. Perspective.

Word Processing
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Note: The above describes existing cassette or disk software by title or content, and is a partial list only. Additional teaching aids including books, audio and video cassettes, tutors and OHP's, are all part of the BBC Computer Literacy Project. Software by Australian and International publishers and developers: Acornsoft, Advisory Unit, Cambridge Educational Software, Edward Arnold, Golem Software, Heineman, Input, Longman, Micro Primer, Passionfruit Software, Tas & WA Education Departments.

BBC MICROCOMPUTER / **BARSON computers**

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inside

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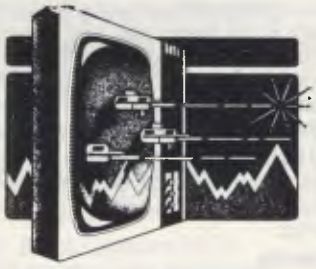
REGULARS

PC Junior: Exclusive Benchtest of IBM's entry into the home market begins on page 26.



APC

Volume 5, Number 3, March 1984

FEATURES AND SERIES

Try our memory tester on page 70.

Losing yourself in tape? Turn to page 166 for some helpful advice.

BENCHTESTS & REVIEWS

FREE SCREEN CLEANER NEXT MONTH

N·E·W·S·P·R·I·N·T

Guy Kewney reports from Las Vegas on micro innovations and trends at the Consumer Electronics Show.

Showtime

The Consumer Electronics Show, held in Las Vegas, (from now on 'CES') is not fun, in the way that the *Australian Personal Computer* Show is fun. It isn't even fun in the way that Comdex, the biggest computer show in the world, was fun last November.

CES is full of video people, video porn, audio amplifiers, car stereos, solar-powered helmets with little fans (no, I'm not joking) to cool your sweaty brow, telephones, telephone diallers, satellite TV dishes, CB radio, video games and, finally, a couple of computers.

I shan't come again.

Commodore gave me a two hour sermon instead of a press conference, and announced a machine I wouldn't have crossed the room to see, never mind the world. Atari showed a few 'new' games. Mattel showed a pair of 3-D yellow spectacles, which wouldn't stay on my nose, but did give the illusion of depth with colour. Coleco told us that there were no defective Adam computers, and was rewarded with raspberries.

The atmosphere is thick with gimmickry and 'sexploitation'. Penthouse 'Pets' sign pictures of themselves (fully clothed) and give you a copy of the magazine, as an attraction on some stands (where as a result, you can't see what's on the stand). Scantily clad 'merchandising' girls hand out bumpf about trivial products that were launched six months ago, or may be launched in six months' time.

The only interesting thing, really, was games software.

The computer games business, on the evidence of what I saw, is not about to take off on a new upwards curve of inspiration and innovation.

The old tired formula still applies: find an arcade game, some kind of blob-chaser with a new script, and transfer it to a computer with new rules, slower action, shapeless graphics and fuzzy colour.

Data Soft showed some understanding of the need to move away from this: time will tell whether the recipe can be brightened up by following film scripts, pop groups, TV comic characters, and so on.

And a final moan: once again, my attempt to use electronic mail as a way of sending stories to you failed.

Over the past three years I have had two computer failures, one mail system failure, two modem failures, three failures to find plug-in phone sockets, and, in every case, a total failure of the industry to provide support.

And the thing that frightens me is: if this is the way I feel about the technology — an enthusiast, with some minor technical know-how — what on earth is the average office administrator going to do when faced with this sort of technical cock-up?

I think the trip to the US was encapsulated by my visit to Apple.

I watched Steve Jobs talk, brilliantly and fascinatingly, about the future, and about the need to attract that huge group of non-innovative buyers who would use a micro if it took less than two hours to learn.

I watched Macintosh do graphics, make sounds, and display text and figures at the twitch of a mouse's tail.

And then I watched the terminal emulation demonstration, run by an expert. He logged onto an IBM mainframe, pretending to be a 3278 terminal. Then he tried to switch to being a simple remote TTY on a timesharing service — and he totally failed.

Prism may think this is the year of the Androbot but Hubotics Inc seems to reckon that the whole point of having a robot is to watch television.

It would be nice if the vision of the future had seemed more real. When it appeared in the aisle of the CES exhibition hall, It didn't.

This picture of the Hubot (demonstrating the robot conspiracy to deprive humans of their digits by distracting them during hazardous operations), doesn't show the owner trying to get the fluff out of the vacuum cleaner under him. It doesn't show the family fighting over whether he should turn his radio on, or display a TV program, or run 'the latest video game' — all ideas from the promotional literature.

'You may think this is something out of the book 1984', concludes Hubotics wittily. 'Well, 1984 is here, and so is Hubot.'

At $3500 for a mobile cheese-board, who cares? Hubotics is on (619) 438 9028.

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In 1981, Osborne Computer Corporation created the concept of portable, low-cost personal business computing. Quite simply, it was a revolutionary change in the way people go to work.

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The Executive was designed, built and priced with one objective: to increase your productivity. It is a tool to help you move ahead quickly in your business or profession **now.**

The Executive is delivered with the hardware and software tools you need to go to work right away on the jobs you do for hours every day. With enhanced hardware and software, the Executive is designed to make the Osborne concept of personal business computing even more attractive.

It's the next logical step.

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It's an investment in your own scarcest resource: thinking time. It lets you put the time you save on mundane chores into creative, "bottom line" tasks.

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At the same time, your secretary is freed to do more useful "assistant" work, while you achieve polished, finished text with total control and privacy.

Letters, memos, reports, articles, copy, ideas – will improve dramatically. They'll take less of your time and minimise interruptions. They'll go out faster. Your time becomes more effective, you become more efficient.

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Two powerful BASIC dialects — MBASIC™ and CBASIC™ come with the Executive. if you have studied a little programming, you'll know the power of these two languages. If you haven't, you may find them useful for business application software and a wide variety of learning programs that will introduce you or your children to the fundamental power of the computer.

Do you work with numbers?

The Executive and SuperCalc™ replace your calculator, paper and pencil with the accuracy and unflagging attention of a speedy, dedicated machine.

Remember the last schedule, forecast or budget you did by hand? Now imagine laying it out without having to add any numbers across or down. Think how fast you could work if changes made in one month's allocation were reflected instantly across the entire spreadsheet.

That's what the Executive can do with SuperCalc.™ It works just as easily on a single column of figures, a complex budget forecast, trend analysis or research report.

Everything you do with numbers can be saved on a diskette for later review or revision. Or it can be run out on your office printer.

Do you want to get organised?

The Executive includes Personal Pearl,™ a powerful database manager. Using your Executive, you can now file, organise and find all sorts of information. Quickly. Easily. All you do is enter the quotes, name and address lists, market data, or whatever, by filling in simple forms on the screen. Forms you specify yourself.

The Executive will sort it all out and store it in a way that lets you find it the first time you look. Fingertip efficiency that is infallible.

It's a personal electronic filing system, address book and calendar pad all wrapped up in one. You can instantly get your hands on facts that used to be jumbled up in a file somewhere. And you need never again call a phone number that's been changed. Change it once and it's instantly changed everywhere in your own personal database.

Lots of memory to work with

The Executive has 128K of user memory, making it extremely quick, a useful attribute when you're working with number-oriented tasks or sorting through data files. Expanded memory also lets you add more rows and columns to your spreadsheets than ever before – extending the range and power of the SuperCalc™ program considerably. The two disk drives store 200K each, which means you can have about 60 typed pages of word and number information at your command on a single disk.

Terminal Emulation (optional)

Most large companies have vast stores of information full of facts that would be useful to the executive . . . if you could only reach them.

The Osborne Executive lets you plug into your company's computer system. In many cases your Executive can function with your main computer just like one of its own terminals.

EXECUTIVE™

Limited Offer
Software worth $3500 all included in price

Includes complete & simple instructions for all hardware & software

$2750.00
(Plus Freight to your Destination)

Say hello to the information age!

The most exciting development in personal business computing is the telephone. The Executive COMM-PAC™ option lets you plug your Executive right into the telephone.* To let you access and control information electronically.
Now you can enjoy instant access to an even wider world of information . . . latest stock listings, news reports, newspaper clipping files, commercial research services . . . the list grows daily.
And you can begin saving time and money with electronic mail. You can exchange files and information with other Osbornes – even other computers – over the telephone lines. Just imagine the advantage of sending a twenty page document anywhere in the world in a matter of minutes!
*Subject to Telecom approval

Newest and best operating systems

The systems that manage computer operations are continually being improved. The Executive includes two different operating systems: CP/M Plus, a new and easier-to-use version of CP/M; and the UCSD p-System, which has recently become an industry standard.

What this means to users is that a vast library of applications tools designed to run with CP/M or p-System computers is available to you. CP/M and p-System software from Osborne and a number of other sources can help you accomplish almost any business task you can imagine.

The bottom line

If quill pens were the state of the art and someone showed you a ballpoint, would you learn how to use one?
If letter-writing was the way business was done and someone told you about the telephone, would you investigate it?
If typists and filing cabinets and mounting postage bills are the bane of your bottom line and someone told you about an inexpensive investment that could set you free to do what you do best, would you check it out?

Your Executive productivity investment goes where you go

Because the Executive is portable, you never need to work without it. And you'll quickly find you don't want to work without it.

N·E·W·S·P·R·I·N·T

He changed the parity. He switched baud rate. He added start and stop bits. He re-booted. He re-dialled. He got garbage on the screen. And then, when I suggested that terminal emulation had some way to go before it matched Macintosh's other friendliness, he got sore. 'Why do you say that?' he asked me.

He was so used to that sort of foul-up that he didn't even notice how bad it was.

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Out of touch

The first MSX computer (after the Spectravideo, of course) to be seen in America, appeared on a Japanese company's stand: Daewoo.

It wasn't working.

A working system, said salesmen, would be around in April, and the price was today's guess for America. No, no idea of plans for other markets.

And it was clear that plans have not even been started. The idea of PAL colour encoding was 'unnecessary' the company said.

Boy, are they in for a surprise.

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Standing up to pressure

Atari surprised nobody with a computer, as the boss James Morgan had promised back in November.

Morgan went on record as saying that Atari 'will produce new products in 1984, but they won't be ready for the CES.' Sure enough, they weren't.

However, the impression gained on the stand was not of a company about to close down computer operations.

For one thing, there was a lot of software, from Atarisoft, not just for Atari machines.

In America, commercial interest focuses on the video game VCS box, rather than the computer. And much of Atarisoft's stuff runs on equivalent games boxes.

But Atarisoft has also done a deal in the educational market, through the Children's Computer Workshop. The name may sound familiar: it may remind you, perhaps, of the *Children's Television Workshop*, producer of the Muppet-infested *Sesame Street* programme. And indeed, the 'workshops' are linked.

People expect Atarisoft to be a success. This doesn't altogether please Atari executives, who are now starting to see the new version of the old Atari 800 computer (it's now the 800XL), and its baby brother, the 600XL, emerge from the factory.

The reason they aren't pleased is that people assume the success (still not proven) of Atarisoft will be at the expense of the hardware side. In other words, they expect the computer side to be closed down.

Machines on which Atarisoft runs fuel this speculation: they run on Atari of course, and also on VIC 20, Commodore 64, TI 99/4, Apple II and IIe, and the IBM PC (and Junior, one day).

These are all seen as competitors whose chances Atari must rate as higher than its own. The argument is false, but a lot of people seem to believe it.

And since Commodore is universally disliked by dealers here (because customers won't let them sell anything else) and Texas is out of the business, they seem to assume that Atari can't keep it up.

This wouldn't matter: what matters is that Wall Street financiers agree. They give quotes to local papers saying that Atari would attract more finance if it dropped hardware.

Nobody knows what the future holds, but Atari is insisting that it has gone through the worst, and is not going to quit after suffering all that pain.

'We spent too much,' said Morgan (the boss) 'but that has been purged out. We are a company that has bottomed out and is on the way back. For somebody to walk out of the business now would be crazy—the opportunity is too great.'

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Link up

If electronic mail is to be the next consumer boom, then somebody has got to start making sense on the subject of that vital link between computer and phone system—the modem.

Anyone who has an idea in this market appears to start from scratch, with their own genius.

The irony was marvellously illustrated at the CES, where I carried a portable computer with terminal emulation software around, testing modems on people's stands.

Only one modem out of ten actually worked.

Oh, they all worked really, just not with my computer.

One had a standard RS232 plug. It had a 'male socket'. I call a male socket a plug, not a socket, but whatever you call it, you can't plug another male plug into it.

The market seems to be turning towards integrated modems.

That makes all the sense in the world. Firstly, the modem can be driven directly by the central processor, without having to worry about what somebody's software may do down the RS232 lines, or what somebody's hardware may require.

And secondly, it can do things like dialling, answering the phone and driving a loudspeaker if the computer on the other end turns out to be a puzzled human being with a wrong number.

Commodore claims to be 'a leader in communications' on the strength of having sold more VIC modems than anybody else, and that shows the strength of the company's plan.

Coleco, with the Adam, has come up with a deal with AT&T—the American telephone authority—which will lead to a Coleco modem designed with AT&T's blessing.

And deals are also being done with bulletin boards, like The Source.

But the stand-alone modems are still around, from the Mura $60 box to the Zoom Apple add-on.

And some of them are using slightly new technology.

Two of the devices were 'phone powered' which sounds wonderful.

Normally, your modem has to plug into the mains, or have batteries. There are many reasons for this, but primarily they fall into two areas: first is that the standard computer RS232 doesn't provide power, and second, the phone company likes things to be isolated from its lines.

But the trouble with isolated systems is that the computer doesn't normally use them. Usually the computer can tell what is going down the line electrically, but optically isolated modems don't have the power to provide this. Instead, they use a 'Data Terminal Ready' signal.

Sadly, the computers seldom look for this signal,

FLEXIBLE DISCS

Question: *Is your Data safe?*

Answer: *It is with*

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Stand No. 304

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Sydney
14-17 March 1984

SYDNEY: 02-9082211 MELB: 03-2672955

N·E·W·S·P·R·I·N·T

so they never get the message back. Write-only electronic mail is the result. Not much use, even at $80 for the modem.

For $250, you can buy a complete system with keyboard and modem, just for accessing bulletin boards. Quazon (of Carrolton in Texas) announced a Quik-Link 300, at that price, which will connect to The Source, Dialcom (BT Gold), Compuserve, and so on.

This has a horrible flat pad keyboard, and its only obvious virtue is the fact that the software is permanently loaded, and you don't have to understand electronic mail to use it. On the other hand, you can't use it for anything else.

Quazon of Carrolton in Texas has no European launch plans.

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Bright future

Rivals of the PC Junior (see exclusive Benchtest in this issue) now use its high price as proof that they (the rivals) are going to stay in business — but the electronics industry is paying no attention to their scepticism. The electronics industry is setting up to manufacture colour monitors.

Both the IBM PC and the PC Junior use a strange colour output, which does not have full brightness control (TV monitors use full brightness). Neither, however, does the IBM use the simple 'off or on' brightness of most computers. Instead, it has a half-on option, giving more colours.

Many of the cheaper TV monitors won't work without expensive extra circuitry, and this obviously attracts the TV monitor makers, who can undercut that, but still charge a premium over their standard products.

So naturally, they are looking for proof that PC Junior will sell and sell and sell.

Forecasts of sales by these people point to nearly a million Juniors going into American homes this year.

This doesn't directly concern Australia, yet. PC Junior won't be in Australia until later this year, and will be rare and expensive then. And US colour is not the same as Australian colour.

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Power to the robots

Robots are 'nicer than computers', according to one robot company. So, instead of having computer terminals to sell things, why not use robots?

Cleverly avoiding the question of 'Why not use humans?', Robot Entertainers has launched QT to do things like collect market research, take orders in hamburger bars, and so on.

The publicity blurb is purported to be written by QT. 'I am a robot,' it starts. 'Our army is marching on the USA to attack funny bones everywhere. We inflict pain by making people laugh until it hurts.'

Invasion plans, says QT, are simple. 'We have brainwashed our inventor into renting us so cheaply that even the hot dog vendor will want us. Earthlings love to play with our computer panel and watch us talk and move.'

I suspect that QT is going to get his cute little keypad bashed, but for those who are obstinately determined to put things which can be vandalised in public places, Robot Entertainers is contactable on (213) 700 8287 at Chatsworth, California 91311, address 9720 Topanga Canyon Place.

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Stocks and shares

Games software produced several surprises at the CES. Not least of these was the appearance of Hewlett Packard with its HP-150, and coupled with this eyebrow-lifter was the appearance of several games programs for the IBM PC (which HP-150 closely resembles).

Examples of IBM software included normal arcade games — but one which might attract more attention

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is a game called Wall Street.

'It is a competitive game of financial speculation,' said Timeworks, the company which launched it. 'You have $1m to invest that will put you on Easy Street, or in the Poorhouse. If your cash is running low, your banker or another player may give you a loan, but the interest rate may be very high. A financial adviser may be available, but he costs, and he isn't always right.'

Timeworks attracted my attention with a special offer, by the way, to Commodore 64 users who have bought the company's tape software and want to transfer it to disk. For this 'service' it is asking $4 plus 70 cents handling.

H-P's appearance is not just a whim, however. The 'software acquisitions' executive in charge of this monochrome screen only, no joysticks, expensive business system assured me that there was no plan to turn it into an arcade machine.

'But we are going to get in touch with people who have done good games, and get them on the 150,' she assured me. Sensible strategy, I say.

In the old days, radio freaks used to tune slowly through the dial, marking the glass with the name of interesting broadcasting stations (such as the Police transmitter, or a Coast Guard wavelength, or an airline flight control frequency).

These days, however, the enthusiast uses a scanner radio, connected to a Commodore 64 computer. When you want a frequency, the computer selects it. When you get there, the computer displays a description of what it is (or should be) based on what it was last time.

It is called the Bearcat Compuscan scanner radio. Radio, computer and software, cost $500 from Electra Company, on (317) 894 1440.

Pioneers they may have been: Sierra Online's release of new games at the CES was disappointing to the point that many visitors declared the company had nothing on the stand.

That wasn't altogether true: HomeWord (see Checkout in this issue), greeted in preview a few months back as 'wonderful' is a word processor that imitates the good features of Apple's LisaWrite. It's easy to use, and if LisaWrite was easy to use at the expense of being powerful, then this suffers from a similar drawback — but not everybody wants the most powerful word processor imaginable.

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The only 'home entertainment system which uses its own screen and uses vector scan display technology' now has a light pen.

Vector Scan means that the electron beam actually writes, like a pen, around the outline of the image displayed, rather than scanning parallel lines down the screen and filling in the bright bits.

Vectrex uses this method, which can't be done on an ordinary TV or monitor, so it has to have its own screen.

The light pen makes it a sort of 'touch sensitive' display, which Vectrex thinks will help with more creative games. Examples are the Art Master game cartridge, supplied free with the $40 pen, AnimAction (you draw things, and make them move around the screen, yippee) and Melody Master, where the light pen is used to select notes.

There is also a geography teaching program.

Vectrex comes from General Consumer Electronics, on (213) 458 1730.

Bicycle riding is dangerous, but good exercise. Exercise bicycles are safe, but boring. So Exus Corporation has bought the Exer-Bike game which first appeared at the West Coast Computer Faire last year, and launched it for $69.

It's an obstacle game, which doesn't work unless you pedal. Then you have to dodge trees, people, buildings and animals and keep going for as long as possible. No cheating on how far you 'travelled', either.

And a jogging mat, which counts the number of steps you take running on the spot, is also available at $99.

They run on Atari computers now, but Exus says other machines will be used, too.

The only frightening thing about this neat idea is the man behind it. George C Coakley, president and chief executive officer, is the man who dreamed up the original 'pet rock' fad.

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Persuasive talk to save Osborne

So, as Adam Osborne predicted, the company was revived, and before Christmas too.

The genius behind the scheme was Ron Brown, head of international operations who persuaded creditors that they would get more out of setting him up to run the company, than from selling off the components.

Key to his proposal was the amazing support of the US and other Osborne user groups.

They have gained the right to buy Osborne 1 models direct from the factory, and to distribute them — something they are well qualified to do, as enthusiasts. As an Osborne enthusiast myself, I understand why they feel they have a good story to tell. The machine is still far quicker than any big-selling rival, and far more capable of expansion than duller 'improvements' like the Kaypro.

My own system has just been enhanced by the addition of a RAM-disk — nearly 400k bytes of memory, pretending to be Drive C: under CP/M. If you want to see speed, use Drive C: — it's amazing!

The question, however, is not 'Will enthusiasts continue to like the One' but 'Will anybody else really be distracted from the choice between IBM, Sirius, Macintosh or Sage?'

The new Executive and the possible Vixen are the answers so far. The Executive now has available an add-on board to turn it into a portable IBM machine 'more compatible than the Compaq' according to Osborne sources. The Vixen will be (one day) a much more portable version of the One.

For the future, the hopes of the company rest on Ron Brown's ability to buy designs in, and put the Osborne badges on. There are lots of innovations coming onto the market, and bearing an Osborne label, they could do well. On the other hand, bearing a Tandy label, they might do better.

Adam himself, oddly enough, remains on the board of the new company, as chairman. How long he plans to do this is a mystery, which will no doubt be resolved before the question of how the company will fare.

Lovers of Adam's style of self-doubt will treasure his latest snippet 'My mistake was simple, the one thing I should not have done was to step down as president of the company, and hand over to Jaunich', he said

As to whether Adam would really have coped better than Jaunich, I prefer not to offer an opinion. That Jaunich was plunged into a job which he simply wasn't equipped to handle, I don't doubt at all. And Adam's theory: 'Jaunich was trying to step back and get a look at decisions which were already overdue when he was asked to make them, and things were just not getting done,' is certainly true.

But the real crunch was the chain store crunch and that is going to hurt bigger people than Osborne over the next couple of years.

Guy Kewney

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IBM Clusters

IBM has a couple of new PC products. The first is a portable PC weighing 30lbs and measuring 20 x 17 x 8 inches. It sells in the States (from March 1) at $2,795. In its basic configuration the machine features 256k of RAM, a 9 inch 80 character by 25 line amber monitor, a 360k disk drive, a colour/graphics monitor adapter, five additional expansion slots in the system unit and a carrying bag. A second disk drive can be purchased doubling on-line storage to 720k.

The IBM Portable PC can run standard PC software and can use most PC hardware options.

The second announcement is a series of hardware and software products to allow IBM PCs to be "clustered" together

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MSX units stand out in the crowd

by Serge Powell in Japan

Somewhere in the back of my mind I recall the science-fiction classic *The Day of the Triffids*, with scenes of madmen running amok in the streets screaming: 'They're everywhere, they're everywhere.' Accordingly, I'm writing this on that Japanese phenomenon, the MSX machine.

At least 11 manufacturers have taken the plunge, with some 17 models making the home micro scene as crowded as the Tokyo area beach on an August weekend. The major producer is Fujitsu, which claims the number three spot in Japan's PC market behind the leader NEC and second-placed Sharp; these two opted out of the MSX plan fairly early on, but a gaggle of others are following it through.

The cheapest current offering, from Fujitsu, is a unit called the FM-X which attaches to an FM-7 ROM adaptor. Another unit comes from Sanyo – the Wavy 10 – featuring 32k of RAM and a facility to draw freehand on to the screen via a lightpen, as well as some music programming.

Canon, a company better known for cameras and photocopiers, was one of the last into the micro field and it has chosen price and performance to make its offering stand out, aiming to lay out more for less. It costs $250, which puts it at the lower end of the MSX range (roughly $220 to $340) and it features an electronic typewriter-like keyboard, two slots besides the cartridge maw and a printer interface.

On the other hand Hitachi, already established as a computer maker, went straight for its target – schoolchildren – and included in its MB-H1 such features as a speed controller to let you slow down games or educational programs until you have the basic skills.

From the maker of musical instruments Yamaha come three units designed to function as the central processor of a synthesiser. With three models available, Yamaha is obviously intent on presenting itself as the supplier of the open option.

JVC has also opted to take advantage of its particular technical strengths with production of micros that interface especially well with video disk and cassette players.

Traditional innovator Sony, with its HB-55, has packed its unit with some original software that works as a single database for scheduling, addresses, messages *etc.* This system is billed as a computer secretary and I'm sure no home is complete without one.

Sony's equally traditional rival Matsushita might not agree, but its 16k RAM CF-2000 doesn't look like too much of a threat except for what must be a highly unusual keyboard – 'joystick-like cursor keys' is Matshushita's description.

Mitsubishi, the electronics giant that we all tend to overlook, has come in with a full array of peripheral devices including a RAM expansion board, a Kanji ROM, a small robot and other items. The CPU itself as 32k RAM which seems mundane by comparison.

Toshiba decided to come in big or not at all with its Pasopia range, and last but not least is General, which offers the PXR – a CPU built into the monitor/receiver TV that uses on-board electronics for game-playing but which requires you to buy a keyboard as an extra.

The point, you will have noticed by now, is that although at face value MSX sounds like a recipe for innumerable micro makers to churn out innumerable identical micros, what is actually happening is that they are all paying to their strengths. The result so far is a variety fo functionally compatible micros with different specialties.

It could be that somebody will scoop the pot by combining these specialties under one label. To do so would bump up the price for sure, but it would spare you the trouble of buying a new micro every time you want to do something significantly different. The purpose of MSX, after all, was supposed to be to encourage standardisation so that software driven functions would be interchangeable between machines.

Stay tuned for the continuing MSX story. Who knows where it will lead next? If it turns out to lead in any volume to the US, it could be The War of the Worlds instead of The Day of the Triffids.

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permitting the sharing of data, software and messages. Both 64 and 66 are suggested in the announcement from IBM as the maximum number of machines which can be connected together. It's probably one or the other.

Sensing the vastness of the small business market where one micro in a firm is insufficient, shared data is a must, and financial resources are limited, IBM has produced a less expensive 'Five-Pack' program to connect up to five PCs. A typical cluster might include five computers — a PC XT and four IBM PCs. The program licences, adapters and cable kits needed for this configuration would cost $2,540 in the US. IBM has also made provision for the new PC Jr to be connected to the cluster. So a diskless PC Jr (about $670 in the States) could be connected to the cluster as a workstation.

This, of course, would be very much cheaper than an IBM PC with disk. A configuration of one IBM PC XT for hard disk mass storage which could be accessed by four PC Juniors in a cluster should, assuming the availability of appropriate software, make great inroads into the small business marketplace. Excluding applications software such a five station configuration would sell for around $12,000 all up.

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Top marks to Sinclair

Amazing how, if you ride a hobby horse yourself, you can spot one a mile away on the freeway. That is why I got so warm and friendly towards Clive Sinclair's new QL number.

My hobby horse is concurrent operating software. A computer which has to 'load and run' one program, then unload, find the next program, load and run again, and so on, has no future.

Sinclair's computer has a future. Lisa has a future. Possibly even Macintosh has a future.

Clive's new QL, however, takes the prize. It is cheaper than the best of its rivals, and it can run, not just one, or two, or even three, simultaneous jobs, but ten, or even twenty (says Clive).

In the month when Apple and Sinclair both launched low-cost machines with a Motorola 68000 inside, most reviews will completely overlook this concurrency aspect.

Instead, you will read a lot of arguments about whether the 68000 is or is not a 16-bit or a 32-bit processor. people will discuss the relative merits of Clive's new Basic, compared with BBC Basic. And sages will debate the performance of the Microdrive, Sinclair's answer to costly floppy disks.

But a machine is not the Basic interpreter supplied with it. And it really isn't easy to say exactly what a machine is, nor (more important, sometimes) what it is not.

We can expect people to rave about the QL, on the strength, mainly, of its very nice SuperBasic. SuperBasic 'puts right all the things that are wrong with Basic,' said Nigel Searle when launching the QL, and what he particularly meant was 'the things that are wrong with the Spectrum Basic'.

SuperBasic is not just the programming language, but the command language for the QL operating system, QDOS(!). It does the job, with commands like GROW, of setting windows, controlling display modes and scrolling.

And it does provide some instructions which aristocratic programmers always ask for: especially in loop controls.

For example, the IF . . . loop test command now includes not just THEN, but ELSE, and ENDIF, to eliminate ambiguity.

REPEAT and ENDREPEAT, FOR . . . IF . . . ENDFOR, and SELECTION commands give extra loop controls.

However, the software that most people will see when they unpack their QLs will be the Psion-written stuff — word processor, spreadsheet, filing system and graphics.

These programs were demonstrated at launch. They impressed everybody with just how easy they were to use, and to modify.

However, the raving has all been over the announcement, not the reality — and you can bet that when people actually start getting hold of the machine, they will start finding fault.

Do the programs have the ability to share the machine? They can share data — or so we were assured at the launch — but can I actually run the QUIL word processor in one window, the spreadsheet in another and the filing system in a third? Or do they use common system variables?

Sinclair and Searle didn't know. 'Can't see why not', was their response, which means that they haven't tried.

Will these programs work without microdrive wafers in the slots?

Or do they need them there for overlays? What file locking mechanisms are there? If both spreadsheet and word processor try to adjust the same file, which wins?

In the long run, it doesn't matter.

Clive Sinclair's new machine is so cheap for its capacity that, supposing all these questions have the wrong answers today, somebody will see a way clear to putting them right within a year — and that just happens to be the sort of delay you can expect before the machine is launched in Australia.

Guy Kewney

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Olivetti LAN

Olivetti Australia has announced a new portable computer and a networking system for its M20.

The computer is the lap-held battery powered machine from Japan that Tandy and NEC are selling under their own labels. There's not much to say about Olivetti's version that hasn't already been said about Tandy's and NEC's (Benchtested in September '83 and January '84 respectively) except to mention that Olivetti's machine has an internal modem option.

The Olivetti stand at the *APC* Show will feature four M20 personal computers connected via a local area network (LAN) and running, as a demonstration, debtor, payroll, spreadsheet and word processing applications. The maximum configuration is 64 machines.

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Quantum leaps for CP/M?

Digital Research International has at last appointed a 'Master Distributor' in Australia. It's the Brisbane based firm, Arcom Pacific who will be demonstrating DRI's latest

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Arcom Pacific marketing manager, Martin Lack, (left) and product specialist David Johnson demonstrating DR Graph software on the NEC APC.

releases at the *APC* Show (which will likely be over by the time you read this).

Release 3.1 of Concurrent CP/M is as big a jump from the previous version as was the leap from CP/M to Concurrent CP/M. It supports, so the press release says, multi-tasking, multi-user configurations (replacing DRI's MP/M-86), networking capabilities as well as windowing in a variety of colours.

The multi-user capability should be demonstrated at the Show on ICL's new 16-bit colour micro. Other than colour support and windowing, this is not particularly newsworthy. Let's hope though that proper record locking is now provided. Ever tried to run a database on four terminals of the old 8-bit ICL multi-user system?

What is newsworthy is networking. Some months ago an announcement from DRI was met with scepticism. It read: 'Version 3.1 . . . will include multi-user support, high level network software, dynamic window management, the ability to run IBM PC-DOS applications directly, a high speed file system, the Intel 8087 maths co-processor support, shared code support, and GSX graphics as standard.'

The announcement containing news of Arcom Pacific demonstrating Release 3.1 at the Show was a little less direct. And the vagueness is worrying.

It begins with 'Concurrent

N·E·W·S·P·R·I·N·T

CP/M with windows is to be demonstrated . . . ', goes on to talk about Arcom's recent appointment as DRI's master distributor, mentions DR Logo, DR Graph, Concurrent CP/M Release 3.1 (but dives into a description of what a breakthrough older versions of Concurrent CP/M were), then slips in 'it allows, among others, multi-user, multi-tasking and networking capabilities'. And that's it! Probably the most important feature of 3.1 scores two words: 'networking capabilities'. How? Which machines? Which processors? Which networks? Having 'covered' networking, the release goes back to DR Logo, DR Graph and GSX.

If you think that release 3.1 is going to let you buy a system with a bit of wire to connect your Sirius to the boss's IBM PC and somebody else's Corvus Concept, then you are a lot less sceptical than we have become over the years. Don't get the idea that we doubt DRI's expertise. The company is caught up in one unfortunate aspect of the industry: product pre-announcement. One day the above network scenario will be possible. We just doubt that release 3.1 which 'allows . . . networking capabilities' will demonstrate this feature on March 14 at the 2nd *APC* Show. Let's hope we're wrong — and we'll be the first to tell you if we are — as Release 3.1 should see DRI maintained at the forefront in micro operating system sales.

➲➲➲

MEGS MicroBee giveaway

The Microcomputer Enthusiasts' Group of Sydney (MEGS) will be giving away a computer at the May meeting as part of a drive for new members. All those who are financial members of MEGS by 8.30pm on the night of the May meeting will be in the running for a chance to win the computer.

Donated by Owen Hill, of Applied Technology, it is a 32k I.C. Plus MicroBee, which is the personal communicator model, including word bee and networking facilities.

Meetings are held in the hall at the rear of St. Andrew's Presbyterian Church, 37 Anderson Street, Chatswood, on the 3rd Monday of each month commencing at 7pm.

Membership forms and further information is available at the monthly meetings, or by 'phoning the President, John Whitlock, at 638 1142; or the Publicity Officer, Jim Hooke, on 419 2568 (in both cases between 7pm and 9pm).

➲➲➲

'64 Multiplan

The third most popular spreadsheet in the US, Microsoft's Multiplan, is now available for the Commodore 64. Human Engineered Software, through a licencing deal with Microsoft, produced the Commodore version.

"This new version of Multiplan gives Commodore 64 users one of the finest worksheet options on the market," explained Phil Woolley, marketing manager of Imagineering.

"Among its many features, the program contains all the advanced Multiplan features, including built in arithmetic, financial and trigonometric functions, screen windows, variable column widths, alphabetic and numeric sorting, the capability to link work sheets, and flexible formatting for screen displays and reports."

Human Engineered Software's Multiplan package comes with a disk, manual and keyboard overlay, and retails for $149.00.

Imagineering distributes the product in Australia and is on (02) 212 1411.

➲➲➲

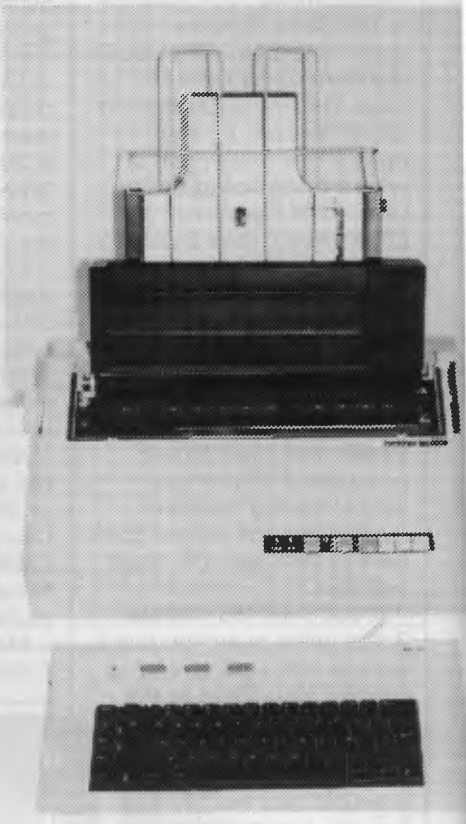
The Chieftan Series business micro has been launched in Australia under the name 'Prest'. It offers multi-user/multi-tasking capability using an OS-9 operating system which was developed by Microware System Corporation in 1980 in co-operation with Motorola.

The maximum configuration is 14 workstations and four printers. The computer itself has 128k of RAM, eight serial and one parallel port, and a range (from 1.5Mb floppy to 20Mb winchester) of storage capacities.

Prest Computers is in Sydney on 683 1557.

Rob's Computer

SOFTWARE SPECIALS



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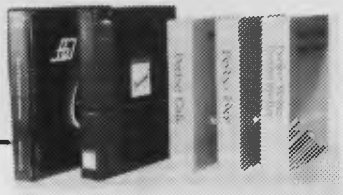
Produced by the same company as DBASE 11. This latest package is simple to use and has a brilliant manual — it can also read and write Data from DBASE II, LOTUS 123, or WORDSTAR etc.



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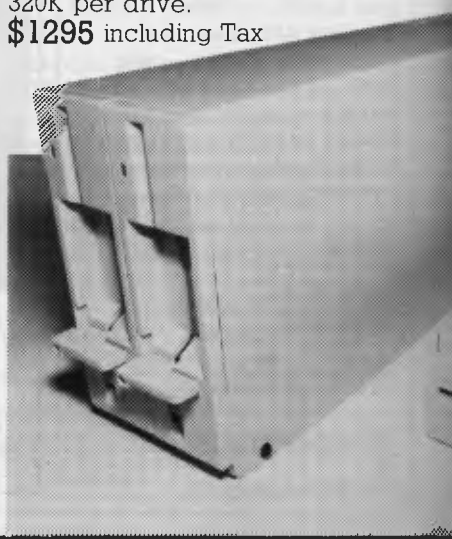

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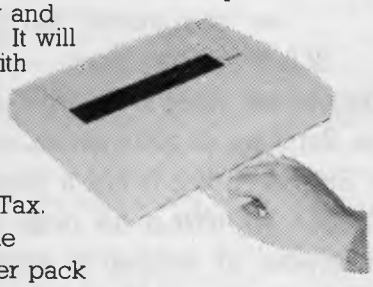

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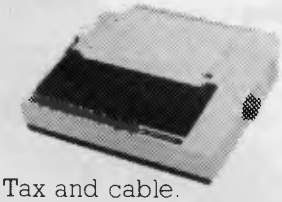

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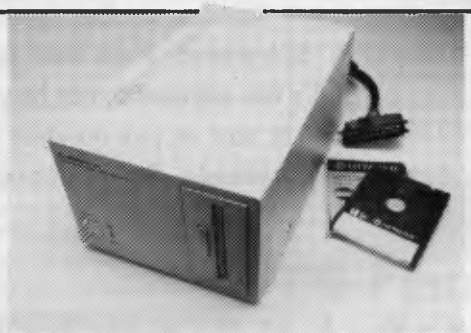

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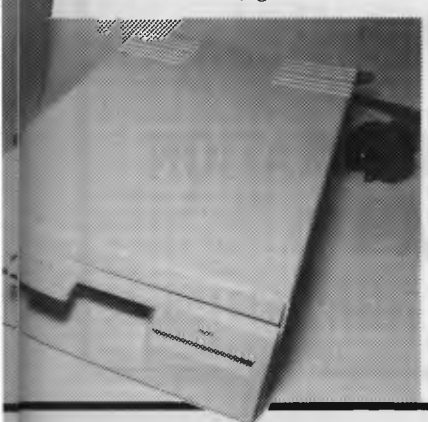

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N·E·W·S·P·R·I·N·T

Atari pins survival hopes on 800XL

By Chris Rowley in the USA

A weird little anxiety attack has been afflicting the US micro industry for the past month. 'Is Atari going down the tubes?' blared the front page of *Infoworld*, America's leading micro weekly. It may seem absurd to think that a company with 16 million video games and one million home computers installed in US homes could be allowed to just disappear, but the question marks continue to rise over Atari.

Will the 800XL sell strongly enough? International newspaper tycoon Rupert Murdoch is bidding to buy more shares in Warner, Atari's owners. What might Murdoch do if Murdoch could? New chairman James Morgan bravely rebuts the doomsayers and points to a revamped company which after a night of the long knives is free of the old fiefdoms and politics.

Even so, there is no hiding the anxiety at Atari as they wait to see what comes out of the courthouse door, Chris Craft (another company becoming involved with Warner) or the Bengal Murdoch.

Elsewhere the mainstream pundits keep chomping on Apple and predicting the Big Blue World. As though it is the only response open to them, the other manufacturers bend a knee, voluntarily or otherwise. When Coleco laid off 50 employees at its headquarters, Wall Street promptly slashed 15 per cent off Coleco stock, noting that on the Adam's slim profit margin 65,000 units a month was simply not enough to keep the banks at bay and meet the overheads.

At Commodore, smoke still swirls around the building after the eruption of Mount Tramiel. The common theme from Wall Street to the micor press is that Commodore will have a hard time coming up with son-of-64 and that by the last quarter of this year it will be squeezed ever tighter by the downwardly mobile Apple II, PC Jr, and a horde of predicted Japanese wonder machines.

The pundits also point to the number of specialist dealers who won't sell Commodore machines again, after being caught out in Jack Tramiel's great spring offensive of 1983, when he halved the price of the 64.

The dreaded IBM effect, as it limbers up its portable PC, will blow a chill wind through the corridors of Compaq, Eagle, and other IBM-compatible portable manufacturers. Prophets of doom are out in force with pronouncements on non-IBM-compatible micro makers. Articles and columns pose the question: 'How does a business machine break out of Catch 1-2-3?'

Lotus 1-2-3 is far and away the best-selling business software in the land. Hence the marketeers of business machines that can't run 1-2-3 have had remarkably little to do lately.

So you develop an IBM clone to cash in, since it can run 1-2-3, and you and your venture backers are soon honoured guests at your bank? Sorry, but dealers have all the IBM-compatibles they can sell. Unless you're spending megabucks on television ads to start customer stampedes, you can forget it.

So instead you develop a wonderful non-compatible system with 256k of RAM, 32-bit processing and so on; but it won't run 1-2-3. You'll have to pay the dealers on your knees to get shelf space.

And so to the vision of IBM world domination, formed by the unstoppable urge of American business to shackle itself to IBM's progress, which will lead to a day three years hence when all the businesses will be integrated blends of IBM workstations. In this scenario the sales of stand-alone micros for business customers will start falling back in 1985 and IBM will take control of the market after Apple goes bust.

All very gloomy stuff, but hard to believe in the light of new developments. This is the year of 32-bit chips, 1-2-3 faces hordes of competitors, and there are fascinating possibilities in mainframes.

The last word should lie with the hot-eyed brigade bravely soldering on — two professors at a Pasadena technology institute have wired 64 8088 chips into a 16in by 14in by 8in box called the Cosmic Cube and have developed software to synchronise the array to run up to three million instructions per second, for about $80,000.

➲➲➲

G-Pascal for '64

Commodore has announced that G-Pascal is now available for the '64 together with a games system.

G-Pascal is a subset of Pascal which once loaded from disk to cassette can be used to edit, compile and test programs continuously without needing further disk or cassette access.

G-Pascal contains 76 separate extensions to the Pascal range to support the Commodore 64's features as well as the important Pascal constructs. It can also compile at a speed more than 6,000 lines per minute and has a built-in Text editor which incorporates a find and replace capability.

Debugging aids include program trace, which can be invoked at any time, from the keyboard. The complete G-Pascal system occupies 16k of memory, leaving substantial room for programs and graphic effects.

Commodore states that "arcade-style games can be written without using a single PEEK or POKE or needing machine-code sub-routines."

Gambit Games is on (03) 497 1283.

➲➲➲

Dick's challengers

It looks like Dick Smith may have thrown the cat amongst the pigeons (in view of the high profile of the fight by Apple against clones of its Apple II) with the release of the CAT at the *APC* Show, an Apple II software-compatible computer. It sells for $699.

Also released at the Show by Dick Smith is an IBM PC compatible called the Challenger. Two versions of the machine are available: a diskless unit for $995 and the expanded machine with disks and bundled software (said to be worth $1800) for $1995.

Dick Smith Electronics is on (02) 888 3200.

➲➲➲

PC Junior

After months of evasion and secrecy, IBM has finally unveiled the PC Junior. Not yet available in Australia Surya reports from the States on IBM's long-awaited and portentous contribution to the home computer market.

After months of rumours and polite 'no comment' from IBM, the PC Junior — IBM's home computer — has finally been launched.

The machine was the subject of much speculation, some of it quite detailed, even before the company officially confirmed that there was to be a new IBM personal computer. Most of the speculators fell into one of two camps: those who believed the machine was going to be a scaled-down version of the PC, and those who felt that IBM had something completely different up its corporate sleeve. As things turned out, the scaled-down PC camp was about right.

The Junior differs from its big brother in a number of ways, but most of the differences are quantitative rather than qualitative. The Junior looks and — to a significant extent — acts like the PC. One of the reasons the Junior has attracted so much interest is that

The IBM PC is referred to as the PC Senior throughout this article.

everybody wants to know whether IBM will have as great an impact on the home market as it has had on the business one. The PC made a sizeable dent in the business micro market when it appeared, non-standard operating system and all. Quite what part the three magic letters played in the machine's success is a matter of opinion and, in any case, irrelevant. The machine not only sold, but created a new standard: IBM-compatibility. Time will tell whether the Junior will have this sort of impact on the home market. I think it might, and I think it will also make its presence felt on the small business market — particularly that section dominated by the Apple II.

The PC Junior is available in two forms. The entry-level model comprises the system unit, 64k RAM, cordless keyboard and step-down transformer, retailing in the United States at $670. The enhanced model, retailing at $1270, is supplied with 128k RAM and a slimline 5.25in disk drive built into the system unit.

System unit

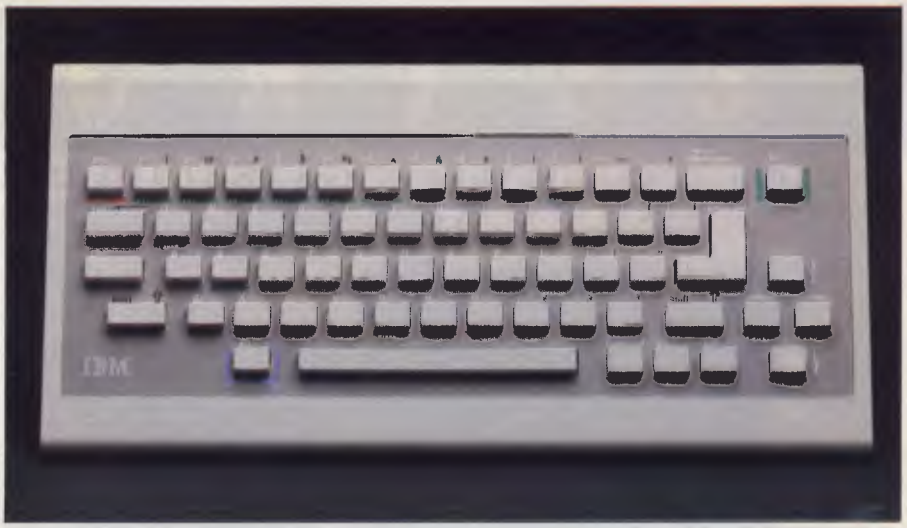
The system unit, measuring 35x29x10cm, looks like a scaled-down version of the PC system unit—which is exactly what it is.

The unit contains everything except the keyboard and monitor. At the front is an infra-red detector and two cartridge slots. On the enhanced model, the 5.25in slimline drive sits above the cartridge slots.

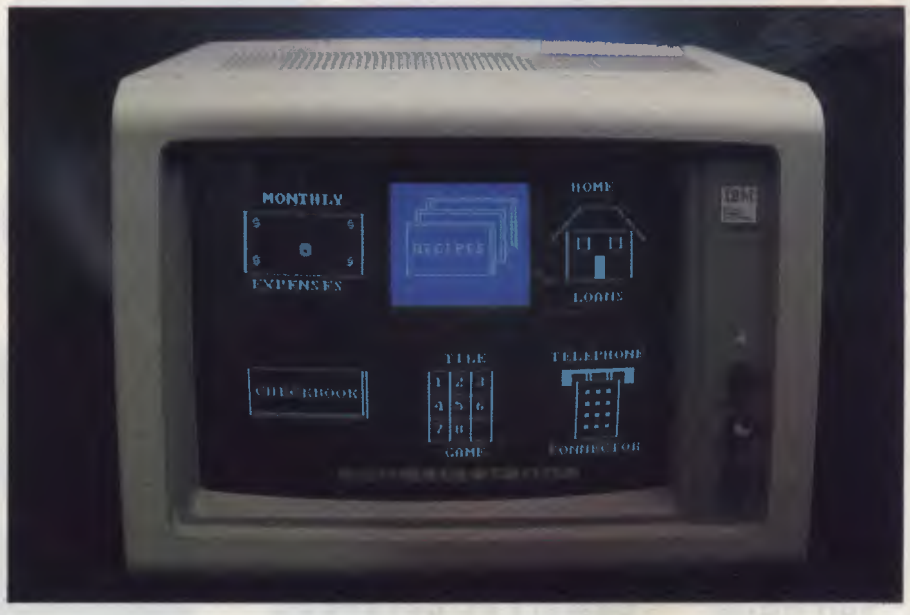
As with the PC, all the interfaces are at the back of the system unit. With one exception, each is marked with a single letter rather than a full label. Perhaps IBM thinks that 'V' is less daunting to a beginner than 'Composite video'. I found it irritating. From left to right, the sockets are labelled J,J,L,K,LP,T,V, M,D,S,P and A. If you don't understand why I found the labels irritating, try to work out the meaning of these letters before reading any further!

Most of the connections are non-standard, so the sockets themselves don't help. The first two sockets are for two joysticks, one unassigned ('L' stands for 'Later use'). Then there's a socket for the optional keyboard cable, and an as yet fictitious light pen. These are followed by sockets for a TV signal, composite video, optional internal modem (US only), IBM colour display, serial port, power lead and audio output.

Several essential or near-essential items are sold as 'optional'. The TV and cassette leads would be essential to most users, as would be the keyboard



The infra-red keyboard: novel, but of little practical benefit.



Enhanced IBM PC graphics — part of the extended Cartridge Basic.

No parallel port, so a serial printer must be used.

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cord if two or more Juniors were to be used in the same room.

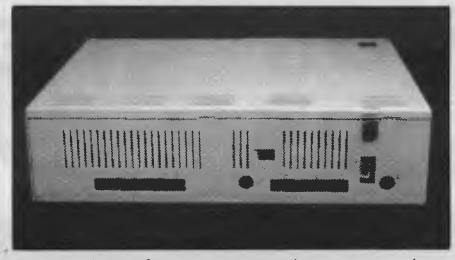
Keyboard

The keyboard measures 34x17x3cm and weighs 700g. The weight is important because the keyboard's main claim to fame is that it's cordless. It sends signals to the system unit via an infra-red beam, the idea being that you can wander around the room with the keyboard on your arm while continuing to use the computer. IBM claims that the system can be operated with the keyboard up to six metres away from the main unit. I put this to the test and found that it's technically true, but only if the keyboard is kept reasonably still and pointing in approximately the right direction. If the signal is too weak to be accurately read, either because the keyboard is too far away or because the angle from the system unit is too great, the Junior gives a warning by bleeping.

The cordless keyboard is an example of an idea that is stunningly obvious — after the event. After all, TV manufacturers have been using infra-red keypads for years. I found myself feeling slightly sceptical about the keyboard. Not being a touch-typist (one day . . .), I have to divide my attention between the keyboard and the display. Using the Junior, I found myself checking that it hadn't missed anything after almost every word. With the keyboard positioned on the desk in front of the unit, the Junior functioned perfectly, but any advertisements which show someone wandering casually around a room, while typing a letter, should be taken with a large sack of salt.

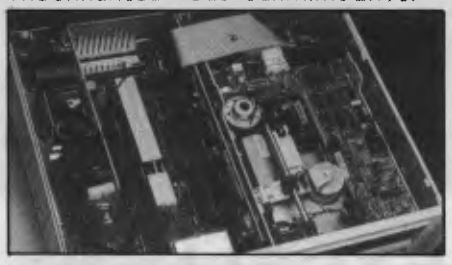
I wrote a one-line program (10 a$=INKEY$:IF a$="" THEN 10 ELSE PRINT a$;:GOTO 10) to display whatever I typed on the screen, and then wandered around the room while typing 'the quick brown fox jumps over the lazy dog'. What actually appeared on the screen was 'thecown foxde lazdP%og' — and it wasn't because the Junior couldn't keep up with my typing speed.

The other problem I encountered with the cordless keyboard was in using it on my lap. Using a Tandy Model 100, I've got into the habit of placing keyboards on my lap rather than on the desk with the machine. With the Junior, however, the desk itself blocks the line of sight unless the system unit is placed right at the edge of the desk. All in all, I found it less trouble to use the keyboard cable. When used without the cable, the keyboard is powered by four alkaline batteries. Plugging in the keyboard cable switches off the infra-red beam and disconnects the battery power supply. The keyboard then takes its power from the main unit.



All the interfaces are neatly recessed.

The enhanced model's slimline drive.



Inside the Junior — a cut-down PC.

The keys themselves are the same size and feel as those on a push-button telephone. They have a reasonably responsive feel and are spaced sufficiently, but are a little wobbly and too small for easy typing. I was disappointed with the keyboard when I first saw a photograph of the Junior, and was more so when I began to use it. Many machines selling at considerably below the price of the Junior have properly pitched, full-sized keyboards. Perhaps part of the reason the Junior keyboard seems so poor is that the keyboard on the PC is simply the best I've ever used — the Junior keyboard looks cheap and nasty by comparison. Another complaint is that the key labels for the unshifted functions are marked in white on a silvery-grey background. Whether this is because whoever designed the keyboard is colour blind, or simply that IBM felt that the two-tone effect was aesthetically pleasing, I don't know. But IBM please note: white on grey does not make for good contrast. All the key functions are marked above and below the keys rather than on the keys themselves.

The keyboard has ALT, FN and CTRL keys. ALT and CTRL work in the usual

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A full range of search and replace functions is provided, including wildcard repeat and case sensitivity. Printing is done directly from the screen without the need to write to disk. All formatting information can be saved within the text. True proportional spacing is provided with right justification that is much more elegant than character resolution spacing.
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KNOWLEDGE MAN
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Integrated software packages, such as Knowledge Man are simpler and more efficient to use than the old style separate programs. Knowledge Man offers the capabilities of data base management and spreadsheet in the one convenient program. The comprehensive facilities offered are:
Relational Data Base. Full data base management facilities are provided.
Ad Hoc Enquiries. For spur of the moment information, merely type in an English like request.
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Statistical Analysis. The most common statistical functions are built into Knowledge Man, including mean, standard deviation and variance.
Printed Form Management. Complete control over printed output is provided. Pre-printed forms can be filled in, disk output can be routed to the printer as well, text and titles can be defined anywhere on a form.
Functions and Procedures. Numeric functions such as exponentiation, random numbers, alpha-numeric conversion are built in.
All the preceding functions can be used by people without programming knowledge. More advanced users can take advantage of the built in, fully structured programming language. Users of this package will find that many of the tedious chores in BASIC of file handling and screen formatting are managed automatically.
$745 incl tax **$655** ex tax

DBASE II
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Many reviews of this data base program have praised its innovation and usefulness. Put simply, what wordprocesasors are to text, DBASE II is to data. Entire data bases can be manipulated at will to suit the requirements of the user. The power of DBASE II is derived from its use of a simple programming language to drive different applications. Menu driven programs with aesthetically pleasing displays are easily implemented using the BDASE II programming language. Because file and data handling are managed automatically by DBASE II, much of the time and programming effort needed to implement an application program in a language such as BASIC is eliminated.
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DISAPPLER?
Disappler is a disassembler for the Apple II series of computers. It will translate 6502 object code (machine code) into source code compatible with the DOS Toolkit 6502 Editor/Assembler, and print a listing. The source code generated may be immediately re-assembled or may be edited and customized before re-assembling.
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way; that is, to enter ^C (Control-C) you hold down the CTRL key and press C. ALT works in the same way. FN stands for function, as you'd expect. The key is pressed and released to engage it, and it is then effective for one keystroke. The programmable function keys, for example, are accessed as FN-1 to FN-0, so to select F1 you press and release the FN key and then press 1. In this way, most of the features of the PC Senior keyboard are retained using fewer keys.

The FN and ALT keys are coloured green and blue respectively, and the related labels on the keyboard are colour coded in the same way, therefore F1 is marked in green underneath numeric 1 (shades of the Sinclair Spectrum here!). Four cursor keys are laid out in a diamond shape, below and to the right of the return key. These double as home, end, page-up and page-down when used with the FN key and are software defined. There are two SHIFT keys, and a two-way tab key. All keys auto-repeat.

Cartridges

The two cartridge slots at the front of the PC Junior are intended for 64k ROM cartridges. A small number of games were available in cartridge form at the time the Benchtest was carried out, and others are expected. It doesn't make any difference which cartridge slot is used. Two slots are included to allow future cartridge based software of up to 128k to be used.

Joysticks

The joysticks, for use with both the PC Junior and the PC Senior, are made in Japan for IBM. It's incongruous to see the letters IBM on a joystick. I mean, joysticks are those things used for Pacman and Frogger, and this is, well, IBM... But the IBM joystick manages to make itself look suitably dignified: IBM-white, of course, and the legend 'IBM Joystick' on a metal plate. It has two fire buttons, centring adjustments and a useful mechanism which allows the user to switch between 'free-floating' and 'spring-return' modes. The former is useful for design and graphics work, remaining where it's left when released. The latter is generally better for games, returning to the centre when released.

Soak test

This Benchtest was carried out in two days at an IBM plant, so I couldn't do a full 24 hour soak test. In the course of the Benchtest, the machine was running for around seven hours each day and I experienced no problems with it.

Inside

The PC Junior has the same 16-bit, 8088 processor as the Senior, and is laid out in a more or less identical fashion. Everything is packed closer together for reasons of space, but that seems to be about the only difference.

Software compatibility

When rumours of a new IBM micro first began to circulate, everybody wanted to know 'Is it going to be compatible with the PC?' Now that the machine actually exists, there is still a certain amount of confusion on the point of compatibility. The entry level model is not compatible with anything, for the simple reason that it doesn't have a disk drive. The enhanced model is compatible with a lot of, but not all, PC Senior software. IBM produces a compatibility chart to show which pieces of approved software are compatible with the Junior, and some incompatible software has been rewritten to enable a version to run on the Junior.

Popular packages which will run on the Junior include Easy Writer, VisiCalc and Multiplan. To run PC-DOS software, PC-DOS Version 2.1 is required. This is a slight variation on 2.0, enabling it to handle the slimline disk drive. If you want to save Basic programs on disk, you'll need to buy both PC-DOS 2.1 and Cartridge Basic. Cartridge Basic is a slight enhancement of BasicA (IBM Advanced PC Basic), offering improved graphics and sound support. It's called Cartridge Basic (not surprisingly) because it's supplied in cartridge form — most of the games and educational software available for the Junior are supplied on disk, which means that they can only be used on the enhanced model. More cartridge-based software is expected to be available by the time the Junior is on sale in Australia.

Basic

The Basic supplied on board the Junior in ROM form is identical to the ROM Basic on board the PC Senior, and is a very respectable implementation of the language. To make full use of the Junior, however, you do need Cartridge Basic.

Cartridge Basic is upward-compatible with standard PC Basic, and is both comprehensive and powerful. It offers enhanced graphics, communications capabilities, an internal clock and what IBM describes as 'event-trapping'. Event-trapping is supported by MSX Basic, and is likely to become a standard feature of most future Basics.

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form ON (event) GOSUB (line number). These statements allow programs to detect specified conditions and react instantly to them — like the ON ERROR GOSUB statement supported by many machines. ON COM, for example, will branch to the specified subroutine immediately an incoming signal is detected on the serial (communications) port. This allows the computer to get on with running a program while remaining available to, for example, incoming electronic mail. Other events (conditions would be a better word) which can be trapped include depression of a joystick 'fire' button, a light pen signal and a function key press.

Cartridge Basic does not support true procedures, but otherwise offers just about everything even the most demanding programmer could ask for.

The Junior offers identical editing facilities to the PC; that is, a full screen editor allowing both statements and line numbers to be edited.

Graphics

The PC Junior offers three graphics resolutions and two text modes. Low resolution graphics of 160x200 with 16 colours available; medium resolution 320x200 in either four or 16 colours, depending on the graphics mode; and high resolution 640x200 with two or four colours. Text mode is either 40- or 80-columns and up to 16 colours may be used.

Cartridge Basic is needed to make use of all the available graphics modes, and 80-column text requires 128k RAM. The Junior offers all the graphics-related statements of the Senior, including PSET, PRESET (Pixel SET and Pixel RESET), LINE, COLOUR, CIRCLE and PAINT, all of which are self explanatory.

Applications software

As mentioned earlier, a number of packages designed for the PC will run on the Junior under PC-DOS 2.1, and other programs are being modified to enable them to run on the Junior. In addition to these, a number of packages are being written from scratch: I tested one of the latter packages — a word-processor called HomeWord (see review done on an Apple elsewhere in this issue).

HomeWord claims to offer all the features of a fully-fledged word-processor while being simple to learn for novices. It does not require a DOS disk, since it has the necessary system tracks. The disk auto-boots and is copy protected.

HomeWord uses simple icons (pictures) to represent all the functions supported. On booting the disk, the user is told to remove the HomeWord disk and to insert the storage disk — you are then placed into text entry mode. Here's an indication of how easy HomeWord is to use. I created a file; moved bits of it around; reformatted it to include right-, left- and full-justification; centred a line; saved the document to disk; and then printed it — without even opening the instruction booklet. With the icons and prompts, everything is self-explanatory.

As text is entered, a tiny graphical picture of the document is created at the bottom-right of the screen, enabling the user to see what the file will look like when printed. This gives immediate confirmation of formatting commands (justification, double line spacing, and so on). To insert text, simply use the cursor keys to move to the appropriate place, and then type in the text. Text can also be deleted using the destructive backspace, but any other form of editing (cut-and-paste, block delete and copy, search or search-and-replace) must be done in edit mode.

Switching to edit mode is simple enough — press the ESCape key to enter an icon menu, then use the horizontal cursor keys followed by the return key to select the edit option from the six functions offered: print, edit, file, layout, alter default settings and exit to DOS. Edit mode presents more icons: block copy, block delete, block move, find and find-and-replace. Each of these options prompts the user to move the cursor to the desired place and enter text as required. Again, the prompts are clear and unambiguous.

The layout icon menu similarly offers five options: justification (left, right, full and centre), insert page breaks, set spacing (line spacing, plus horizontal and vertical margins), print style (normal, bold and underlined) and set headers and footers.

The print menu presents three options: display document on the screen as it will be printed, set the page numbering, and print the document. Since HomeWord doesn't work on the what-you-see-is-what-you-get principle, the first option is a useful feature.

One problem with the icon menu system is that it may be necessary to go two or three levels 'deep' before you find what you're looking for. Having made your selection, you will then be returned directly to the top level. This can be a nuisance if you want to set the line-spacing to double and then insert a page-break, for example, since you need to go back through the same

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menu levels twice.

The file menu is concerned with disk-handling. The four options are: load a document, save current document, erase current document and insert (merge) another document. Error-messages, like prompts, are friendly and straightforward without being patronising: 'The diskette is write-protected. Remove the write-protect tab or insert a disk that is not write-protected' appears on the screen on attempting to save a file to a read-only disk, for example.

HomeWord is not WordStar, but it does live up to its claim to be extremely easy to use. Usually, the price of ease of use is two-fold; firstly, you sacrifice power for simplicity, and secondly, the system becomes incredibly cumbersome once you are familiar with it. HomeWord avoids both. It isn't the most powerful word processor in the world, but neither is it a toy. It has most of the features you'd expect in a professional package: cut-and-paste, variable justification, document merging, adjustable margins and line spacing, and so on. Documents can be saved to disk in HomeWord format, or printed to disk as ASCII files so that they can be loaded into other programs, and transmitted over the telephone network. Once the system has become familiar, the icon display can be switched off. CTRL-key commands can then be used instead of icon selections. Switching off the icons dramatically increases the response speed of the program.

I don't like separate text entry and editing modes, but this does enable a first time user to learn to use the program very quickly. As a word-processor for beginners, HomeWord is far and away the best package I've seen. It also stands up well as a semi-professional package in competition with products like EasyWriter.

Documentation

The documentation supplied with the Junior takes the form of two manuals (a user guide and an IBM Basic tutorial), and a built-in program called 'Keyboard adventure'. The enhanced model is also supplied with a program called 'Exploring the PC Junior'. The user guide is typical of IBM: thorough, comprehensive and pedantic. Overall, it is well-presented, well-indexed and easy to use.

The Basic tutorial is very unlike IBM. It's written in the 'Gee, isn't this fun?' style normally reserved for VIC 20s and the like. I'm not enthusiastic about this style, but it's clear and informative, and it does make the system seem less daunting to a first-time user. 'Keyboard adventure' is on board the Junior in ROM. It can be called at any time you're in Basic and not running a Basic program by pressing the escape key. It is, as the name indicates, a program introducing the user to the Junior keyboard.

The program begins by presenting a large box and a little man on the screen. After using the cursor keys to move the man into the box and watching him 'drop' through different coloured screens, you then enter the program proper. This invites you to press each of the keys on the keyboard in order to find out what they do. The program is fairly tedious but useful to someone unaccustomed to a computer keyboard.

'Exploring the PC Junior' is a program supplied on disk with the enhanced model. This is an interactive tutorial and is quite simply superb. It's presented as a computerised book, but includes interactive sessions like 'Practice DOS' and 'Practice Basic'. Practice DOS and Practice Basic are pseudo environments offering many of the features supported by the genuine article, and responding true to form. The difference is that the top half of the screen is reserved for friendly explanations and prompts.

Users can enter or leave interactive sessions as they please, and they can flick through the 'book' forwards or backwards, by page or chapter. It's a pity that 'Exploring the PC Junior' couldn't be supplied with the entry level model, but it does require a disk drive.

Prices

Australian prices not yet fixed; US dollar prices given below for general guidance only.

PC Junior entry level model	$669
PC Junior enhanced model (includes disk)	$1269
TV lead	$30
Cassette lead	$30
Serial lead	$25
DOS 2.10	$65
Cartridge Basic	$75
HomeWord	$75

Conclusions

Without the letters 'IBM' and without compatibility with the PC, I'm not convinced that the Junior would have much going for it. But the reality is that it does have 'IBM' on it, and it's largely compatible with the PC Senior.

It's difficult to judge a machine without knowing its selling price, and if the PC is anything to go by then the

BENCHTEST

Benchmarks

Benchmark timings carried out using cartridge Basic.

BM1	1.9
BM2	6.4
BM3	11.2
BM4	15.0
BM5	16.5
BM6	29.3
BM7	46.6
BM8	47.4

All timings in seconds. For a listing of the Benchmark programs see 'Direct Access'.

Technical specifications

Processor	8088 running at 4.77 MHz
ROM	64k
RAM	64k entry level (44k Basic program storage); 128k enhanced model (60k Basic program storage).
Interfaces	2 joysticks, 3 video (TV, direct, composite), 1 serial, 1 audio, Internal expansion bus.
Keyboard	62-key, multi-function, infra-red (cordless).
Disk drive	Enhanced model only, 360k double-sided.
Operating System	PC-DOS Version 2.10.

Australian price of the Junior may differ considerably from the US price. Assuming that it does sell at a roughly equivalent price in Australia, this puts the entry level model at about $1,000 and the enhanced model at around $1,800. At $1,000, the entry level model is at the top end of the home market, and will be competing primarily with machines like the Apple.

As a hobbyist machine, the Junior is pricey, but the price tag doesn't seem to have deterred people from buying the Apple, and the ability to upgrade to a PC-DOS system is likely to be a significant sales factor. For those new to computing, IBM might seem to have an advantage in being a household name.

The enhanced model is not a home micro at all, whatever IBM may choose to call it. At $1,800, it has to be classed as a small business micro. In this light, the main thing in its favour is compatibility with the IBM PC. Software houses are not going to be slow to see the opportunities offered by the Junior; I think we're going to witness a flood of PC software labelled 'PC Junior compatible' and 'PC Junior version available' as soon as the machine comes to Australia. And people looking for a small business micro are going to be equally quick in seeing that, for many applications, an enhanced PC Junior = an IBM PC + $2,500 in the bank.

This area of the market is becoming increasingly competitive. The Macintosh looks likely to sell at around the same price as the enhanced Junior, for example, and we're going to see a lot of activity around the $1,800 mark over the next six months or so.

I'm not sure how the entry level PC will fare as a home and education machine. I'm not going to make any predictions until I know the Australian price: at this level, $100 could make all the difference. But as far as the enhanced model is concerned, I feel confident that — whatever the competition — it's going to be quite a success.

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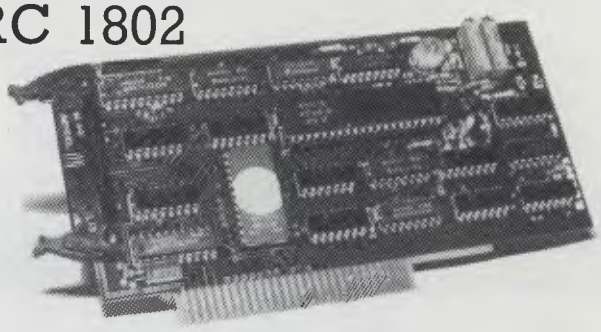

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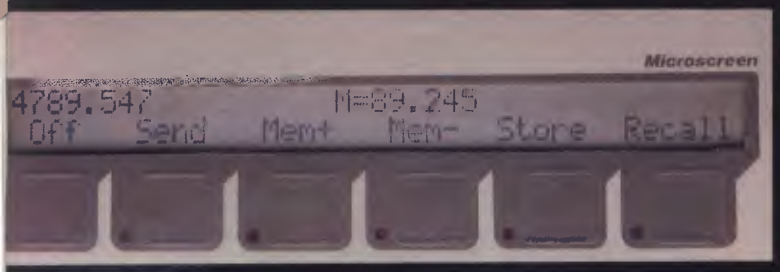

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A BEGINNER'S GUIDE TO PROGRAM CONVERSION
PART 3:APPLE II GRAPHICS

Surya begins the graphics supplement to the APC Basic Converter Chart with a look at the Apple II.

Applesoft supports no less than four forms of tab statement: SPC, TAB, HTAB and VTAB. SPC (x) prints x spaces. So, SPC(10);"Hello" would move the cursor ten columns forward and then print 'Hello'. TAB (x) moves the cursor to column x. If x is less than the current cursor column, then the statement is ignored. Thus SPC moves the cursor relative to its current position, wrapping around lines as necessary, whereas TAB moves to the absolute screen column specified.

HTAB (Horizontal TAB) is similar to TAB, but can move left as well as right. HTAB (x) moves the cursor to column regardless of the cursor's current position. VTAB (Vertical TAB) is used to position the cursor vertically. VTAB (x) moves the cursor to line x leaving its column position unchanged.

As an example:

```
100 REM: Tabulating on an Apple II
110 HOME: REM clear screen, position
    cursor top-left.
120 PRINT TAB(10); "Line 1, column
    10"
130 PRINT "Line 2, column 0";
SPC(5);      "column 22"; HTAB(16);
"and";
140 REM Above line would appear on
    screen as Line 2, column 0 and
    column 22
150 PRINT VTAB(12); HTAB(19); "*":
    REM centre of 40-column screen
160 END
```

To find the current cursor position, the POS (POSition) statement is used. POS (x) returns the current cursor column. The expression x is a dummy value (that is, the value has no effect) but must be a valid expression which Applesoft can evaluate.

INVERSE switches on the inverse video attribute, and is cancelled by the NORMAL statement. So:

```
100 HOME
110 INVERSE
120 PRINT "This will be printed in
    inverse"
130 NORMAL
140 PRINT "This will be printed
    normally"
150 END
```

FLASH works in a similar fashion to INVERSE, switching on the flashing attribute:

```
100 HOME
110 FLASH
120 PRINT "This text will flash"
130 NORMAL
140 PRINT "And this text won't!"
150 END
```

Finally, the SPEED statement allows the user to control the speed at which text is displayed on the screen. By default, the Apple prints text to the screen as fast as it can, but other speeds can be selected. Slow speeds (<100) are useful for displaying instructions and so on, where the display speed is set to the average reading speed.

The statement takes the form SPEED=x, where x is an expression between 0 (slowest) and 255 (default):

```
100 HOME: SPEED=0
110 PRINT "This will be printed very
    slowly . . . "
120 SPEED=255
130 PRINT "And this will be printed at
    the normal speed"
140 END
```

The easiest way to simulate slow printing on other machines is to place the With many things in the micro-computing world, there are agreed standards. The ASCII code for communications; the RS232, Centronics and IEEE for interfacing; the 5.25in disk and so forth. But when it comes to graphics it seems that manufacturers and designers don't know the meaning of the word 'standard'. The reason for this is simple. In the time it would take to debate, argue, redesign and eventually implement a set of standards, the graphics capabilities of the machines being developed would have increased beyond all recognition, rendering the standards useless.

Different machines not only use different screen resolutions, but the range of graphics-handling statements supported varies from simple SET, RESET and POINT to a whole array of sophisticated features like drawing circles and filling-in shapes. All this is a rather roundabout way of saying that it is not possible to cover the subject of graphics in the form of a quick-reference chart as with the *APC* Basic Converter Chart. (See November '83, *APC.)*

What I have set out to do in this series of articles is to give you enough information about the graphics-handling of each machine covered by the chart to enable you to work out what is happening in a listing.

Incidentally, as a general tip when converting graphics, I recommend mapping out a picture of the graphics screen of the machine from which you are converting on square-ruled paper, marking on it rough values. Next, place a piece of tracing paper over this grid and follow the listing through, sketching in lines and text. You can then place this tracing paper over a map of your own screen to see roughly what values you will need to use.

The complexity of micros' graphics often make program listings for one machine all but incomprehensible to the owners of other computers. There are a lot of well written listings in *APC* for a variety of machines which readers would no doubt like to get up and running on their own micros. For this reason it is worthwhile going into the subject of graphics in a fair amount of detail.

The Apple Family

The Apple II has three variations: the Apple II, the Apple II+ and the Apple IIe. All three support Applesoft Basic and therefore use the same graphics handling statements.

Applesoft supports three screen modes — text, low-resolution graphics and high-resolution graphics. These are called by the statements TEXT, GR and HGR respectively.

Text

The normal text screen comprises 24 lines by 40 columns. An 80-column screen is available by installing an optional circuit board; and *APC* programs written for an 80-column machine will have this clearly stated in the accompanying notes.

Text mode has ten statements which may be used to format text output on the screen:

HOME clears the screen and positions the cursor at the top-left corner. On most machines, this is achieved by the statement CLS.

text into DATA statements and use a FOR-NEXT loop to print one character at a time. A delay loop is used after each character is printed to achieve the reduced speed:

```
100 REM: This solution is designed to
    be portable, not elegant!
110 FOR a=1 TO 3: REM number of
    data statements to read
120   READ a$: REM read line of text to
      be printed
130   FOR b=1 to LEN(a$)
140     PRINT MID$(a$,b,1);:  REM
        print one character of a$
150     FOR c=1 to 12: NEXT: REM
        empty loop to cause delay
160     REM adjust value of above
        loop to vary speed
170   NEXT b: REM repeat for next
      character in data statement
180   PRINT: REM move cursor onto
      next line
190 NEXT a: REM repeat for next data
    statement
200 DATA This text will be printed
    slowly
210 DATA So will this
220 DATA And this
230 END
```

Low resolution graphics (GR)

The low-resolution screen on the Apple is addressed as 40 columns by 48 rows. Sixteen colours are available. The bottom four lines (8 rows) are normally reserved for text, but the oft-used POKE-16302,0 makes these available for graphics use. (The CALL-1998 statement which usually follows the above POKE simply sets the extra rows to black.

Once in GR mode, there are five graphics statements available:

COLOR=x sets the foreground colour, where x is in the range 0-15 and is defined:

0 black
1 magenta
2 dark blue
3 violet
4 dark green
5 grey
6 medium blue
7 light blue
8 brown
9 orange
10 a different shade of grey!
11 pink
12 green
13 yellow
14 aqua
15 white

Although I just said that x must be in the range 0-15, it is possible to use any value up to 255. But since 16 is equivalent to 0, 17 to 1 and so on, this fact is not spectacularly useful.

PLOTx,y is used to light up the specified block in the current foreground colour, where x is the column and y is the row. In GR mode, the origin (0,0) is top-left.

HLIN x1,x2 AT y is used to draw a Horizontal LINe in the current foreground colour from (x1,y) to (x2,y) where x1 and x2 are different column numbers and y is the row.

VLINy1,y2 ATx — of course — draws a Vertical LINe from (x,y1) to (x,y2) where x is the column number and y1 and y2 are different rows.

SCRN (x,y) returns the code of the colour at position (x,y). On most machines, this is achieved using a POINT (x,y) statement.

Next month: Apple II high resolution graphics and sound, and the TRS-80/ System 80.

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GOT A FOGGY NOTION?

Ever found that you haven't the foggiest idea what you're reading — or what you're writing? Test it out with the fog index, and gauge the gobbledegook.

If you've ever got a spare masochistic moment, try to read some of the articles prescribed in Law courses – heavy, to say the least. We found some impossible to comprehend without many scans over the same chunk of text. This painful task reminded us of a formula called the 'fog index'.

The fog index was devised by Robert Gunning as a measure of the effort needed to read. The more effort needed to interpret what is written, the less is left for interpreting the ideas you are reading about. The formula is based on two central values that make reading difficult, which are quite simply long words and long sentences.

A long word is defined to be one that contains three or more syllables, but excludes proper nouns, continuation words (such as 'nevermore') and part or present participles where the 'ed' or 'ing' ending is the third syllable. To calculate the fog index of an article, a sample piece of text about 100 words is tested. The procedure is as follows:

○ Calculate the average sentence length.

○ Count the number of words containing three or more syllables.

○ Adjust the count of polysyllabic (now there's a goodie!) words to a percentage of the total.

○ Add the average sentence length to the above percentage and multiply the total by 0.4.

Robert Gunning found that an acceptable range for adults is a value in the range 8 to 14. Less than 8 can be insulting, the article reading like a primary school book. If an article's fog index is more than 14 then the meaning of it may be obscured by the writing style. The higher the index, the more difficult an article is to read.

We thought we would write a program to calculate the fog index, and apply it to various publications. Dangerous perhaps, but fun! Just to make sure we're not making fools of ourselves, we tested the fog index of this article – 11.1,

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in fact, just about right.

The program takes three sentences, one at a time. Each sentence is broken down into words, and each word checked to see if it contains three syllables or more. This is where there is a slight problem: how do you test for a syllable? In most cases, a separate syllable occurs when a vowel is followed by a consonant. For example, take the word 'fortunate': the three syllables are for-tun-ate, in each case marked by the vowel to consonant change. Note that the ending 'e' is not followed by another letter, so does not count.

Most words seem to conform to this simple rule: for example, ed-it-or, mon-it-or, prec-e-dent, in-clude, sim-ple, sep-ar-ate, and so on. However, there are of course exceptions, especially with words ending in 'y'. 'Simply' would be counted as one syllable instead of two, 'disgracefully' would count as four, and is four, but for the wrong reasons! There are other exceptions, such as 'committee' (which should be three and not two).

But as this simple method works in most cases, and we are only interested in a guide, we can tolerate some small errors.

Also the program cannot tell whether a word is a proper name, continuation words, or 'ing' or 'ed' word. These modifications are left to the reader.

Perhaps programmers could include the calculation when writing word-processors! Unfortunately we think some writers may use such a facility to produce as high a value as possible. It is, of course, disgraceful that so much academic material is written to impress rather than written to be understood; disgraceful, and also unfortunate, as the writer's point may well be valid, but impossible to see in the fog of terminology.

By Dr Peter Turcan.

```
10 REM COMMODORE FOG
20 CW=0: CT=0
30 CLR
40 PRINT "**************"
50 PRINT "* FOG INDEX *"
60 PRINT "**************"
70 PRINT
80 FOR A=1 TO 3
90 PRINT
100 PRINT "TYPE IN SENTENCE ";A;
110 INPUT S$
120 GOSUB 2000
130 NEXT A
140 FG=(CW/3+(100*CT/CW))*0.4
150 PRINT
160 PRINT "NUMBER OF WORDS=";CW
170 PRINT "NUMBER >2 SYLLABLES=";CT.
180 PRINT
190 PRINT "FOG INDEX=";FG
200 END
1000 REM COUNT SYLLABLES
1010 CS=0: VW=0
1030 FOR I=1 TO LEN(W$)
1040 L$=MID$(W$,I,1)
1050 IF L$="A" OR L$="E" OR L$="I" THEN GOTO 1100
1060 IF L$="O" OR L$="U" THEN GOTO 1100
1070 IF VW=1 THEN CS=CS+1
1080 VW=0
1090 GOTO 1110
1100 VW=1
1110 NEXT I
1120 RETURN
2000 REM ANALYSE SENTENCE
2010 SS=1
2020 IF MID$(S$,SS,1)<>" " THEN GOTO 2060
2030 SS=SS+1
2040 GOTO 2020
2060 W$=""
2070 FOR M=SS TO LEN(S$)
2080 J$=MID$(S$,M,1)
2090 IF J$=" " THEN GOTO 2120
2100 W$=W$+J$
2105 IF M=LEN(S$) THEN GOTO 2120
2110 GOTO 2200
2120 CW=CW+1
2130 GOSUB 1000
2140 IF CS>2 THEN CT=CT+1
2150 W$=""
2200 NEXT M
2210 RETURN

READY.
```

Figure 1: Listing for the Commodore 64 and VIC-20. Note that the maximum length of strings in the Commodore is not very long, so for really foggy sentences you should use the GET statement to fill a larger array.

When a vowel changes to a consonant then the syllable count is incremented

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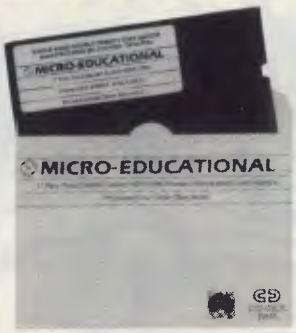

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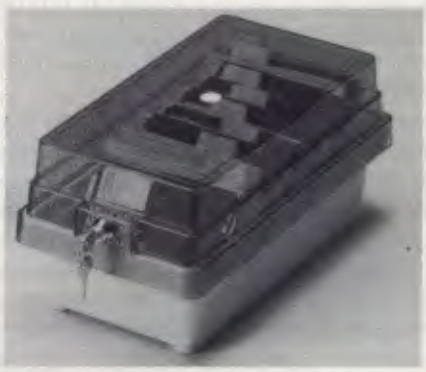

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LNP ARTPRINT 001

TOPO does not have any collision sensors, and so his movement can only be controlled in a pre-programmed manner. It is not possible to perform any serious artificial intelligence work with TOPO.

While TOPO's RS-232C port provides a high degree of device independence, Androbot Inc. do not take advantage of this. TOPO's user manual is dedicated to Apple II owners, and his software diskette, TOPOsoft, is written in Apple II format FORTH. I do not object to this in itself — the Apple is a popular machine, and FORTH is certainly a terrific language to provide a software interface. The problem is, however, the documentation *only* refers to Androbot's TOPOsoft language. Nowhere is there a description of what ASCII characters to send to the machine's RS-232C port in order to drive TOPO directly. Had this information been available, I would have happily driven TOPO from anything ranging from an IBM PC up to a VAX or a Cyber. Due to this lack of documentation, TOPO is tightly locked into the Apple. While I do not expect Androbot to rewrite TOPOsoft for every machine under the sun, I do expect them to make technical documentation available so that those who wish to may drive TOPO directly from their own machine. The Australian importers of TOPO assured me that such documentation existed, but that they did not have any.

TOPOsoft itself is an adequately powerful language, providing commands to make TOPO move forward and back a certain distance, rotate a given angle, set speeds and accelerations, interrogate TOPO as to his status, and also speak a string of text. TOPOs text to speech synthesiser is particularly powerful, allowing the user to set speed, pitch, volume, punctuation handling and inflection.

TOPO's communication link provides 16 channels, so it is possible for one computer to control 16 TOPOs simultaneously. The mind boggles — create your own crowd, build a party, synthetic ballet, and much much more.

Despite the manual, I feel that it is safe to say that TOPO has no practical use. The absence of collision detection and hands makes this quite clear. I do, however, feel that TOPO has a very bright future in educational institutions. I see TOPO as an infinitely more exciting alternative to the LOGO "turtle". Many of the "robots" available today are nothing but pretence. They come complete with AM/FM car radios imbedded in their backs and are claimed to be capable of useful work. TOPO, by comparison, is acknowledged by his manufacturers and importers to be of little or no practical use. They also see him in educational institutions, and hence have endowed him with the functionality that today's technology *can* provide, rather than disguising impracticality with car radios.

TOPO is distributed in Australia by Futuretronics and retails for $2,990, including tax. Later this year, we hope to review TOPOs new brother, BOB, who will be providing enhanced functionality, although it is currently not too clear what form that will take. I feel very positive towards TOPO, and would encourage primary and secondary schools to take him for a test drive.

C♦H♦E♦C♦K♦O♦U♦T

Homeword

Peter Bright looks at a friendly and inexpensive word processing package for the Apple II, IBM PC, Commodore 64 and Atari which is unconventional in that it uses icons.

If you have a home micro you may well be looking around for something useful to do with your machine. One idea is home accounts. Another is word processing — I wasn't planning to tackle this area for a while and then a package turned up on my desk which looked too good to be true.

Homeword is a word processing package that runs on the Apple II, IBM PC, Commodore 64 and Atari. (This review was done on an Apple II.) It differs from other word processors on home micros in that it uses icons, which make it very simple to use while retaining powerful commands. Up until now icons have only been used on expensive business machines like Apple's Lisa (see review, *APC*, August 1983). This package only costs $59.95.

According to the instructions all you need to run Homeword is an Apple II, II+, or IIe plus 64k of RAM and at least one disk drive. You could add a printer to that list — there isn't much point in using a word processor without a printer!

Homeword is very easy to use. To start it you insert the system disk in drive A, switch on and go. Incidentally, the system disk is copy protected in best Apple tradition which means that you can't make a back-up, so you had better look after it.

In use

When you start to use Homeword the first thing you see is the screen split into two halves. The top half is where you type your document and the bottom half has six little pictures — a printer, a piece of paper, a filing cabinet, two pieces of paper, a strange looking semi-circle, and a computer disk. These are the icons which are used to issue commands (see below). If you want to get into the typing area it is necessary to press the ESCape key. This gets rid of the icons and lets you get on with typing your document. If you want to get back into command mode, you just press the ESCape key again, and you will be back with the icons.

Icons

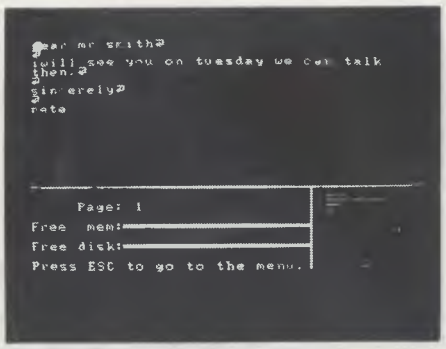
The program makes extensive use of icons to make it easier to use. In this case they take the form of pictures of filing cabinets, pieces of paper, disks, and so on, to represent different functions. They are selected by using the cursor control keys to move a 'picture frame' over the different icons. When the frame is around the icon you want to select, you press the return button which then calls that function. For example, if you want to call up a document that you have previously saved on the disk you would move the picture frame to the picture of the filing cabinet and hit the return key.

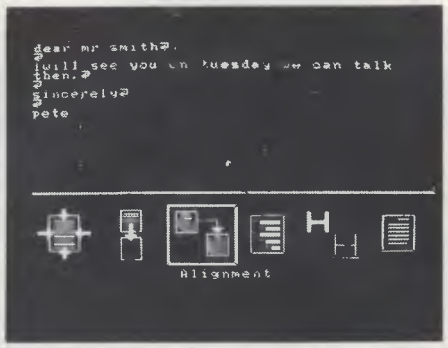
Setting up

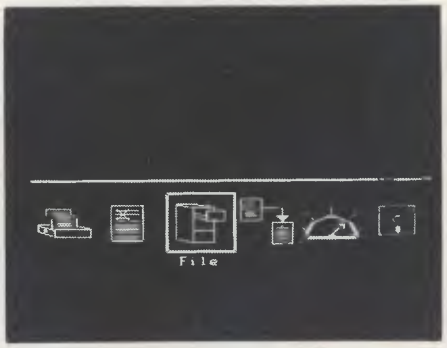
If you are using the package for the first time, you will need to tell the program about the way your Apple is set up. This is very easy to do and is achieved by using the 'Customize' (note American spelling) option. The icon representing this option looks very like one of those old art deco lift indicators — the ones with an arrow that point to the floor the lift is on. Using the Customize option you can change the default values for line spacing, margins, and so on, as well as inform the program how many disk drives you have (it assumes you only have one) and which type of printer card you are using. Once you have entered these settings you can save them to disk and never need to look at the Customize option again.

The typing area

Once you have entered the typing area (by pressing the ESCape key) the screen is split into three sections. The top two thirds is the main typing area which can display 16 lines × 40 characters of text. The lower third is split in two. The left-hand side shows the page number, the amount of free memory and the amount of free disk space. The free memory and free disk values are represented by horizontal lines which get shorter as you use up memory.







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'If you are using the package for the first time, you will need to tell the program about the way your Apple is set up. This is very easy to do and is achieved by using the "Customize" option.

The right-hand side shows a small picture of the page of text on which you are currently working. This is one of the nicest features of this package. The picture shows a visual representation of the complete 60 character × 80 line page as it will be printed out. This is helpful because the main typing area only shows the words you've typed; it doesn't show how the text will be displayed when it is printed out.

The keyboard

Anyone who has ever used an Apple II or II+ keyboard will know it's not ideal for word processing. One of the major problems is that many Apple keyboards don't support both upper and lower case letters so, although the keyboard has a SHIFT key for capitals, it doesn't do anything useful. Homeword gets around this problem by using CTRL S to produce capital letters. If CTRL S is pressed once the next letter you type will be converted to a capital. Pressing CTRL S twice has the same effect as CAPS LOCK. Other fun things about the Apple keyboard are that it doesn't have a delete key (CTRL D), or a cursor up key (CTRL Z or J), or a cursor down key (CTRL A or K). All this means that if you are used to a normal keyboard it may take some time to get used to the Apple keyboard. To be fair, all these problems are Apple's fault and Homeword's authors have done their best to get around the problems by providing an easy-to-read card showing all the necessary control codes.

When you are entering text the program defaults to insert mode. This means that if you go back over a piece of text and type in some other words, the original text will be pushed aside to make way for the new. The alternative to this is to switch to replace mode (CTRL C) which will allow you to type over the original text. Another feature supported by Homeword is automatic word-wrap. This means that when you get to the end of a line you can carry on typing and the program will automatically move split words to the next line. Using this, the only time you'll need to use the RETURN key is to start new paragraphs or to insert spaces into the text.

Filing

When you have finished your letter you will want to save it to disk. The exact method of saving to disk will vary according to whether you have one or two disk drives. I was using two drives: drive 1 was used for the program disk and drive 2 for the document disk. If you only have one drive you'll have to swap disks in and out.

Saving a letter is simply a matter of selecting the 'file' option (the icon looks like a filing cabinet). You are then greeted by four more icons — save file, get file, insert document and include document. The first two are self-explanatory. Insert document and include document allow you to combine different files to make up a new file. For example, you could have ten or twenty standard paragraphs which could be combined in different ways to make up personalised letters.

Editing

Homeword provides some powerful features to allow you to alter text in a document. The editing function is represented by an icon showing a piece of paper with some words crossed out. Using the editing tools it is possible to mark out blocks of text and then move, copy or erase those blocks. A nice feature is that it is possible to reconstitute erased text so even if you accidentally erase some text all may not be lost. Using edit it is also possible to find a word in the text and replace it with another word. The icon to do this is a magnifying glass which is quite apt.

For playing around with the text, Homeword provides some more powerful tools to alter the layout of your document. Using the layout option you can set up headers and footers, change the typestyle to bold or underlined, change the line spacing, etc.

Printing

When you have finished laying out the letter you may not be quite sure how it will look once printed out. This is because the only indication of how your printed document will look is the miniature picture of the page which is displayed on the text entry screen. This is very small and could be prone to errors. To get over this problem Homeword allows you to print the letter to the screen so that you can correct any layout problems without wasting printer paper. This means that you should only have to use the printer once to provide the final copy — no excuse for bung print-outs!

Criticisms

I have very few criticisms of this product. In general all errors are very well trapped with a bleep from the machine and a helpful message appearing on the screen. As the program makes such heavy use of icons which only use the cursor and return keys to issue commands, it is very difficult to make command error.

The maximum number of pages the machine can hold at any one time is about seven or eight pages of solid text. If you want more pages it is simple to save the document in parts and join it back together when it is printed (using the include document option). When the program does run out of memory it can sometimes lock up solid. This can be a problem but you get plenty of warning because the memory indicator line will become very short.

More disturbing is the fact that it would sometimes produce random errors for no apparent reason. In my case, its favourite trick was to drop into command mode when I was typing text. This was not too serious because I could just hit the ESCape key and carry on typing but it did once crash totally which is rather worrying.

Documentation

The documentation is very good indeed. The main instructions for use were contained on a cassette tape in the form of a tutorial taking you through the features. In case you don't have a tape recorder a transcript of the tape is also included. The reference manual is called *The Homeword Story* and lists all the commands along with a short troubleshooting guide which contains such gems as 'If you have no picture on the screen . . . make sure that your monitor's on/off switch is "on".' The manual is also embellished with cartoons featuring a cat leaping across the pages — I'm not quite sure how this helps you learn but it's entertaining.

Conclusions

I was very impressed with this program — it's certainly the best value piece of software that I've seen this year. For $59.95 you get Lisa-like user friendliness, icons and, above all, a package with which you can actually do something useful. I think Homeword will be even better on the other machines on which it is available because they have better keyboards than the Apple. Even so, if you have an Apple and need a word processor, take a close look at this one.

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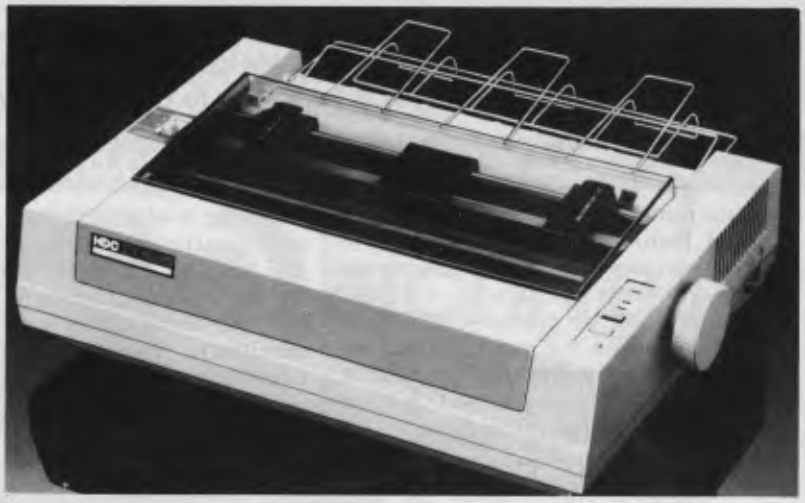

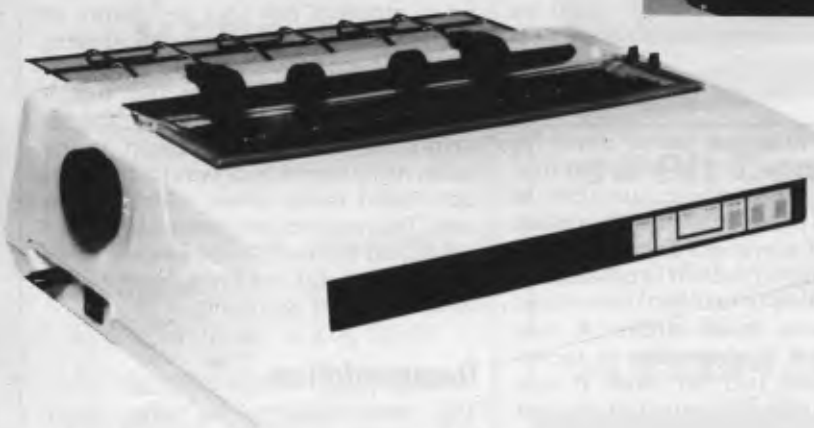

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WE PRESENT WORDWHIZZ FOR THE VIC-20 – THE SPEEDY WORD GAME THAT WILL ENTHRAL AND EDUCATE IN ONE GO – INCLUDING A COMPLETE LISTING EXPLANATORY TABLE.

A game that educates and entertains at the same time can't be bad, and this one is a challenge. Called *Wordwhizz*, it's based on anagrams, and uses a selection of words (listed in the second introduction screen) that are jumbled up and displayed at various locations on the screen. Your job is to push each letter into the top left hand corner of the screen.

We have found that *Wordwhizz* neatly combines arcade skills (fast reactions and so on) with literary ones. It also helps improve your spelling, hence the educational element.

The introductory screens explain how the game works, but here's a description in hard copy in case you forget. First the keys: you can use a joystick if you have access to one, otherwise you use the keyboard in the following configuration: G moves you (represented by a small human sort of shape) left, H right, Y up and B down. You move yourself to the appropriate side of the letter you want to push and press the RETURN key to push it.

You're being timed, so you have to move fast, and remember, you have to avoid the little bugs (fleas, in fact) that prove deadly.

You can get rid of the fleas by pushing them out of the way with the letters, practice, you will no doubt find, will make perfect.

Now a word on the listing (*Fig. 2*). We have listed the program using a very useful device from the US called CardPrint (from Cardco of Kansas). As far as we know this is not yet available in Australia, but we urge a keen distributor to import it, because it's very useful.

It plugs into a serial I/O port on either the VIC or 64 and between the cassette edge connector and cassette plug, the other end has a Centronics plug which will connect without hassle into most printers. It has several modes, including a program listing mode we have used, which turns special VIC/64 symbols into the printable characters. Every time you encounter the two letter keys in curly brackets, simply look up what they mean in the table below (*Fig. 1*) and type the appropriate key. Thus where you encounter {SC} press SHIFT and HOME. Enjoy the game.

You will need a VIC with 3k expansion (for example the Commodore Super Expander), or switchable 3/8/16k switchable RAM pack.

We invite readers to play around with the Wordwhizz listing and see what they can add. We would be interested in seeing a new front-end, which enables the player to enter whatever words he/she wishes at the start of the game.

Figure 1: Key to Listing

{CU}	CURSOR UP	{BK}	BLACK
{CD}	CURSOR DOWN	{WH}	WHITE
{CL}	CURSOR LEFT	{RD}	RED
{CR}	CURSOR RIGHT	{CY}	CYAN
{HM}	CURSOR HOME	{PU}	PURPLE
{SC}	CLEAR SCREEN	{GR}	GREEN
		{BL}	BLUE
{RV}	REVERSE ON	{YL}	YELLOW
{RO}	REVERSE OFF	{OR}	ORANGE
{IN}	INSERT	{BR}	BROWN
{DL}	DELETE	{LR}	LIGHT RED
{SS}	SHIFTED SPACE	{LB}	LIGHT BLUE
{SU}	SHIFT TO UPPER CASE	{LG}	LIGHT GREEN
{SL}	SHIFT TO LOWER CASE	{G1}	GREY 1
{??}	UNDEFINED CHARACTER	{G2}	GREY 2
		{G3}	GREY 3

Program written by Caspian Prince.

```
0 :FORI=0TO511:POKE7168+I,PEEK(32768+I):NEXT:POKE1029,143
1 RESTORE:FORI=0TO71:READA:POKE7432+I,A:NEXT:MX=8:FORI=0TO7:READA:POKE7512+I,A:NEXT
2 S=0:SS=20:D(1)=-22:D(2)=22:D(3)=-1:D(4)=1:FORI=1TOMX:READW$(I):NEXT
3 PRINT"{SC}":POKE36879,26
4 GOSUB900:SC=1
5 PRINT"{SC}":F=0:MV=0
6 S=S+1:GOSUB950:FORI=1TOLEN(W$(S))
7 L=7702+INT(RND(1)*485):IFPEEK(L)<>32THEN7
8 PRINT"{HM}";MID$(W$(S),I,1):P=PEEK(7680):POKEL,P:POKEL+30720,6:NEXT:GOSUB996
9 PRINT"{HM}{RV}SCORE:"SC"    ":PRINT"{HM}{CR}{CR}{CR}{CR}{CR}{CR}{CR}{CR}{CR}{CR}{CR}{CR}{CR}{RV}HI:"HC
10 REM MAIN
11 IFPEEK(203)=11ORRJOY(1)=1THEND=1:GOTO100
12 IFPEEK(203)=35ORRJOY(1)=2THEND=2:GOTO100
```

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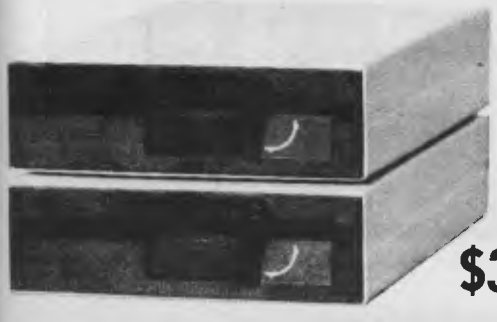

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```
13 IFPEEK(203)=19ORRJOY(1)=4THEND=3:GOTO100
14 IFPEEK(203)=43ORRJOY(1)=8THEND=4:GOTO100
15 IFPEEK(203)=15ORRJOY(1)=128THEN200
16 IFVAL(TI$)>TMTHENPRINT"{HM}{??}T1GECGECGECGECGECGECGEC":GOTO92
17 IFF=0ANDRND(1)<.02THEN300
18 IFF=1THEN400
19 JK=JK+1:IFJK>5THENJK=0:SC=SC+1:SOUND0,0,200,0,15:SOUND0,0,0,0,0:GOTO21
20 GOTO24
21 IFSC/5<>INT(SC/5)THEN20
22 P=7680+INT(RND(1)*485)+22:IFPEEK(P)=32THENPOKEP,40:POKEP+30720,4:GOTO20
23 SC=SC+5:GOTO20
24 IFSC/550=INT(SC/550)THEN30
25 GOTO9


30 POKE36879,9
31 PRINT"{SC}{WH}   GOOD WORK,PAL{RV}!!!"
32 PRINT"{??}T2CEFT4GRT2CEFT4GRT2CEFT4GECET6DT3"
33 A$="{RD}){CY}){YL}){WH}){BL})"
34 PRINT"{CD}":FORI=1TO10
35 PRINT"{CU}";SPC(I-1);" ":PRINT"{CU}";SPC(I);A$
36 FORP=1TO50:NEXT:NEXT
37 PRINT"{CD}{CD}{WH}{CR}{CR}{CR}{CR}{CR}{RV}HIT ANY KEY!{BL}"
38 WAIT203,191:GETA$
39 SC=SC+10:POKE36879,26:GOTO5
90 PRINT"{HM}{??}T1CEGCEGCEGCEGCEGCEGCEG"
91 SC=SC+LEN(W$(S))*10:SC=SC+(TM-VAL(TI$))*2
92 IFS+1>MXTHENS=0:SS=SS-1:SC=SC+100:PRINT"{HM}{??}T3CCEEGGO3T5CT3O2CCEET2GEGET5CT3"
93 IFSS<(MX/2)THEN:FORI=128TO254:SOUNDI,I,I,0,15:NEXT:SOUND0,0,0,0,0:SC=SC+1000:GOTO540
94 PRINT"{SC}":GOTO5
100 REM MOVE YOU
103 IFY+D(D)<7702THEN180
106 IFY+D(D)>8185THEN180
110 IFPEEK(Y+D(D))<>32THEN150
120 POKEY,32:Y=Y+D(D)
130 POKEY+30720,0:POKEY,32+D
140 GOTO180
150 POKEY+30720,0:POKEY,32+D
160 IFPEEK(Y+D(D))=40THENPOKEY,32:Y=Y+D(D):GOTO500
170 IFPEEK(Y+D(D))=37ORPEEK(Y+D(D))=43THENPOKEY,32:Y=Y+D(D):GOTO500
180 FORI=1TO50:NEXT
190 GOTO15
200 REM PUSH
205 KK=0
210 B=Y+D(D):N=PEEK(B):IFN<>32THEN225


220 GOTO16
225 IFN=38THENPOKEB,42:FORI=1TO50:NEXT:POKEB,32:SC=SC+2:GOTO16
227 IFN=39ANDPEEK(B+D(D))=32THENPOKEB,32:POKEB+D(D),39:POKEB+D(D)+30720,3:GOTO16
230 KK=KK+.5:IFPEEK(B+D(D))=40THENSC=SC+50:PRINT"{HM}{??}T0O3S3CDES2O2T3"
235 IFPEEK(B+D(D))=37ORPEEK(B+D(D))=43THENSC=SC+100:PRINT"{HM}{??}T0O3S3GFES2O2T3":GOTO296
240 IFPEEK(B+D(D))<>32ANDPEEK(B+D(D))<>40THEN260
250 POKEB,32:B=B+D(D):POKEB,N:POKEB+30720,6:GOTO230
260 IF(N=37ORN=43)ANDPEEK(B+D(D))=38THENPOKEB,32:SC=SC+(INT(RND(1)*100)*10):GOTO298
265 IF(N=37ORN=43)ANDPEEK(B+D(D))=38THENPOKEB,32:SC=SC+(INT(RND(1)*100)*10):GOTO298
270 IFN=37ORN=43THENFORI=1TO10:SOUND0,0,230,0,15:SOUND0,0,0,0,15:NEXT:E=B:GOTO19
280 FORI=1TOLEN(W$(S)):PRINT"{HM}";MID$(W$(S),I,1):IFPEEK(7724+I)=PEEK(7680)THENNEXT:GOTO90
290 GOTO16
296 POKEE,32:F=0:MV=0:E=0:FORI=1TO10:SOUND0,0,200+I,0,15:SOUND0,0,0,0,0:NEXT
297 GOTO240
298 POKEE,32:F=0:MV=0:E=0
299 GOTO16
300 REM INITIALISE DOG
310 E=7725+(INT(RND(1)*20)*22):DR=4:IFRND(1)<.5THENE=E+19:DR=3
320 FORI=0TO5
330 IFPEEK(E+(I*D(DR)))<>32THEN19
340 NEXT:F=1:MV=0
350 PRINT"{HM}{??}T0O3S3BBBBBO2S2T3"
360 GOTO19
400 REM MOVE DOG
410 POKEE,32:E=E+D(DR):MV=MV+1
420 IFMV>19THENMV=0:F=0:E=0:GOTO19
430 P=PEEK(E)
440 IFP<>38ANDP<>32THEN470
445 CH=37:IFDR=3THENCH=43


450 POKEE,CH:POKEE+30720,5
460 GOTO19
470 IFP=32+DTHEN500
472 IFP=39THENFORI=254TO128STEP-3:SOUNDI,0,0,I,15:NEXT:SOUND0,0,0,0,0:GOTO474
473 GOTO475
474 POKEE,42:FORI=1TO10:NEXT:GOTO5
```

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DCS.2641

```
475 IFP=40THENPOKEE,42:FORI=1TO10:SOUND128+I,0,0,0,15:FORM=1TO10:NEXT:NEXT:GOTO477
476 GOTO480
477 FORI=10TO1STEP-1:SOUND128+I,0,0,0,15:FORM=1TO10:NEXT:NEXT:SC=SC+20:POKEE,32:F=0
478 E=0:MV=0
479 GOTO19
480 FORI=15TO0STEP-3:FORP=230TO130STEP-5:SOUND0,P,P,0,I:NEXT:NEXT
490 FORI=1TOINT(RND(1)*50)+1
492 REM PRINT"{HM}SCORE:";
494 SC=SC-10:SC=ABS(SC)
496 PRINT"{HM}{RV}SCORE:"SC"    {CL}{CL}{CL}{CL}"


498 NEXT:F=0:E=0:MV=0:GOTO19
500 POKE36875,230:FORI=1TO10:FORP=1TO4
510 POKEY,32+P:FORO=1TO50:NEXT
520 SOUND0,PEEK(36875)-1,0,0,15:NEXT
530 NEXT:POKEY,41:FORI=1TO1000:NEXT
540 IFSC>HCTHENHC=SC
550 GOTO0
600 DATA28,28,28,62,28,28,20,54
610 DATA28,20,28,62,28,28,20,54
620 DATA28,44,28,124,28,28,20,60
630 DATA56,52,56,62,56,56,40,60
640 DATA0,60,122,122,254,84,88,0
645 DATA255,255,255,255,255,255,255,255
647 DATA255,129,189,165,165,189,129,255
648 DATA36,24,165,126,60,126,189,24
649 DATA189,165,126,24,24,36,36,102
650 DATA0,60,94,94,127,42,26,0
660 DATA"SUPERMAN","DORMOUSE","HELLO THERE","BEWARE OF TEACHERS","I HATE MATHEMATICS
670 DATA"GOOD PROGRAM,EH?","I AM GREAT","YOU ARE BONKERS"


900 REM INSTRUCTIONS
901 POKE36869,240:PRINT"{SC}{CD}{CR}{CR}{CR}{CR}{CR}{CR}WORD WHIZZ"
902 PRINT"{CR}{CR}{CR}{CR}{CR}{CR}7777777777"
903 PRINT"PUSH ALL THE LETTERS"
904 PRINT"TO THE TOP OF THE"
905 PRINT"SCREEN TO GET SUPER":SOUND0,0,0,0,0
906 PRINT"BONUS.BUT BEWARE,THE"
907 PRINT"DOGFLEA MIGHT GET THE"
908 PRINT"LETTERS SO PUSH HIM"
909 PRINT"INTO THE ELECTRIC"
910 PRINT"BORDER.APPROXIMATLEY"
911 PRINT"20 SECONDS PER LETTER"
912 PRINT"(LESS EVERY 5 SENTEN-"
913 PRINT"CES!).THE DOGFLEA"
914 PRINT"KILLS YOU,SO BE VERY"
915 PRINT"CAREFUL!!ALSO YOU ARE"
916 PRINT"EQUIPPED WITH 3 BLOCK-";
917 PRINT"ERS WHICH ONLY MOVE 1"
918 PRINT"SPACE AT A TIME."
919 PRINT" Y{CD}{CL}{CL}G{H  <RETURN>-PUSH"
920 PRINT" B    {RV}HIT A KEY!{RO}"
921 WAIT203,191:GETA$:
922 PRINT"{SC}THESE ARE WHAT YOU"
923 PRINT"MUST SPELL{RV}..THEY'RE"
924 PRINT"NOT IN ORDER{RV},THOUGH!"
925 PRINT"{CD}DORMOUSE"
926 PRINT"I HATE MATHEMATICS":PRINT"YOU ARE BONKERS"
927 PRINT"SUPERMAN"
928 PRINT"BEWARE OF TEACHERS":PRINT"I AM GREAT"
929 PRINT"HELLO THERE":PRINT"GOOD PROGRAM,EH?"
930 POKE36869,255
931 PRINT"{CD}{GR}%{BL}{RV}-??? POINTS"
932 REM
933 PRINT"SPLAT A {GR}%{BL}{RV}-100 PTS"
934 PRINT"SPLAT A {PU}({BL}{RV}-50 PTS"
935 PRINT"{CD}IF A DOGFLEA GETS IN"
936 PRINT"AN ARGUMENT WITH A"
937 PRINT"BUGSECT YOU GET 20"
938 PRINT"POINTS {RV}!!"
939 PRINT"{CD}{CR}{CR}{CR}{CR}{CR}{RV}HIT ANY KEY!{HM}"
940 WAIT203,191:GETA$:RETURN
950 REM BORDER-INIT
951 TI$="000000":TM=LEN(W$(S))*SS
955 Y=7910:POKEY,33:D=1
960 FORI=0TO21:POKE7702+I,38:POKE38422+I,0:POKE8164+I,38:POKE38884+I,0:NEXT
970 FORI=1TO21:PDKE7680+I*22,38:POKE38400+I*22,0:POKE7701+I*22,38:POKE38421+I*22,0:NEXT
980 POKE36869,255
990 RETURN
996 FORI=1TO3
997 P=7680+INT(RND(1)*485)+22:IFPEEK(P)<>32THEN997
998 POKEP+30720,3:POKEP,39:POKEY+30720,0
999 NEXT:RETURN
```

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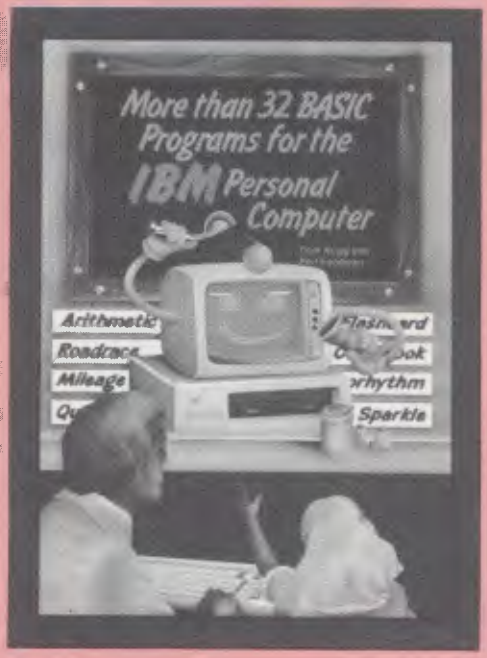
B·I·B·L·I·O·F·I·L·E

They say a change is as good as a rest, so this month Steve Withers looks at a stack of books dealing with a single machine — the IBM PC.

More than 32 BASIC Programs



Why "more than 32" programs? At first I thought it was another example of dilithium whimsy (the first being the name of the company), but then I discovered that they have published a whole series of books containing "32 BASIC Programs" for various machines. To get things straight, the table of contents lists 38 programs, drawn from several different areas. There are games, some graphic programs that are simply intended to look nice, a few for the mathematically inclined, and some with educational value.

Several of the programs are old favourites like biorhythms, chequebook balancer, a Mastermind-style game, and a Morse code trainer, but newcomers to personal computing are unlikely to care about that, There is little novelty, but I thought "Wallons" (an animated acrobatic team) looked amusing.

I was pleased to see that once again dilithium are selling a disk containing all the programs from this book, and they even offer a telephone support service (I admit this is only useful in the USA, but it could be the start of a trend). On top of that, readers are invited to send $US1 plus a stamped, self-addressed envelope for a copy of any errata sheet that may be produced. If no mistakes are found, "some other worthwhile information about the IBM PC" will be sent instead.

The main market for this book will be those people who bought an IBM PC to run serious applications packages, but who have now decided to explore the possibilities of programming in Basic. It won't teach them how to program — it doesn't even set a very good example so far as including REMarks is concerned, although the accompanying notes are good — but it should serve to fire up the imagination, especially as many suggestions are provided for the further development of the programs.

More Than 32 BASIC Programs for the IBM Personal Computer.

Authors: Tom Rugg and Phil Feldman.
Publisher: dilithium Press, Beaverton, Oregon, USA.
Price: $39.95

Your IBM PC

If the authors had chosen to prefix the title of this book with the words "All you really need to know about . . . ", I probably wouldn't have objected. In a single volume it provides a reference source to Basic and PC-DOS version 2, as well as the most important pieces of hardware information (e.g. the pin assignments for the RS-232 port).

The sections on Basic (which occupy about two-thirds of the book) don't provide a tutorial for the absolute beginner, but a reader with some knowledge of programming would benefit from the clear exposition of the features of the extended Basic found on the IBM. Graphics are given good coverage, including the use of GET and PUT statements for animation, and WINDOW to let the computer worry about scaling a convenient coordinate system (e.g. -100 to +100 in each dimension).

I was disappointed about the superficial coverage given to the more advanced PC-DOS commands for use in batch files. These allow relatively sophisticated processing, but their use isn't immediately obvious, especially those which provide flow control. The examples given are trivial, and don't shed much light on the subject. For instance, there is provision for commands to be executed more than once — you might use it to recompile all the modules of a particular program, but the example in this book merely displays the directory twice.

"Your IBM PC" would be a very convenient reference source for the IBM user who programs mainly in Basic, as it collects the most important information from two or three manuals into a single book.

Your IBM PC

Authors: Lyle J Graham and Tim Field
Publisher: Osborne/McGraw-Hill
Price: $30.55

How To Program The IBM PC

With a title like that, this book couldn't be anything but a tutorial. It was written by Tim Hartnell (a familiar name to *APC* readers), and is aimed at the absolute beginner — the complete title is "How to program the IBM PC if you've never programmed a computer before". I am always suspicious of this type of book, as too many authors end up teaching a particular language rather than describing the process of programming using a certain language. It seems to me that Hartnell has fallen into this trap, as he seems to gloss over the hard part of turning an idea into a program in favour of the relatively easy task of writing Basic code. My experience of teaching programming is that beginners have conceptual problems which are more significant than any difficulty in memorising the syntax of the language.

In the main the book is clearly written. The only sentence that I had to read twice was 'note that the ASC value for the letter "A" has nothing to do with the value assigned to A when it is a numeric variable, but refers to "A" when we actually want the computer to print the letter "A" '. Mind you, I'm not sure that I could do better.

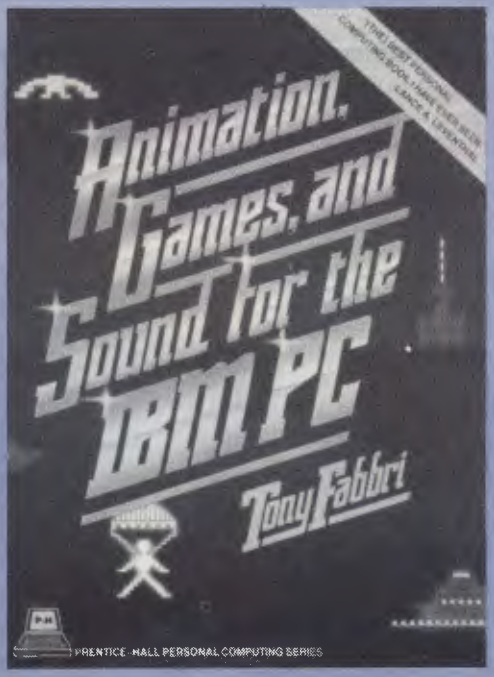
An interesting feature of the book is that the first chapter is a quick guide to the IBM PC, explaining how to run the Basic interpreter, and how to format and copy floppy disks. This is very similar to the information at the beginning of the manuals for many popular packages, presumably because many people don't read the manuals that come with the machine (but do they read software manuals?).

All the usual material is covered: printing, looping, subroutines, random number generation, etc. Some of the particular features of the IBM PC are included, like the function keys and sound generator, although the more advanced uses of these are considered beyond the scope of the book. Instead of the contrived programming examples found in so many books, many of Hartnell's routines are actually interesting, such as the one that simulates Brownian motion.

How To Program The IBM PC

Author: Tim Hartnell
Publisher: Interface (available through Pitman)
Price: $22.50

Animation, Games, and Sound for the IBM PC



Once an IBM user has got to grips with Basic, it is fairly likely that he or she will want to explore some of the more lighthearted things that can be done with a microcomputer, things like animation, games, and sound. Indeed, many introductions to Basic programming cover this kind of material. As its title suggests, this book is devoted to the area closest to the heart of many micro owners.

The illustrations on the front cover are rather misleading, as they show medium-resolution graphics representations of game figures like spaceships and parachutists, when the book is devoted to "character" graphics, e.g. rockets that look like this:

You can do a lot with this kind of thing, and it can result in a satisfying game, so why dress up the book as if it includes arcade-style games?

This book reminded me of a Yum Cha — it presents lots of small items, but it is up to you to select the combination that will give a satisfying meal. I have no doubt that it is an excellent guide to the possibilities of character graphics and sound effects, and it provides plenty of material with which the reader can experiment.

The presentation of the book is well above average, probably because it comes from a mainstream publisher. The layout and typefaces employed are far more pleasing to the eye than the typscript that is increasingly common. This might be a result of larger print runs, but I hope we are not in for a spate of "coffee table" books on computers.

Prentice-Hall (the publishers) actually include a diskette containing all the programs — it's in a sealed, well reinforced plastic sleeve stuck inside the back cover. That certainly beats writing to the USA for a copy. Trivia fans might be able to tell me if this is the first diskette to carry an International Standard Book Number (it isn't the same as the book's ISBN). As the book is also available separately, it's worth mentioning that the program listings are annotated wherever there is room for confusion — notes like "lower case L" and "3 spaces" abound.

Animation, Games and Sound for the IBM PC

Author: Tony Fabbri
Publisher: Prentice-Hall, Englewood Cliffs, New Jersey, USA
Price: $26.95

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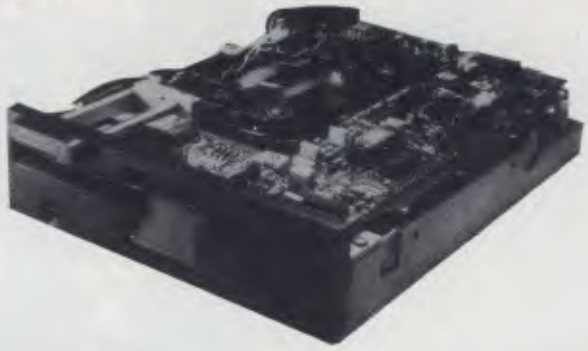

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APC welcomes correspondence from its readers but we must warn that it tends to be one way! Address letters to: 'Communciations', APC, 77 Glenhuntly Road, Elwood, Victoria 3184.

Lookalike

Being a micro owner, I am thinking of buying a larger computer. Could you explain why some computers are called 'IBM lookalikes' and what exactly is the IBM computer? I know IBM is a firm so why the 'lookalike'?

Chris Green

The IBM PC is a 16 bit home/business micro. It uses an Intel 8088 processor running the PC-DOS operating system. The term 'IBM lookalike' covers a multitude of sins. In its broadest interpretation it covers any micro that uses the Intel 8088/86 processor and runs MS-DOS (MS-DOS is virtually the same as PC-DOS). The definition of 'IBM lookalike' I prefer is that you can take a disk out of an IBM and put it into the 'lookalike' machine and it will run quite happily. Very few machines can do this, as they not only have to look like an IBM but also think like an IBM.

Peter Bright

Slow sort

The article "Column Sort" (*APC* January 1984) describes a sorting algorithm which resembles what Wirth calls a straight insertion sort. When a record is added to the list, *all* the existing records must be scanned.

This means that if n records were to be sorted using this method,

C=n(n-1)/2 comparisons would be necessary:

n	10	50	100	500	1000
c	45	1225	4950	124750	499500

It is possible to improve the performance of this (slow) algorithm by forgetting about the first number list altogether. The i-th element in the inverse number list points to the alphabetically i-th element in the name list. All that is needed to insert a name is to scan the inverse list (accessing the name list using the pointers), determine where the pointer to the new name should be placed, place the new name at the end of the name list and insert the pointer to the new name into the inverse list. The scan of the inverse list could be done using a binary search to make it more efficient.

It should be kept in mind that more sophisticated and more efficient data structures and sorting algorithms are available, and perhaps should be used if the number of records is large.

C E Chew

Fortran transposition

Programs have been given in the August and November issues of *APC* for storing the transpose of a matrix in a separately allocated section of memory. An editorial question was raised about replacing the original matrix by its transpose. The original operation is relatively trivial but the second is much more difficult as John Hardman has found.

The attached Fortran subroutine has been well tested over six years and will achieve the required transposition within the same memory allocation. Row by row storage as opposed to column by column is evidently non-essential. However, as part of a package of matrix algebra subroutines it was selected for convenience in row by row print out of matrices.

An editorial question concerned uses to which transposition could be put. Most usually transposes arise as a consequence of certain processes in matrix algebra, after which the transposition may be required. For example one convenient procedure for generalised matrix inversion leads naturally to the transpose of the generalised inverse. Transposition within the same memory space is then required to yield the untransposed inverse, which usually is needed for following applications. Typical intermediate results in matrix algebra incur matrix products of which one member is transposed. It is thus possible to achieve useful savings with matrix products by designing the algorithms so that they may be adapted to give three types of product A x B, A^1 x B and A x B^1. There does not commonly occur a requirement for the A^1 x B^1 product, but this can be readily achieved as B x A followed by transposition.

A package of subroutines which include the above is available from Decus.

H W Holdaway

1 p.159, The Australian Computer Journal, Vol 9, No 4, November 1977

P.S. The Fortran problem given will fail for very large matrices where the integers and integer arithmetic exceed allowable bounds. One simple procedure to alleviate such a problem is to employ floating point arithmetic followed by floating point to integer conversion in the problem areas.

```
C   RETURNS THE TRANSPOSE OF
    MATRIX A(M,N), STORED
C   ROW BY ROW IN A SINGLE
    ROW ARRAY, AS A'(N,M)

C   STORED SIMILARLY IN
    THE SAME MxN ARRAY A
    MN  = M*N-1
    MNN = MN-N
    MN1 = MN-1
```

C·O·M·M·U·N·I·C·A·T·I·O·N·S

```
      K = 0
      I1 = 1
      DO 25 I = 2,MN1
      IF (K.GT.MNN) GOTO 5
      K = K+N
      J = K
      GOTO 10
    5 K = K-MNN
      J = K
   10 IF(J.GE.I1) GOTO 15
      JN = J*N
      J = JN-MN*(JN/MN)
      GOTO 10
   15 IF(J.EQ.I1) GOTO 20
      J = J+1
      SAV = A(I)
      A(I) = A(J)
      A(J) = SAV
   20 I1 = I
   25 CONTINUE
      RETURN
      END
```

Another angle

In the current hiatus over software copyright, there is little, if any, discussion on who hopes to get what from what. With a few exceptions like Applied Technology and L&L Industries, the Australian computer industry is better described as the retailing of material developed abroad — usually in the United States. The result is that computers in Australia are more expensive than 'over there' — partly because of Government charges but also because of the high distribution costs.

I do not agree with Albert Langer's Software Liberation movement. Instead of using his unemployed workers to plagiarise other people's hard work, he would be more helpful to his fellow citizens if he were to write improved packages for the public domain.

I believe the cost of software in Australia is generally too high and is the direct cause of most of the pirating. The current system is selling high-priced packaging into a market which is generally interested in good but cheap generic products. It is like trying to sell hard cover books when the readers are waiting to buy the paperback edition (or borrow from the local library).

If the customer wants the deluxe glossy manuals and immediate support then they pay top prices. But if the manual is presented as a disk tape file then the buyer can opt for their copy to be generated at the point of sale and so avoid all unnecessary distribution costs and import charges and duties. There seems little reason why software should cost more here than 'over there'. The cost of software could be reduced to: the media, any royalties, and point of sale margin — even after-sales support would be an optional extra. I wonder how much of the currect fuss is about copyright and how much is about the 'value' added in the distribution chain.

Neither do I agree with Computer Edge importing pseudo-Apples — the Wombat could have been built here! It is a pity that they did not devise a system so superior that even Apple could not claim it was a copy. At the moment US computers double in price across the Pacific — would Mr Barson please explain the pricing policy for the BBC. Just what does the copyright system hope to achieve — is Australia to be the dumping ground for over-priced dinosaurs? It is good news that the IBM PC and the BBC are to be made here. But does that mean that Australia makes Mk 1 versions while the rest of the world makes and uses Mk 2 and 3 versions?

The sooner the current confusion is cleared up the better. Is it too much to ask that the Government says what (if anything) it intends to do? As a start I suggest that we find out who is gaining and losing from the copyright system and where the money we all pay is going — how much actually gets to the program generators?

Dave Nowlan

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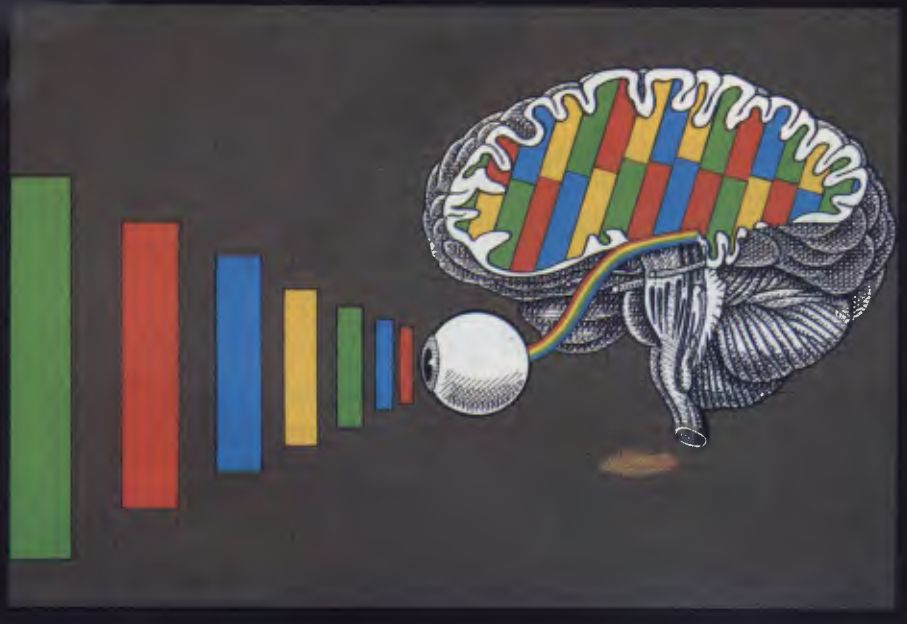
A CLOSE ENCOUNTER OF THE ATARI KIND

You can learn about yourself with this music synthesiser/light-show version of SIMON for the Atari by Tim Banse.

Have you ever watched kids and grown-ups at the video arcade pouring an oil shiek's ransom in twenty cent pieces into a game of intergalactic conquest? Besides passing time and building hand-eye coordination, the gamers are flexing an advantage unavailable to yesteryear's Neanderthal hunter-warrior kind. With these readily accessible new-fangled micros comes a new way of thinking, seeing and communicating with the universe. And although at first glance the 'R is for Red' game offered here may appear similar to a well-known chain store home entertainment device, close scrutiny reveals several dimensions that run deeper than any party game.

One of the discovered jewels in this dawn of the Age of High Technology has been researchers' realisation that different hemispheres of the brain click in or out while performing different tasks. The brain can operate in two different dimensions in deciphering this light and sound cryptogram. First is the conscious level where you can remember: 'Let's see, I saw a blue bar, two greens and then a red.' But probably more important is the unconscious, or Zen, part: the Force part where the participant doesn't think about the tennis, jogging or computer game strategy. He simply reacts without thinking, as many of us do.

In 'R is for Red', the colour and music sequence is not remembered for its individual sights and sounds, but rather is recalled as an entire block or 'word' made up of colours. The colour bars are like an alphabet — words are spelt out, not with A to Z characters, but with patterns of blues, reds, greens and yellows. As the colours flash on to the screen you don't dissect the pattern letter by letter, but speed-read it as a word, phrase and sentence.



Doesn't it sound fascinating? The concept becomes intriguing when you recall the film *Close Encounters of the Third Kind,* in which an international team of scientists assemble at Devil's Tower to set up a music synthesiser/light-show to communicate with aliens. They communicate with blocks of colour and sound in a high-tech, computer-driven Esperanto. How many colours can your eye and brain distinguish? Six or seven at one time is about average, but with practice the galaxy is the limit.

One of the more sophisticated software aspects of this colour cryptogram is how it uses the player missile graphics. While no animation is used, the program does exploit some of the unique qualities of the Atari personal computer, such as its speed. Instead of having to draw, undraw and then draw again every time the program needs to flash a colour on the screen, the Atari uses the player-missile graphics. The first step is to draw the bars from top to bottom, one at a time, from left to right. Since no colour for the bars is specified they are automatically assigned the default black.

All four players are displayed on the screen, side by side, waiting for the routine that will call each to life when its appropriate colour register is POKEd: it remains painted for as long as the skill level delay loop lets it. The bar is then faded to black and the next appropriate colour bar comes out of hiding.

With the Atari, each player has an individual size register that controls its width. For experimentation's sake, POKE the number 3 instead of the number 1 with each of the four registers assigned to statement number 1280. Run the program. Each player will have quadrupled in width and each will be overlapping the others. The display will now be quite ugly. For an aesthetic remedy, change the horizontal locations of each of the layers in lines 1300 and 1310. Replace the values of 90,110,130 and 150 with 50,90,130 and 170, respectively. Next time you run the program it will look much prettier.

To play the game, wait while the player/missile graphics are initialising. Read, filling that area of RAM with zeros to clear it and then actually drawing the colour bars. A message will then flash on the screen saying SKILL LEVEL (1-5). At that point, hit any number from 1 to 5, with 1 being the slowest and easiest routine and 5 being the fastest, toughest and most interesting.

As the program puts you through its paces, it will flash a colour bar on the screen, the colour accompanied by its own musical note. When you see a blue bar, hit the letter B. Just touch the key — you won't need to hit return: R is for red; B is for blue; and Y is for yellow. When you respond with the correct key for the correct colour, another colour musical note will be added to the sequence.

Line 110 clears the screen. The poke 84 modifies the print command so that it stays within the range of the graphics 2 mode, preventing an error message.

Line 120 directs the program to the player/missile graphics sequence. Lines 1180 through 1260 draw the vertical bars 70 bits tall by eight bits wide and paint them black, by default. Line 1280 sets the player at single width, which translates into eight bits across. Lines 1300 through 1310 place the boxes at their horizontal positions. Line 1330 gives the final signal to turn on the graphics.

Meanwhile, back at the top of the program: line 170 prints the skill level message and the micro waits at line 200 for the choice. When a key from 1 to 5 is typed, that key's ASCII code is compared to the table in lines 230-270. The appropriate skill value will be placed in the delay loop that determines how long the colour bars will be on-screen. Line 290 routes you to the beginning of the main program.

Line 640 picks a random number, any number between 1 and 4. That number is given a number. The first number will be between 1 and 4 and will tell the program which of the four colours (red, blue, green or yellow) to display. The second number, which keeps track of each colour in the sequence, is assigned in each turn by line 690. Once a colour is chosen, and having told the computer where it is in the sequence, the program jumps to line 300.

Lines 300-410 hold the program loop where all the colours in the sequence so far are flashed on the screen. You will see all the previous colours you have remembered and keyed correctly, plus one addition to the pattern.

Lines 470-600 will test your memory

```
100 REM "R" IS FOR RED GAME
110 ? CHR$(125):REM CLEAR SCREEN
120 GOSUB 1000:REM GO DRAW COLOR BARS
130 DIM TURN(255),SKILL$(3),NUMBER(255)
140 REM LOCATE CURSOR
150 POSITION 2,10
160 REM CHOOSE SKILL LEVEL
170 ? #6;"SKILL LEVEL  (1-5)"
180 REM READ KEYBOARD
190 OPEN #1,12,0,"K:"
200 GET #1,SKILL
210 CLOSE #1
220 REM SET SPEED OF DISPLAY
230 IF SKILL=49 THEN SKILL=150
240 IF SKILL=50 THEN SKILL=100
250 IF SKILL=51 THEN SKILL=50
260 IF SKILL=52 THEN SKILL=25
270 IF SKILL=53 THEN SKILL=10
280 REM GET FIRST COLOUR
290 GOTO 640
300 COUNT=0:REM RESET COUNTER
310 REM LOOP TO DO EACH COLOUR
320 FOR I=1 TO NUMBER
330 REM DISPLAY EACH COLOR
340 IF TURN(COUNT)=0 THEN GOSUB 720
350 IF TURN(COUNT)=1 THEN GOSUB 780
360 IF TURN(COUNT)=2 THEN GOSUB 840
370 IF TURN(COUNT)=3 THEN GOSUB 900
380 REM INCREMENT EACH TIME
390 COUNT=COUNT+1
400 REM DO NEXT COLOR
410 NEXT I
420 REM OPEN KEYBOARD  FOR READ
430 OPEN #1,4,0,"K:"
440 COUNT=0
450 REM FIRST TIME THROUGH IS 1
460 IF NUMBER<1 THEN NUMBER=1
470 FOR K=1 TO NUMBER
480 REM READ KEYBOARD
490 GET #1,RESPONSE
500 REM KEEP TRACK OF TIMES THROUGH-
510 LET ANSWER=TURN(COUNT)
520 REM TRANSLATE ANSWER
530 IF ANSWER=0 THEN ANSWER=82
540 IF ANSWER=1 THEN ANSWER=66
550 IF ANSWER=2 THEN ANSWER=71
560 IF ANSWER=3 THEN ANSWER=89
570 REM MATCH PATTERN AGAINST PLAYER RESPONSE
580 IF RESPONSE<>ANSWER THEN 970
590 COUNT=COUNT+1
600 NEXT K
610 CLOSE #1
620 NUMBER=NUMBER+1
630 REM CHOOSE RANDOM COLOUR
640 LET COLOR=INT(4*RND(1))
650 REM SAVE COUNT IN NUMBER
660 LET COUNT=NUMBER
670 IF COUNT=0 THEN COUNT=1
680 REM LABLE EACH COLOR IN SEQUENCE
690 LET TURN(COUNT)=COLOR
700 REM DO AGAIN
710 GOTO 300
720 POKE 704,40:REM COLOR RED
730 REM MAKE SOUND
740 SOUND 1,50,10,8:FOR J=1 TO SKILL:NEXT J
750 SOUND 1,0,0,0:REM KILL SOUND
760 POKE 704,0:REM COLOR BLACK
770 RETURN
780 POKE 705,120:REM COLOR BLUE
790 REM MAKE SOUND
800 SOUND 1,72,10,8:FOR J=1 TO SKILL:NEXT J
810 SOUND 1,0,0,0:REM KILL SOUND
820 POKE 705,0:REM COLOR BLACK
830 RETURN
840 POKE 706,192:REM COLOR GREEN
850 REM MAKE SOUND
860 SOUND 3,96,10,8:FOR J=1 TO SKILL:NEXT J
870 SOUND 3,0,0,0:REM KILL SOUND
880 POKE 706,0:REM COLOR BLACK
890 RETURN
900 POKE 707,255:REM COLOR YELLOW
910 REM MAKE SOUND
920 SOUND 3,96,10,8:FOR J=1 TO SKILL:NEXT J
930 SOUND 3,0,0,0:REM KILL SOUND
940 POKE 707,0:REM COLOR BLACK
950 RETURN
960 TRAP 960:GOTO 240
970 REM MISTAKE ROUTINE
980 CLOSE #1:REM TURN-OFF KEYBOARD
990 REM BLUNDER SOUND
1000 SOUND 1,243,10,8
1010 REM DELAY TO PLAY SOUND
1020 FOR I=1 TO 200:NEXT I
1030 REM TURN OFF SOUND
1040 SOUND 1,0,0,0
1050 REM CLEAR ALL VARIABLES TO ZERO
1060 REM THEN BEGIN AGAIN
1070 CLR :GOTO 130
1080 GRAPHICS 2+16:SETCOLOR 4,7,4
1090 REM LOCATE CURSOR
1100 POSITION 4,10
1110 REM WAIT MESSAGE WHILE DRAWING
1120 REM PLAYER/MISSILE GRAPHICS
1170 ? #6;"PLEASE WAIT"
1140 A=PEEK(106)-8:POKE 54279,A
1150 PMBASE=256*A:POKE 559,46
1160 REM CLEAR GRAPHIC MEMORY BY LOADING WITH ZEROS
1170 FOR I=PMBASE+512 TO PMBASE+1024:POKE I,0:NEXT I
1180 REM DRAW BOXES 8 BITS WIDE BY 70 BITS TALL
1190 FOR RED=PMBASE+528 TO PMBASE+598
1200 POKE RED,255:NEXT RED
1210 FOR BLUE=PMBASE+656 TO PMBASE+726
1220 POKE BLUE,255:NEXT BLUE
1230 FOR GREEN=PMBASE+784 TO PMBASE+854
1240 POKE GREEN,255:NEXT GREEN
1250 FOR YELLOW=PMBASE+912 TO PMBASE+982
1260 POKE YELLOW,255:NEXT YELLOW
1270 REM SET WIDTH OF BOXES
1280 POKE 53256,1:POKE 53257,1:POKE 53258,1:POKE 53259,1
1290 REM LOCATE BOXES HORIZ. POSITION
1300 POKE 53248,90:POKE 53249,110
1310 POKE 53250,130:POKE 53251,150
1320 REM TURN ON GRAPHICS
1330 POKE 53277,3
1340 RETURN
```

Close Encounters Listing

of the sequence.

As each colour comes up on its turn, lines 320-410 will send the program to the subroutine which paints that colour. There are four such subroutines: lines 720-770, 780-830, 840-890 and 900-950. On reaching one of these subroutines, the program will paint the bar either red, blue, green or yellow. Then comes the musical note. Colour and note are delayed for as long as was specified in the skill level. After the delay is satisfied, the sound is killed and the bar is painted black, then it's back to the main loop for the next colour bar.

The loop knows how many colours were flashed on the screen and will wait for that many keystrokes. Each keystroke will be matched against the proper sequence. If you enter a colour out of sequence, the program lumbers off to the 'blunder' routine to let you know you aren't as quick or as smart as you once were.

The blunder routine, lines 1000 through 1070, shuts off the keyboard, plays a sour note, clears the value of all variables to zero and starts the game over.

However, if you haven't yet goofed, the game will continue randomly adding colour bars to the sequence.

One thought — why not close both eyes and play by ear? Can you recall the sequence of musical notes? How about manual dexterity? Where is that R? Here's where you try out the computer Zen I mentioned earlier, remembering what you 'saw' with your mind's eye, reaching out with that inner sanctum of grey matter that we little understand and so much crave to master. END

Tim Banse is author of Home Applications for the Atari Personal Computer *published in the USA by Computer Science, August 1983.*

Teach yourself Assembler

Starting this month we begin APC's introduction to assembly language programming. In order to give you the best possible understanding of it, Paul Overaa uses Basic as his reference point.

If you've been wondering whether you would ever learn to program in assembly language . . . if you've picked up a teach yourself book and been blinded by science . . . if you've wished you could join the other *APC* readers for whom Subset is a monthly treasure trove . . . then today is your red-letter day. Each article will deal with a digestible section of assembler and will contain a piece of code for you to type in and run: to do this you will need an assembler program. You can buy one for your computer from a software dealer. Our series will contain details for computers using the Intel 8080, the Zilog Z80 or the MOS 6502 processors, but if your machine doesn't happen to be based on one of these, don't despair. Throughout the series emphasis will be placed on the programming structures used, so you should be able to implement the example programs using the instruction set appropriate to your computer's processor.

What is an assembly language?

Your first question may be . . . What is an assembly language anyway? The language a microprocessor understands — machine language — is that of binary numbers. For example, the binary number 11000011, (a jump instruction in the language of one processor), is rather like a GOTO in Basic. The difference is that a memory location instead of a Basic line-number is targeted. It's possible to program a computer using these codes, or using hexadecimal numbers in their place, but the moment you use any system other than binary, the computer cannot recognise the instruction. Instructions need to be converted into binary, either by hand or using the computer itself, before the processor can act on them.

Hexadecimal numbers are almost as incomprehensible to humans as are binary ones: would it matter to you whether you had to use 11000011 or C3 instead of a word like GOTO? There is certainly a difference, and early on in the development of the computer it became clear that to write even moderately sized programs in binary, hexadecimal ('hex') or octal was a masochistic activity. So a language was created that used operations identical to those the computer could perform, but which was easier for humans to understand. That's how assembly language programming was born. The names given to the instructions are mnemonics (a word meaning 'memory jogger'). The mnemonic for the 11000011 instruction is JMP, which is a useful improvement.

Hexadecimal numbers

You'll still need to manipulate some hexadecimal numbers as memory locations. Don't panic! You've probably already used hexadecimal counting unconsciously. When you'd add pounds and ounces, you'd add the ounces first: if they came to more than 16 you'd carry the number of multiples of 16 into the pounds column, for example:

2lbs 14 ounces
+
2lbs 5 ounces

5lbs 3 ounces
(14+5=19 which is 'one of 16' and '3 oz left over')

If, instead of using numbers from 0 to 15 for ounces we used 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F, we could then write 2lbs 14oz as 2E and so on. This extended numbering system forms the basis of the hexadecimal notation. If you now consider the eight bits of a byte of binary information as two groups of four bits, you will appreciate that we can represent each of those groups by a hexadecimal digit. So, with binary number 10001111.

1000 Binary=8 Decimal=8 Hex
1111 Binary=15 Decimal=F Hex,

so 10001111 binary can be written very compactly as 8F hex. An eight bit binary number can take values from 0 to 255, that is, from 00000000 binary to 11111111 binary. Only two characters are needed to express the same range in hexadecimal notation! In a similar fashion, we can represent two bytes (16 bits) of information by using four hex digits: try writing 1111000010001111 in hex yourself. Most assemblers expect memory locations to be provided as hexadecimal numbers.

Standard mnemonics

The choice of mnemonics to be used with a particular processor is arbitrary, and the selection is made and recommended by the people who make the chip in question. If you think in terms of Basic, you may have realised that different software houses write their Basic interpreters and compilers around various standard facilities, but still end up producing slightly different versions of Basic. If you compare the Basic keywords for the Apple with those for the VIC-20 you'll see the difference. That's why you need the *APC* converter chart when you want that wizard ZX81 program of Uncle Sam's to run on your Tandy. Manufacturers of microprocessors also design differently, so that each type has its own characteristics and methods of implementing the functions it provides, thus its own set of mnemonics. For this reason, the mnemonics you use will depend on the chip around which your computer is built.

In this series we deal with three chips, the Intel 8080, the Zilog Z80 and the MOS 6502. The Z80 is used, for example, in the System 80 and MicroBee; the 6502 in the Apple and Pet, to name only a couple. The 8080 is included because although getting on in years, it is a useful jumping-off point for some of our explanations.

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What is an assembler program?

Having written in assembly language mnemonics, you need to convert your program into binary for the computer to work. The computer program that does this conversion for you is called an assembler. Nowadays, many assembler programs have editing facilities incorporated. This means you can write your assembly language program direct into the computer as you would a Basic program, and the editor will pick you up on your errors. Then, when the program is bug-free, you press a key and the program is 'assembled'. The assembler itself can be on a cassette, like a games program, which you load into your machine.

Each assembler has its own rules, which you will need to be aware of. One of the things you will learn this month is how to use your assembler to get the code in this article into your machine. Have a glance through the documentation supplied with your assembler before you begin, but don't worry if a lot of it seems like incomprehensible jargon to start with.

A line in an assembly language program can be divided into three regions or 'fields'. These are a label field, an instruction field and a comments field. The first and last are optional. Your assembler will have fixed rules for identifying the individual fields and you'll find these in the documentation provided with it (see Fig 1, example line from an assembly language program).

```
CHECK^CHARACTER:   CPI CARRIAGE RETURN      : end of input?
^                  ^                        ^
Label field        Instruction field        Comment field
(Optional)                                  (Optional)
```

Fig 1 Example line from an assembly language program

Comments within the program

You'll probably be familiar with REM statements in Basic. In such a high-level language you can often work out what a program does even if it hasn't been properly documented with a healthy sprinkling of REM statements. The same is not true of assembly language. One of the fundamental differences between high level languages (such as Basic) and assembly language is that the latter is difficult to analyse. This is because any inherent structure is not always obvious in the code, so make the most of a lesson many of us have learnt the hard way and document to the maximum extent, time and your assembler permitting. *The importance of placing understandable comments within an assembly language program cannot be over-emphasised.*

Labels

Most assemblers allow you to use meaningful names for specific locations in memory. This means you don't have to remember, for example, that location 0A3F Hex is the start of a subroutine that checks for keyboard input characters. Instead, you may use a label, say CHECK^CHARACTER in the label field of the first instruction of that subroutine. The assembler will add the label to an internal symbol table it maintains, and you can then use the label to reference the routine. (Some assemblers require you to place a delimiter character, often a colon, immediately after a label definition in order that the assembler can distinguish it from the instruction field.)

Equate directive

Another facility offered by assemblers enables names to be assigned to numeric values. Since this facility is a function of the assembler rather than the processor, the equate directive is known as a pseudo operation, pseudo-op for short. It is especially useful for defining many of the common ASCII characters.

By placing the following statement at the start of an assembly language program, you cause the assembler to include these definitions in its symbol table.

```
CARRIAGE$RETURN     EQU  13
SPACE               EQU  32
```

Using these definitions will make your programs more readable to yourself . . . and to others.

Other pseudo-ops such as ORG (short for origin) are available: ORG selects whereabouts in memory your program is to start. Having given you an idea of what assembly language is, we'll add to your knowledge of pseudo-ops as and when required.

Operating systems

Before a microprocessor can do anything useful, it needs a means of getting data, somewhere to send its output, additional memory, and a way of coordinating everything that's going on. The routines which perform these and other functions are known collectively as the computer's operating system. Micros that use disk drives for input/output data generally use one of a number of 'soft' operating systems such as CP/M (Control Program for Microcomputers) or MS-DOS (Microsoft Disk Operating System). These are programs which the user needs to load into his machine before any other work is done. Home micros generally have an 'own-brand' operating system resident in read only memory (ROM).

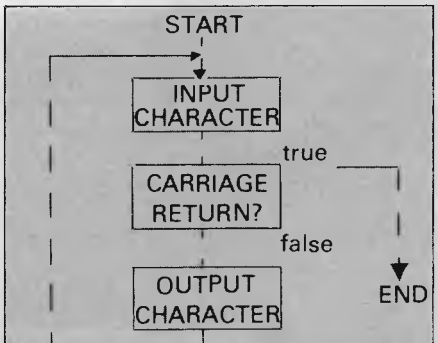

Fig 2 Flowchart for the example program

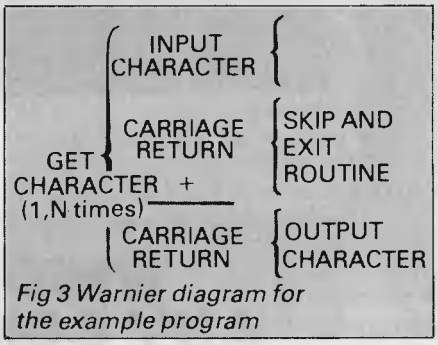

Fig 3 Warnier diagram for the example program

Operating systems usually contain accessible routines which you may use in your own programs to simplify many operations. In this series we can't cover *all* the available operating systems, so we'll avoid reference to specific computers. This means that when the time comes, you will have to delve into your computer's manual for certain details you'll need. But by the time we get to that stage you'll have been given sufficient grounding in the general principles to know what you're looking for.

Memory pages

I've already said that it's possible with a two byte address to specify any one memory location out of a total of 64k (64 × 1024=65536) such locations. Such an address can be written in hex form

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using four digits. An additional concept of dividing available memory into pages, each of 256 locations, has proved useful. The first byte, or high byte, of such an address is often called the page number. Page zero refers to the initial 256 bytes of memory, whose addresses go from 0000 hex to 00FF hex. Structured programming has been made possible thanks to the discovery that virtually all problems can be solved using a combination of three structures, sequence, repetition and alternation.

For our theme this month, let's take repetition — the loop structure. The program we'll use to illustrate it, and to give you your first hands on experience of assembly language programming, is a simple one to collect characters directly from the keyboard and print them on the VDU screen. This program could be written in various ways in Basic. We've chosen a representation that makes for easy comparison with the assembly language equivalent. Figs 2 and 3 contain the flowchart and Warnier diagram for our program.

```
5  ***************************  REM  SETUPBLOCK  **********
10 CLEAR
20 CARRIAGE.RETURN$=CHR$(13)
22 ***************************  REM  ENDSETUPBLOCK *******
23
24
25 ***************************  REM  MAINBLOCK ************
30 X$=INPUT$(1)                REM  COLLECT CHARACTER IN X$
40 IF X$=CARRIAGE.RETURN$
   THEN 70                     REM  END OF INPUT IF TRUE
50 PRINT X$                    REM  OUTPUT CHARACTER TO VDU
60 GOTO 30                     REM  GET NEXT CHARACTER
62 ***************************  REM  ENDMAIN BLOCK *********
63
64
65 ***************************  REM  END BLOCK
70 END
72 ***************************  REM  END OF END BLOCK
```

Fig 5 Complete Basic Version

In use

The Basic program can be divided into three parts. An initial or 'set up' block is used to define a variable called CARRIAGE.RETURN$ as the string equivalent of the ASCII 13 carriage return code. The end block is nothing more than a single Basic END statement. The bulk of the program, labelled the main block, performs several functions. The INPUT$() function collects a character. We then check to see if it's a carriage return character, and if it is we jump to the end of the program. Otherwise, we print the character and jump back to the input statement in line 40 for the next character. An example of the basic form can be seen in Fig 5.

When we write an equivalent program in assembly language we use the same type of program structure. The set up block will, however, vary according to your processor, assembler and operating system. We give three examples of the kind of coding that could be expected. First we shall deal with the 8080 form:

8080 MNEMONICS FOR THE SET UP BLOCK

```
CARRIAGE$RETURN    EQU   13
                   ORG   100H
                   JMP   STACK
                   ORG   150H
STACK:             LXI   S,P,$-2
```

Operations used

1. Define CARRIAGE$RETURN so that the assembler will recognise this term as meaning the number 13.
2. Define whereabouts in memory your program is to start. Our assembler uses ORG, so in the example above the program starts at 100 hex.
3. We perform an unconditional jump to an address labelled STACK. A stack is an area of memory which is used to store items the processor will need from time to time. It's called a stack because items are added to it and taken from it in the same way you would take and add cards to and from the top of a pack of playing cards on the last in, first out basis. Each of the three processors we are describing has a stack pointer register to determine the memory location currently at the top of the stack. Instructions for placing items on top of the stack automatically adjust the stack pointer accordingly. We'll be using the stack often, and will deal with its other uses as appropriate. It is common practice to talk of the placing of data on the stack as 'pushing' onto the stack. When items are removed the terms popping or pulling are used.

A register is a place within a processor that can hold binary information. With eight bit processors we talk of an eight bit word length, and this, as you probably know, is called a 'byte'. 8 bit registers in our processors can therefore hold one byte of information.

Eight bit processors usually provide some means of combining pairs of their eight bit registers in order that a 16 bit (two byte) memory address can be specified. This is vital if we are to be able to 'address by name' all the memory locations in the 0 to 64k range. In fact, certain memory addressing instructions enable less than the full address to be given and this can have advantages in terms of speed of operation.

Since we've digressed, lets complete our digression by looking at a schematic layout of the 8080 processor (Fig 4). The 'Accumulator' is a straightforward 8 bit register, and is used, often

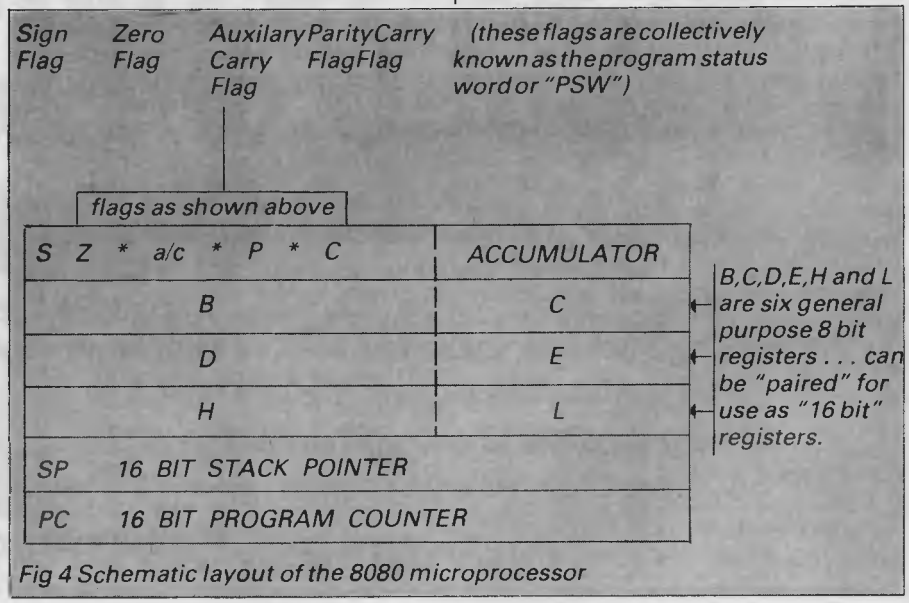

Fig 4 Schematic layout of the 8080 microprocessor

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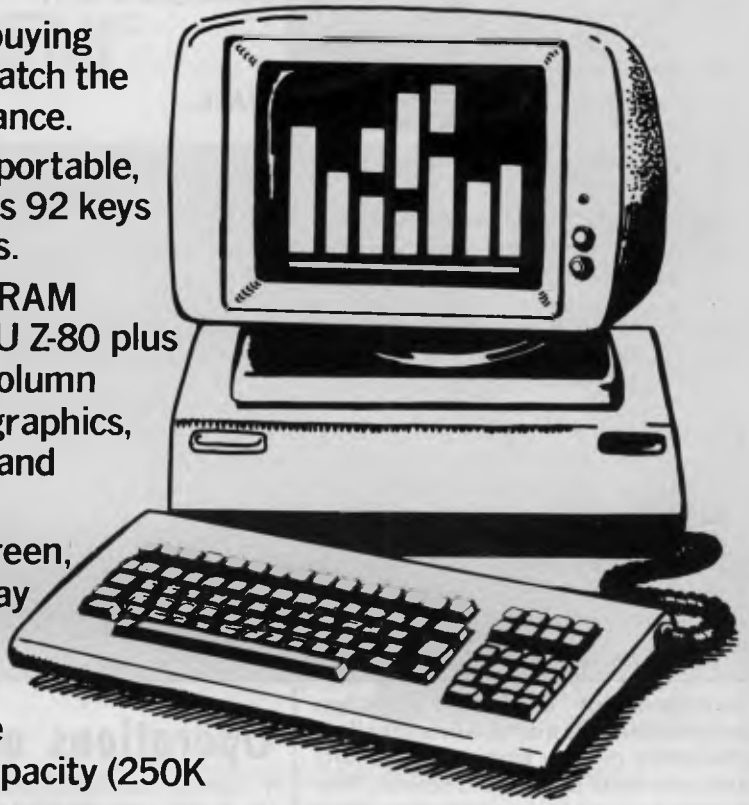

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implicitly, for all data I/O and arithmetic/ Boolean operations. Many instructions apply specifically to this register.

Six 'Secondary Registers' are shown. Each can be used as an individual 8 bit register, but it's possible to pair B,C...D,E..and H,L to create effective 16 bit registers.

You'll also notice a set of 'Flags'. Flags are a group of bits which collectively can be referred to as a status word or program status word. These bits are affected by the occurrence of certain conditions: for example, any arithmetic operation that results in zero being present in the accumulator will set the zero flag to 1. (Remember that a bit can only take the value of 0 or 1), and that by convention, 1 is used to represent the 'true' condition.

That's the end of the digression, so back to the code. The unconditional jump we performed (JMP STACK) is the first real assembly language instruction we have encountered. It's called an unconditional jump because it is performed irrespective of any processor flag conditions. The mnemonic JMP represents a three byte instruction. The first byte is the op code, that is, the numerical representation of the mnemonic. The second and third bytes are the address that is specified.

The microprocessor performs this jump by placing the address following the op code into the program counter register, which is the destination register for the information transfer. As the mnemonic JMP uses the two byte address (or a label) as its operand it is said to be able to use the immediate addressing mode.

4. Now we tell the assembler to pass over the space we are reserving for use as a stack. The ORG 150H instruction means the assembler places our next mnemonic at this new origin, leaving half a page of memory for the stack.

5. Lastly, we load the stack pointer register (SP) with the value $-2. This is because our assembler uses '$' to define the address of the current memory location, and is done with the mnemonic LXI, used by the 8080 to place a 16 bit address into a register pair, in this case SP.

Remember to check with your assembler manual whether the pseudo-ops ORG and EQU are achieved using these or different mnemonics.

Z80 MNEMONICS FOR THE SET UP BLOCK

The only difference is the unconditional jump mnemonic which on the Z80 is JP. We again use immediate addressing.

```
CARRIAGE$RETURN    EQU 13
                   ORG 100H
                   JP STACK
                   ORG 150H
STACK:             LD SP,$-2
```

6502 MNEMONICS FOR THE SET UP BLOCK

The 6502 uses page one addresses for the stack. The stack pointer is an eight bit register but using an extra leading bit (implied with a bit of hardware jiggery pokery) the 6502 creates a nine bit address for the stack pointer. So, if you load it with FF hex it will be pointing to memory location 1FF. You can't load the stack pointer register directly on the 6502, so instead you load the X register using mnemonic LDX and then transfer the contents of X to the stack pointer (S) register using TXS. With 6502 systems the stack will have been set up by the operating system, so you will use the existing stack. Typical code for the 6502 set-up block is shown below:

```
CARRIAGE$RETURN    EQU 13
                   OKG 800H
```

We have indicated the general type of set up block usually required. It may be that your particular system requires joint use of the stack and that your programs should simply use an existing stack. In other cases, it is necessary to save the 'operating systems' stack pointer so that it can be re-instated when your program has finished. You must, to a large extent, be

FULL LISTING 8080 VERSION

Notes: The operating system we are using requires that you identify the system function needed by placing a 'function number' into the microprocessors C register. It also expects 'output characters' to be in the E register and not the accumulator. This means we have to use instructions to transfer the contents of the accumulator into the E register. We set up the necessary details and then we CALL the operating system through a common entry point which is a jump located at memory location 5. The direct I/0 function used also needs FF hex present in the E register to indicate that imput (rather than output) is required.

SET-UP-BLOCK

```
CARRIAGE$RETURN   EQU   13
OPERATING$SYSTEM  EQU   5
                  ORG   100H
                  JMP   STACK
                  ORG   150H
STACK:            LXI   SP,$-2
```

MAIN BLOCK

```
START:            CALL  INPUT$ROUTINE
                  CPI   CARRIAGE$RETURN
                  JZ    FINISH
                  CALL  OUTPUT$ROUTINE
                  IMP   START
```

END-BLOCK

```
FINISH            JMP   0          ;Reboot operating
                                   system
```

INPUT-ROUTINE

Notes: We have to use a 'wait for input' loop here. With our system it is necessary to preserve registers before using the operating system 'calls'.

```
INPUT$ROUTINE:    PUSH B!PUSH D! PUSH H   Preserve registers
INPUT$ROUTINES1:  MVI   E,0FFH            ;Signifies console
                                          input
                  MVI   C,6               Direct console 1/0
                                          function
                  CALL  OPERATING$SYSTEM
                  CPI   0                 ;0= no key preseed
                  JZ    INPUT$ROUTINES1
                  POP H ! POP D ! POP B   ;Restore registers
                  RET
```

OUTPUT-ROUTINE

```
OUTPUT$ROUTINE:   PUSH PSW ! PUSH B ! PUSH D ! PUSH H
                  MOV   E,A               ;transfer is in E reg-
                                          ister
                  MVI   C,2               ;Console output
                                          function
                  CALL  OPERATING$SYTEM
                  POP H ! POP D ! POP B ! POP PSW
                  RET
```

8080 MNEMONICS

```
START:  CALL    INPUT$ROUTINE           :collect character in
                                        :accumulator
        CPI     CARRIAGE$RETURN         :end of input if true
        JZ      FINISH
        CALL    OUTPUT$ROUTINE          :output character to VDU
        JMP     START                   :get next character
```

Z80 MNEMONICS

```
START:  CALL    INPUT$ROUTINE           :COLLECT CHARACTER in
                                        ;accumulator
        CP      CARRIAGE$RETURN         :end of input if true
        JP      Z, FINISH
        CALL    OUTPUT$ROUTINE          :output character to VDU
        JP      START                   :get next character
```

6502 MNEMONICS

```
START:  JSR     INPUT$ROUTINE           :collect character in
                                        :accumulator
        CMP     # CARRIAGE$RETURN      :end of input if true
        BEQ     FINISH
        JSR     OUTPUT$ROUTINE          :output character to VDU
        JMP     START                   :get next character
```

Fig 6 Main block coding

FULL LISTING Z80 VERSION

Notes: See the 8080 notes for details concerning our operating system

SET-UP-BLOCK

```
CARRIAGE$RETURN     EQU     13
OPERATING$SYSTEM    EQU     5
                    ORG     100H
                    JP      STACK
                    ORG     150H
STACK:              LD      SP,$-2
```

MAIN-BLOCK

```
START:              CALL    INPUT$ROUTINE
                    CP      CARRIAGE$RETURN
                    JP      Z,FINISH
                    CALL    OUTPUT$ROUTINE
                    JP      START
```

END-BLOCK

```
FINISH              JP      0               ;Reboot operating
                                            system
```

INPUT-ROUTINE

Notes: See the 8080 notes for details concerning our operating system

```
INPUT$ROUTINE:      PUSH B ! PUSH D ! PUSH H    ;Preserve registers
INPUT$ROUTINES1:    LD      E,0FFH              ;Signifies console
                                                input
                    LD      C,6                 ;Direct console 1/0
                                                function
                    CALL    OPERATING$SYSTEM
                    CP      0                   ;0= no key preseed
                    JP      Z,INPUT$ROUTINE$1
                    POP H ! POP D ! POP B       ;Restore registers
                    RET
```

OUTPUT-ROUTINE

```
OUTPUT$ROUTINE:     PUSH PSW ! PUSH B ! PUSH D ! PUSH H
                    LD      E,A                 ;transfer is in E reg-
                                                ister
                    LD      C,2                 ;Console output
                                                function
                    CALL    OPERATING$SYSTEM
                    POP H ! POP D ! POP B! POP PSW
                    RET
```

guided by your own system requirements.

As you can see in Fig 6, the structure of all three examples of main block coding is identical. We first call INPUT$ROUTINE to collect the character in the accumulator: note that the 6502 mnemonic for a subroutine call is different from the Z80 and the 8080. The address INPUT$ROUTINE is put into the program counter to achieve a jump to the required subroutine. Prior to this the processor's program counter, which points to the next instruction, is automatically pushed onto the stack. When the subroutine ends, this address is popped off the stack and replaced in the program counter, which then points to the instruction after the CALL or JSR instruction.

The next instructions compare the character collected in the accumulator with the value CARRIAGE$RETURN. The processor subtracts the contents of the accumulator from the value of the byte specified (in this case 13). The zero flag is set if the result is zero but the result of the subtraction is not stored anywhere, nor are the contents of the accumulator altered.

Immediately following the comparison test we have used a conditional jump instruction. If the zero flag has been set, a jump to an as yet unspecified FINISH routine will follow.

If the zero flag has *not* been set, instead of jumping to FINISH, a further subroutine call (this time to an output routine) is made. We then jump back to the start of the main block to collect another character.

Let's look at the difference between the JZ AND THE JP instructions and the 6502's BEQ. The first two result in jumps to addresses that have been specified by a two byte operand. The 6502, on the other hand, executes a 'branch if equal to zero' instruction, using a form of addressing known as relative addressing. The value of the operand is a one byte displacement, not an address. The branch is limited to values that can be specified in one byte. (Your assembler will calculate the displacement and should tell you if you exceed this limit.)

Relative addressing has the advantage of only requiring a two byte instruction (which makes for faster execution). Since we do not use an absolute address it also means that the code produced is relocatable. The disadvantage is that you are limited to a displacement of +127 to −128 (added to the contents of the program counter). We'll wait until we have examined two's complement arithmetic for a full explanation of this instruction.

To finish your program you will need to look at your machine manual again.

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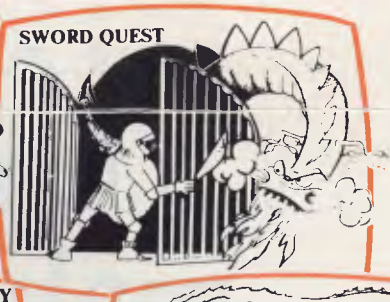

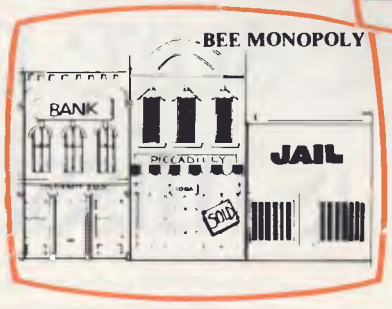

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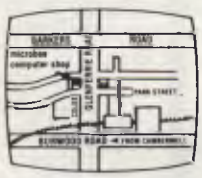

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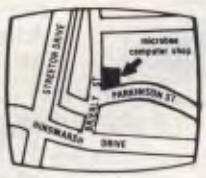

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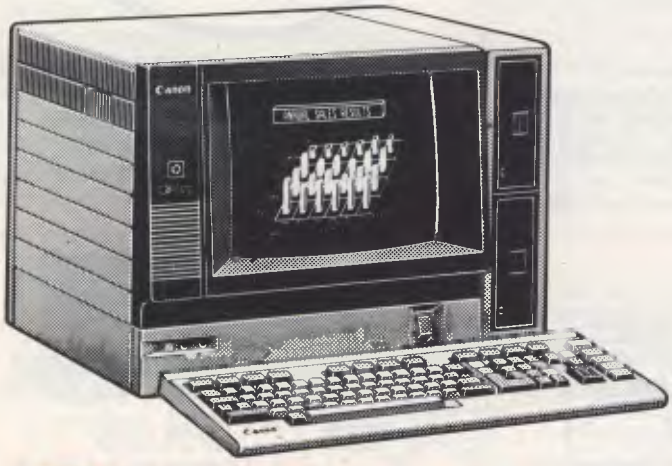

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CC344

Programs operating in a CP/M environment can use a JMP 0 instruction to 'reboot' the operating system. In such a case FINISH would look like this:

```
FINISH: JMP 0        ; Reboot operating system
```

Other systems may expect your program to perform an additional subroutine return instruction. The 8080/Z80 mnemonics for this instruction are both RET; the 6502 uses RTS:

```
FINISH: RET (or RTS for the 6502) ; Return to O/S.
```

Input — output subroutines

Once again you'll be dependent on your operating system: you should find addresses for functions such as direct input and console output. These might be given abbreviations such as GETCHAR, CONIN and OUCH etc. If you can call these functions directly, all you need to do is add the necessary equate definitions into your 'set up' block.

A possible problem

Discovering that your operating system routine returns a zero value to the accumulator if no keyboard character is available, that is, it doesn't 'wait' for input, is a problem. In this case you'll need to create a 'wait for input' loop. The idea is the same for all three processors, so we'll just show the 8080 version:

```
INPUT$ROUTINE:
CALL SYSTEM$INPUT$ROUTINE
CPI 0
JZ INPUT[ROUTINE
RET
; system direct input
; is accumulator 0?
; no input, so wait
```

In this case you would use an equate directive in the set up block to define SYSTEM$INPUT$ROUTINE's address, and then place the above routine into your program. Remember that when you call a subroutine, the address of the next instruction is pushed onto the stack. By making the last instruction of the routine a RET (or RTS is the case of the 6502) that address is popped off the stack and replaced into the program counter. The next instruction to be executed after the subroutine is then the one that followed the subroutine call instruction.

Having explained how our example program operates, it's over to you to put it into practice. Don't undervalue the time you'll spend checking your assembler documentation and computer handbook: it's up to you to become familiar with the information that is there waiting for you to use it. One word of warning: don't get so engrossed in your practical work that you forget to buy next month's *APC*, when we'll take the next step in your journey into assembly language programming.

FULL LISTING 6502 VERSION

```
                    SET-UP-BLOCK
CARRIAGE$RETURN     EQU     13
INPUT$ROUTINE       EQU     FDF0H
OUTPUT$ROUTINE      EQU     FD10H
                    ORG     800H
                    MAIN-BLOCK
START:              JSR     INPUT$ROUTINE
                    CMP     #CARRIAGE$RETURN
                    BEQ     FINISH
                    JSR     OUTPUT$ROUTINE
                    JMP     START
                    END-BLOCK
FINISH              RTS
```

For your convenience, a version of this month's program for each processor is included in this article.

END

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TK! Solver

Has Software Arts come up with another successful formula in the shape of TK!Solver? Mike Liardet examines this unique equation-solving system from the inventors of VisiCalc.

Software Arts' new baby originated in the brain of Milos Konopasek, a textile engineer. Way back in the sixties he devised a suite of programs for solving complex textile equations. In 1980, he approached VisiCalc author, Dan Bricklin, with his idea. And now, after a massive re-programming effort by the Software Arts team, TK!Solver has arrived. 'TK' by the way stands for 'toolkit' and the '!' is the system's most important keystroke.

TK!Solver is, as VisiCalc was four years ago, a highly original and unique product. Essentially it is the world's first commercially available equation-solving system. Now if you have not looked at a mathematical equation since you were thrown out of your Year 11 class, don't worry; Software Arts has made things as easy as possible for you. Along with TK!Solver it is making available a number of 'solver-packs' where the equations are already set up and all the hard work has already been done. Software Arts is aiming to produce a variety of these packs for different application areas, but it already has four available: Financial Management, Mechanical Engineering (both included with my review system), Building Design and Introduction to Science.

TK!Solver is only the second product in five years from Software Arts. Its first effort was the world-famous VisiCalc — the system that invented spreadsheet software. For TK!Solver, Software Arts has dropped its arrangement with Visicorp, the publishers of VisiCalc, and is publishing it itself, with some involvement from McGraw-Hill which is involved in publishing the solver-packs. TK!Solver is available from PC Systems in Adelaide, telephone (08) 223 2688.

What does it do?

It should be obvious by now that TK!Solver is definitely not a run-of-the-mill spreadsheet system. Basically it is an equation-solving system. You type in a series of equations, key in the values for some of the variables, then press the action key ('!') to work out the values of the other variables.

With conventional spreadsheet systems you have to decide before you start which aspects of the model are going to be input, and which will be output. For example, if you were using a spreadsheet on a mortgage calculation, you might use it to calculate (ie, output) repayments, given the input of the amount borrowed, and interest rates, etc. Although you may not realise it, you are actually using equations as the basis for the model. However, if you subsequently wish to know how much you can borrow for a specific repayment, you would then need to set up a completely different model, where repayments are an input not an output. Nonetheless, this model is based on the very same equations, and *you* would have to solve them manually, before you could even set up the new model.

With TK!Solver, you just specify the equations once, and then freely change your mind about which variables are input and which output. With TK! Solver you can put the cart before the horse. So once the mortgage equations are set up you can readily answer questions like: how much could I borrow at a repayment of $100 per month? What repayment period would keep repayments down to $120 per month? What will happen if interest rates fall.

Of course there are many other facilities in TK!Solver that would do credit to any spreadsheet package — for example, graph plotting, extensive 'help' messages, and automatic unit

Spreadsheets — a guide for beginners

Spreadsheet software is useful to anyone who regularly uses a calculator.

The VDU screen acts like a 'window' on a large 'sheet' of numbers — neatly laid out rows and columns, occasionally interspersed with text headings.

By using a few quickly learned keystrokes it is possible to shift the VDU window to the desired point of interest. It is possible to enter text, a number of 'formula' which can, if required, be a complex calculation referring to several other positions on the sheet. The result of the calculation is displayed immediately with automatic recalculations throughout. Frequently an alteration on the top line of a spreadsheet can change everything from top to bottom in just two or three seconds — an exercise that would take several hours by hand!

The APC *'Which Spreadsheet?' series analyses and tests spreadsheet systems. Further information for beginners can be found in the spreadsheet article in April 1983 issue of* APC.

conversion (eg, imperial to metric).

Getting started

My review copy of TK!Solver was for the IBM PC. Currently, in the US at least, there are other versions available for the DEC Rainbow, Apple IIe, and Wang machines running MS-DOS. Between them, these versions encompass two different processors and four different operating systems, which speaks volumes for the versatility of Software Arts internal developmental language 'IL' (short for 'implementation language'). Software Arts is planning further versions, but don't be surprised if CP/M is not one of them. Quite simply, the limited 64k of RAM in CP/M systems causes all sorts of problems for software packing this amount of sophistication.

To run TK!Solver on a PC, at least 96k of RAM and one disk drive must be present. To get the best out of it, however, a less minimal system would be advised, in particular an 80-column display, printer and more RAM.

Having let my PC knowledge get a little rusty of late, I was particularly well placed to check out whether the introductory information to TK!Solver on the PC was up to scratch. The documentation included a short booklet with clear concise instructions for getting started and solving a first simple problem. Thus it is possible to solve your first equation literally five minutes after you start — a great confidence boost!

TK!Solver Scorecard
Easy to learn: !!! (excellent)
Easy to use: !! (good)
Robustness/
Error handling: !!! (excellent)
Facilities: !!! (excellent)

SRule
rconsum = distanc/petrol
speed = distanc/time
cost = petrol * price
rconsum = (speed * (200-2 * speed))/125

Fig 1 Printout of rules-sheet for petrol consumption model

As this was a special PC version there was no need to go through a 'VDU-installation' procedure. The software was already primed with all the PC peculiarities. The booklet seems to anticipate every silly thing you might do — for example, confuse the letter 'l' with the digit '1' — explains special keys on the keyboard and is well-illustrated, with pictures of how to insert disks and so on.

Unfortunately the TK!Solver program is copy-protected, so you are unable to copy it onto a working disk or transfer it onto a hard-disk, etc. Software Arts does include a backup disk with the package, so you are not left in the lurch while ordering a replacement.

Fairly early on it is necessary to use a data disk for 'saving' equations you will be setting up, and regrettably you are forced to wrestle with the standard PC-DOS commands to do this. In comparison, the PC version of the Lotus 1-2-3 spreadsheet system (and Software Arts' very own Apple VisiCalc for that matter) does all the formatting and copying for you, simply under menu control. Nevertheless the TK!Solver manual does contain clear instructions on how to go about this.

'To run TK! Solver you simply type 'TK' in response to the PC-DOS prompt, give the copyright screen a quick glance and then you immediately enter the world of automated equation solving.'

Solving TK-style!

To run TK!Solver you simply type 'TK' in response to the PC-DOS prompt, give the copyright screen a quick glance and then you immediately enter the world of automated equation-solving.

This world is organised as eight 'sheets', used to hold all the information about the equations and other related matters. At any given moment any two of these sheets can be visible on the VDU screen, or alternatively the whole display can be given over to just one sheet. The familiar 'windowing' principle is used to organise the display, with the current 'action point' denoted by a cursor. With a more complicated model, some sheets may grow bigger than the display space allocated to them. Attempts to move the cursor (using the arrow keys) out of the bounds of the display result in a rapid redraw to accommodate the destination point of the cursor — all very familiar to spreadsheet users. Although most of the sheets can grow as long as necessary, they all have a fixed width, and fixed column headings, so there is no need for them to grow horizontally, as a spreadsheet does.

To get started with TK!Solver it is only necessary to work with just two of the sheets, and these are the two sheets on display when the system is first entered: the rule-sheet is used to store the equations and the variable-sheet is used for information on all the variables in the equations. As the equations are keyed in the variable names are automatically entered on the variable-sheet. You can enter as many equations as you like, limited only by the amount of memory available in the machine, but, in practice, quite complex models can be set up with just 10-20 equations.

As an example, consider the simple petrol consumption model in Figs 1 and 2. This model has four equations and seven variables. Suppose we are about to embark on a 300-mile motorway journey, and we are concerned to get there quickly, but not so quickly that we consume a huge amount of petrol. The first three equations simply define what we mean by rate of consumption, speed and total-cost and the fourth equation specifies how petrol consumption and speed are related. In this instance the minimum rate of consumption is 40mpg at 50mph, decreasing to a ludicrous level as the speed falls to 0mph or rises to 100mph. Clearly this equation is a gross approximation of the way petrol consumption corresponds to speed, but if we had the real figures available then TK!Solver would provide a mechanism whereby you could actually set up a 'user function'. This would exactly model the tabulated performance characteristics of the car.

In Fig 2 three variables have been given input values (300 miles for distance, 10 hours journey time and $1.80 per gallon for petrol), and the formatted reports. The information

StInput	Name	Output	Unit	Comment
	rconsum	33.6		rate of petrol consumption
300	distanc			distance travelled
	petrol	8.9285714		petrol consumed
	speed	30		average speed
10	time			time taken
	cost	16.071429		cost of journey
1.8	price			price per unit of petrol

Fig 2 Printout of variable-sheet for petrol consumption model

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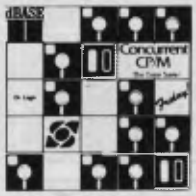

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remaining output values have been calculated by TK!Solver: nearly nine gallons of petrol, costing just over $16.

Now suppose we decide that we may be prepared to spend more, say, $18, and are wondering what difference this will make to the journey time. In Fig 3, TK!Solver has been given this very problem. Notice that 'time' is no longer an input, but 'cost' is instead. In this instance TK!Solver has calculated that the journey will take just four hours at 75mph. Well that's how long it will take if we don't get pulled up by the police!

Although this last printout gives no indication of the fact, the answers were obtained by using 'iterative' solving. The answers in the previous printout were obtained by 'direct' solving. TK!Solver always tries direct solving first, and if this works the answers 'tumble out' almost immediately. But not all equations will succumb to this method. Failing direct solution, TK!Solver resorts to its powerful iterative solver. To get started the iterative solver must be fed with a guess value for one or more of the unknown variables. In this instance the speed was guessed as 50mph.

Iterative solving takes longer than direct solving, and in the worst cases may fail altogether. It is possible to control the number of iterations before TK!Solver gives up, and of course the better the initial guess, the better the chance of reaching a solution. In the example given, TK!Solver's standard 10 iterations were not sufficient to solve the problem when the initial speed guess was 0mph. During iterative solving TK!Solver displays an iteration count together with an estimate of the number of iterations it will need. However, there seems to be no way of interrupting the iterative solver if you get fed up waiting and want to try a better guess.

Notice that two of the columns in Figs 2 and 3 are blank. The 'St' column is for status information — for example, if a value is a guess—and the 'Unit' column is where the units can be specified. If you intend working with a mixture of units, say, metric and imperial or feet and inches, then you must specify what's what in the units column, and also use a third sheet — the units sheet — to indicate how one unit can be converted to another (for example, '12 inches = 1 foot', '1 metre = 1.094 yards').

So far we have mentioned just three of the nine sheets in TK!Solver. The remaining six are:

★ **Global sheet.** This sheet is used to set up various system parameters, like the maximum iterations allowed, paper width and other miscellaneous details.

★ **List sheet.** Instead of a variable being assigned a single value it can be assigned a list of values, so that a sequence of solutions can be generated.

The list-sheet lists any variable which has a list of values, then for each variable there is a sub-sheet which contains the actual sequence of values.

★ **User function sheet.** There are instances when two or more variables are related in some way, but the relationship cannot be stated in a normal equation. User functions can be employed in these situations. For example, a motoring magazine may publish a table giving a car's petrol consumption at various speeds and, using TK!Solver's user function sheet, this table can be set up to model accurately the car's performance in this respect.

★ **Plot sheet.** Several lists of values (from the list sheet) can be plotted on the screen or printer. The plot sheet is used to specify which lists are to be used and how the graph is to be annotated.

TK!Solver does not use high resolution graphics facilities for its plots (see Fig 4). It builds up the image using normal text characters like '+', '!' and '–'. This means that TK!Solver requires no special graphics hardware, which is obviously an advantage, but the final result is not very pretty, and of course cannot be as accurate as a high-resolution plot.

★ **Table sheet.** As an alternative to graph plotting, TK!Solver can generate

St	Input	Name	Output	Unit	Comment
		rconsum	30		rate of petrol consumption
	300	distanc			distance travelled
		petrol	10		petrol consumed
		speed	75		average speed
		time	4		time taken
	18	cost			cost of journey
	1.8	price			price per unit of petrol

Fig 3 Printout of variable-sheet for petrol consumption with 'cost' as input instead of time.

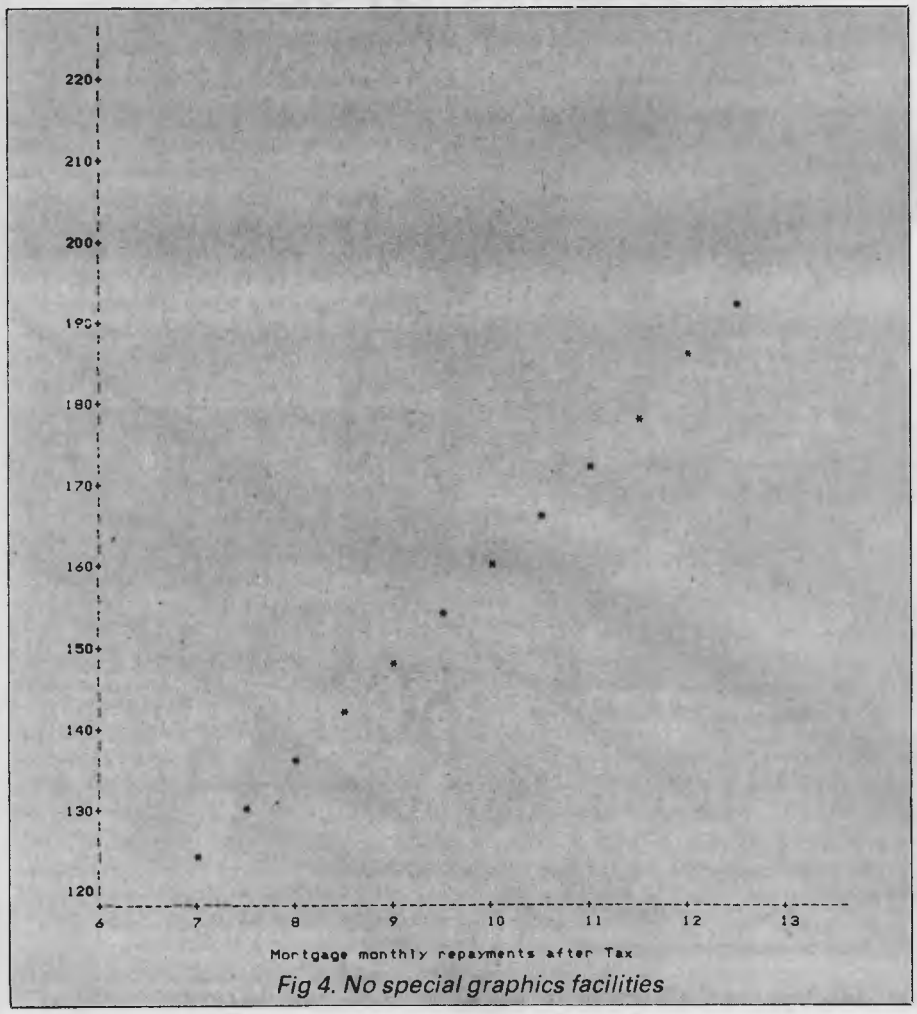

Fig 4. No special graphics facilities

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needed for each report — that is, lists to be reported on with column widths, and so on, is contained within the table sheet.

Solver-Packs

Software Arts has anticipated that a number of potential TK!Solver purchasers will not have the time, inclination or ability to set up the equations to model their particular problem area. The solver-packs have been introduced specifically for their benefit.

Each pack is targeted at a specific application area, and is supplied as a disk and well-presented spiral-bound manual. When using a solver-pack you can safely ignore the rule and unit sheets and concentrate primarily on the variable sheet.

You can use any of the models by simply setting up your chosen input values for the variables and then getting it to solve the equations to get the answers.

Specifically, the financial management solver-pack contains 13 different models ranging from compound interest, through 'leverage' to bond analyses, and so on. There are 126 pages in the manual, and the presentation is of the same high standard as the TK!Solver manual proper.

One minor irritation is that all monetary units use the '$' symbol. It would not be too difficult to change this to our own pound-sign, but it is a pity that Software Arts has not done this already for the UK market.

Documentation

Since TK!Solver was Software Arts' first venture in publishing, the company was especially anxious to ensure that the overall presentation and standard of the documentation was second to none. In its efforts to please it has really gone overboard.

The manual, housed in an IBM-style library box, is comprehensive, well written, and beautifully packaged. An attractive reference poster is thrown in for good measure.

A particularly nice touch is the introductory guide — specifically written for the IBM PC.

Immediately following on from this is a 200-page instruction manual. Nearly every other page shows a picture of the screen, and this manual takes you, tutorial fashion, through nearly every facility in the system.

Bringing up the rear, there is a massive reference manual outlining every last detail of the system. Software Arts did not forget the index, so it is very easy to find your way around everything.

And if all that is not enough documentation for you, the program itself provides extensive on-line help screens.

How it works

Software Arts is fairly confident that TK!Solver will not be so extensively plagiarised as VisiCalc has been. Although VisiCalc is an extremely clever piece of software, a competent systems programmer will have a fairly clear idea of the internal workings of it once the user has seen it. This is definitely not the case with TK!Solver. So, a discussion of how TK!Solver works can only be fairly superficial.

The solving process always starts with an attempt at direct solution. An equation can be solved directly if, among other things, only one variable is unknown and that variable occurs only once. Thus if b & c are known (already solved or given input values), then the following equation can be solved directly as follows:

b * c + a^2 + max(b,10) = min(c,5)
a^2+ max(b,10) = min(c,5) − b * c
a^2 = min(c,5) − b * c − max(b,10)
a = sqrt (min(c,5) − b * c − max(b,10))

Talking of square roots, TK!Solver will not perform complex arithmetic, and can only work with real numbers.

A surprisingly large number of systems of equations succumb to the direct solver, which generally works quite quickly. In many instances there may be just one equation which can be solved directly, but once it has been solved, the newly solved variable allows another equation to be solved directly, and so on.

If some or all of the equations cannot be solved directly then iterative solving is attempted. Iterative solving works by taking an initial guess value for the unknown variable(s), then applying a bit of mathematical magic to produce a 'better' guess. If the 'better' guess is not good enough then it iterates again, and so on until either it hits the nail on the head or is forced to give up because it has exceeded the maximum permitted number of iterations. Note that the iterative solver needs to be fed an initial guess before it can start. This guess must be keyed into the variable sheet by the user. If it is a good guess then the solution process will be faster. Also some systems of equation can have more than one solution, and the initial guess will determine which solution is found.

Finally, if all else fails the TK!Solver manual gives some advice on what to do. Principally this amounts to rewriting one or more of the equations into a form with which it can work more easily. TK!Solver is happier with expressions like x^2 than x * x, and sometimes it helps if an equation is entered redundantly in some equivalent but different form. Obviously, the maximum permitted number of iterations can be increased, but this means longer waits. It is also possible to adjust the comparison tolerance — so that if two successive guesses differ by less than this the equations are deemed solved.

Conclusions

TK!Solver has no direct competition. If you need a general purpose equation solver, and especially if your field of application is covered by the solver-packs, then you must have it.

Although there are no rival general purpose equation-solvers to TK!Solver, there are special purpose ones available — in the shape of linear programming, software. In addition to their prime function of optimising resources, linear programming systems can solve sets of linear equations, but without the need for initial guesses that TK!Solver demands. However, LP systems cannot handle non-linear equations. (Examples: '3 * x + 5 * y = 7' is a linear equation, but '3 * x * y = 4' and '3 * x^2 = 12' are not.)

However, what if you are not sure whether you need equation-solving, or whether some other modelling package might not suffice? Well, you might put TK!Solver alongside spreadsheet software like 1-2-3 or VisiCalc for that matter — all three are excellent in their own way and available on the IBM PC. But, undoubtedly, most users would find the spreadsheet systems easier to get to grips with.

Finally, will Software Arts break all records again? Well, TK!Solver is certainly innovatory and with huge potential. But I can't help thinking that it is going to have to work a lot harder to convince the masses of its real worth.

END

'Specifically, the financial management solver-pack contains 13 different models ranging from compound interest, through 'leverage' to bond analyses.'

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MUSIC MICRO PLEASE

The final part of Music Micro, Please contains the Basic listing providing the user interface: it does the calculations needed to produce sounds.

Having typed in and recorded the two programs published in Part 2 (February '84) you now need to add this listing to the tape. Make sure when you produce your working tape that you leave about 30 seconds between each of the three programs to allow time for each to run before the next one is loaded.

The first thing the user will discover is that to synthesise a particular sound a number of tables must be constructed. There are five different types of table. To see what tables are available type "TABLE<RETURN><RETURN>" or "<f0><RETURN>" which should produce the output shown in Fig 4. When the program is run for the first time, the system sets up six tables called 'firsttune', 'firstfreq', 'firstenv', 'firstcont', 'firstwave' and ',,'. All other tables (there are 12 left) are empty, and can be put to any use the user wants. These predefined tables, which cannot be deleted, provide the minimum information needed to synthesise a sound. In many cases, there will be no need to define any other tables.

The system works via a set of 13 commands which allow tables to be set up and altered. A summary of the different commands and their actions is shown in Fig 1. Let's now look at what the different types of table can do.

Tune

The tune table contains about 40 sounds. The name of the current tune is always displayed at the bottom right corner of the screen. Further information referring to a sound within the tune is also available along the bottom of the screen. The frequency in Hz and the length of a sound in units (0 to 255) are shown as 'pitch' and 'duration'. The names of the three tables which decide the character of the sound are shown under the headings FREQUENCY, ENVELOPE and CONTROL. It may seem a little confusing to have the 'pitch' of a sound and the 'frequency' table characterising the sound. This is because the frequency must sometimes vary while the note is sounding to produce effects such as *vibrato* (see Part 1, January '84). Thus the 'pitch' is the basic frequency of the sound, about which instantaneous variations are caused by the frequency table.

Commands are available to move from sound to sound, and to insert and delete sounds from the tune (see Fig 1). The duration and pitch in Hz of sounds can be changed at any time using the DURATION (<f8>) and PITCH (<f9>) commands. When the pitch is entered, the program alters it to the nearest frequency that the software can produce. This value is then displayed as the pitch of the sound. The resolution of the system is a few Hz and the difference between the required frequency and the frequency which the system produces is inaudible. Often, the pitches required will be those of notes in the musical scale (see Fig 2).

Frequency

As mentioned above, this table together with the stated pitch determines the instantaneous frequency of a note. Thus it is possible to change the note's frequency while it is sounding. The table contains 256 values numbered 0 to 255. Each value is added to the pitch of the note to determine the frequency of the note for 1/256th of the time the note sounds. The value numbered 0 determines the frequency at the beginning of the note and the value numbered 255, the frequency at the end of the note.

Each number in the frequency table is one byte and so can take values from 0 to 255. When the table is first created, and if the table is cleared using the CLEAR command, all the 256 values in the table will be 128. This mid-value means the frequency is the stated pitch of the sound. A value in the table of 255 increases the frequency of the note by about 170Hz, and a value of 0 decreases the frequency of the note by about 170Hz from the stated pitch.

The TABLE command is used to select a frequency table. The contents of the table are plotted in the form of a graph

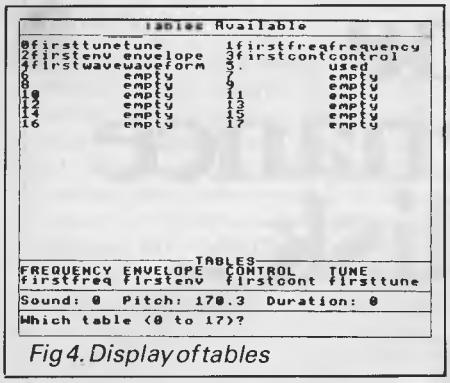

Fig 4. Display of tables

with time horizontally, and frequency vertically. The command used to change values in the frequency table is SEGMENT (see Fig 1). When the SEGMENT command was first included, it produced straight lines from one point to another in the graph. It was thought that this would easily enable any shape to be produced. In practice, it was found necessary to provide something more flexible to produce effects such as the sinusoidal modulation needed for *vibrato*. Thus an extra feature called a modulation equation' was incorporated into the command. To simply draw a line on the graph the user specifies the start position and value, end position and value and a modulation equation of zero. The two parts will be joined up and the graph redrawn.

The modulation equation is evaluated using the BBC's EVAL command. If modulation is needed, an expression is typed in which depends on the variable x% (lower case) which points to the value being calculated. For instance, to produce gentle *vibrato* about the pitch of the note, repeating every 10 values in the table, a segment from 0 to 255 with start and end values of 128 and a modulation equation of

5 * SIN(2 * PI x% / 10)

would be used. In general, to produce sinusoidal modulation on a straight line with the SEGMENT command, a modulation equation will be of the form:

amplitude * SIN(2 * PI * x% / Period)

Envelope

The envelope table determines the overall volume of the note as it sounds. Like the frequency table it has 256 values numbered 0 to 255. A value of 0 gives no output and a value of 255 gives the maximum output. When the table is created, or cleared using the CLEAR command, all 256 values in the table are zeroed to give no output. Once again, the TABLE command is used to display the contents of the table as a graph.

The envelope is also altered using the SEGMENT command which can produce straight lines and, by imaginative use of the modulation equation, natural contours.

A good example is using the first half of a sinewave to form an envelope which smoothly rises to a maximum and then dies away again. In this case, we are bypassing the straight line aspect of the SEGMENT command and are defining our own function directly.

For this reason the start and end values are zero and the modulation equation alone decides the envelope shape. The command is thus SEGMENT from 0 with value 0 to 255, also with value 0 and a modulation equation of

255 * SIN(2 * PI * x% / 512)

Command	Function key	Description
TABLE	f0	Selects a particular table which will be displayed and included in the current sound. If the table requested is a tune table, changes to a new tune. If the table selected is unused the user can specify its new use.
HARMONIC	f1	Provided a waveform table has been selected with the TABLE command, changes the strength of a particular harmonic or the noise component in the waveform. The strengths of components must be integers. 16 harmonics are provided for; the noise is pseudo-random.
SEGMENT	f2	If a control table is displayed, allows a different waveform to be specified for some time period. If a frequency or envelope table has been selected, adds a line segment from one point to another in the table. The start and end positions and start and end values must be specified. A modulation equation allows the user to add sinewave modulation to the lines, or to bypass the idea of lines altogether and to specify an arbitrary function.
NEXT	f3	Moves on to the next sound in the tune.
LAST	f4	Moves back to the sound before the current sound in the tune.
INSERT	f5	Inserts a blank sound infront of the current sound. A blank sound has a the frequency, envelope and control tables numbered 1, 2 and 3 ("firstfreq", "firstenv" and "firstcont" unless renamed).
DELETE	f6	Deletes the current sound from the tune.
PITCH	f7	Changes the pitch of the current sound.
DURATION	f8	Changes the duration of the current sound. A duration of 0 gives the maximum duration of 256 units.
PLAY	f9	Plays the current tune.
CLEAR		Clears the displayed table (frequency tables are cleared to 128, all others to 0).
RENAME		Allows the name of the tune, or displayed table to be changed.
QUIT		Returns the user to BASIC. (Note that pressing <ESCAPE> within the program simply terminates the command being executed.)

Fig 1. Commands

Note	Frequency
C	130.8
C#	138.6
D	146.8
D#	155.5
E	164.6
F	174.6
F#	184.9
G	195.9
G#	207.6
A	220
A#	233.1
B	246.9
C	261.6
C#	277.1
D	293.6
D#	331.1
E	329.6
F	349.2
F#	369.9
G	391.9
G#	415.3
A	440
A#	466.1
B	493.9
C	523.2
C#	554.3
D	587.3
D#	622.2
E	659.2
F	698.4

Fig 2. Pitches in the musical scale

Harmonic	Amplitude
f	140
2f	350
3f	130
4f	740
5f	560
6f	180
7f	215
8f	250
9f	115
10f	50
11f	95
12f	68
13f	42
14f	40
15f	20

Fig 3. Harmonic strengths of violin tone

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Waveform

The waveform table provides the basic waveform of the sound. Unlike the frequency and envelope tables, the waveform occupies two tables. As before, the waveform itself consists of 256 values, each in the range 0 to 255. Values are not, however, altered directly by the user. An HARMONIC command allows the strengths of harmonic partials and a noise component to be specified directly. As a result, information on the strengths of harmonics needs to be kept in a second table which has the name ',,' and appears immediately after the waveform table itself.

When a waveform is selected with the TABLE command, the user must decide whether he wants to see a graph of the waveform table giving the actual shape of the waveform (time display), or a display of the harmonic spectrum. The spectrum is a bar graph type display with the harmonic number along the bottom of the display. The fundamental is numbered '1' and the noise component is labelled 'N'. Every time the harmonic strengths are altered the display is redrawn to reflect the change.

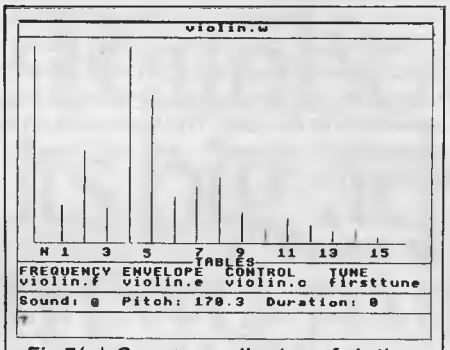

Fig 5(a). Spectrum display of violin waveform table

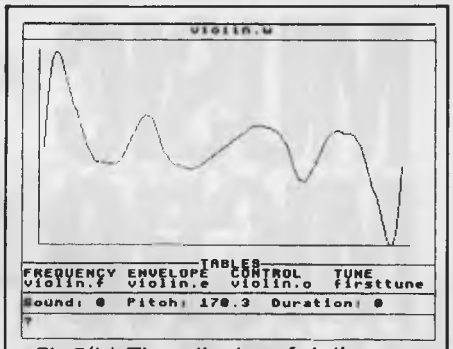

Fig 5(b). Time display of violin waveform table

Control

Every sound needs three tables to characterise it fully for frequency, envelope and control. Waveforms are not specified directly because it may be desirable to change the harmonic content, in a similar way to volume and

Listing 3. SYN.BAS program

```
   10 REM******** Di9isyn 0.3 ********
   20 REM (c) S.P.Tait 24th March 1983
  231 MODE4
 1000 REM***********CONSTANTS**********
 1010 nooftables%=18
 1020 nooftypes%=7
 1030 emptyp%=6
 1040 usedp%=5
 1050 frequencyp%=0
 1060 envelope%=1
 1070 controlp%=2
 1080 tunep%=4
 1090 wavep%=3
 1100 minPitch%=170
 1110 maxPitch%=10000
 1120 Pitch%=3
 1130 mindur%=0
 1140 maxdur%=255
 1150 dur%=5
 1160 noofParams%=6
 1170 noofharmonics%=16
 1200 lastsound%=256/noofParams%-1
 2000 REM***********ARRAYS**********
 2001 tables%=0
 2005 REPEAT DIMdummy% 0:UNTILdummy%MOD256=255
 2010 DIM tables% (nooftables%-1)%256
 2020 DIM name$(nooftables%-1)
 2030 DIM type%(nooftables%-1)
 2040 DIM store(255)
 2050 DIM sin(255)
 3000 REM**********INITIAL VALUES********
 3020 tune%=0:type%(0)=tunetp%:name$(0)="firsttune"
 3030 sound%=0
 3040 type%(1)=frequencytp%:name$(1)="firstfreq"
 3050 type%(2)=envelopetp%:name$(2)="firstenv"
 3060 type%(3)=controltp%:name$(3)="firstcont"
 3070 type%(4)=wavetp%:name$(4)="firstwave"
 3080 type%(5)=usedtp%:name$(5)="."
 3090 FORx%=6TOnooftables%-1:type%(x%)=emptytp%:name$(x%)="":NEXTx%
 3095 FORcurrent%=0TO5:PROCclear:NEXTcurrent%
 3100 display$="TIME"
 3105 current%=1
 3200 PROCnewsound
 3220 FORx%=6%256TO(nooftables%-1)%256-1:tables%?x%=0:NEXTx%
 3230 FORx%=0TO255
 3240   sin(x%)=SIN(x%*2*PI/256)
 3250   store(x%)=0
 3260   NEXTx%
 3270 storecontents%=4
 4910 PROCscreen
 5000 REM**************MAIN PROGRAM*********
 5005 ON ERROR GOTO5000
 5010 REPEAT
 5012   PROCdisplaystatus
 5015   PROCinPutfield
 5020   INPUTi$
 5030   IFi$="TABLE"THEN PROCtable
 5040   IFi$="PITCH"THEN PROCpitch
 5050   IFi$="DURATION"THEN PROCduration
 5060   IFi$="NEXT"THEN PROCnext
 5070   IFi$="LAST"THEN PROClast
 5080   IFi$="DELETE"THEN PROCdelete
 5090   IFi$="INSERT"THEN PROCinsert
 5100   IFi$="CLEAR"THEN PROCclear
 5110   IFi$="RENAME"THEN PROCrename
 5120   IFi$="HARMONIC"THEN PROCharmonic
 5130   IFi$="SEGMENT"THEN PROCsegment
 5140   IFi$="PLAY"THEN ?&81=tune%:N%=tables%:CALL M%:PRINT"PLAYED"
 5150   IFi$="QUIT"THENEND
 5500   UNTIL0
10000 REM************MAIN PROCEDURES*****
10010 DEFPROCtable
10020 PROClistall
10030 PROCinPutfield
10040 REPEAT
10050   PRINT"Which table (0 to ";nooftables%-1;")";
10060   INPUTi%
10070   invalid%=i%<0 OR i%>nooftables%-1
10080   UNTIL NOTinvalid%
10090 IFtype%(i%)=usedtp% THEN PRINT"Table already used":ENDPROC
10100 IFtype%(i%)=emptytp% THEN PROCnewtable
10110 IFtype%(i%)=tunetp% THEN sound%=0:tune%=i%:IF?FNparam(frequencytp%)=0THENP
ROCnewtune:ENDPROC ELSE IFtype%(i%)=tunetp% THEN ENDPROC
10120 IFtype%(i%)=wavetp% THEN REPEAT:INPUT"TIME or SPECTRUM display (T or S)",i
$:UNTILLEFT$(i$,1)="T" OR LEFT$(i$,1)="S":display$=i$ ELSE ?FNparam(type%(i%))=i
%
10130 current%=i%
10140 PROCdisplaytable
10150 ENDPROC
10300 DEFPROCpitch
10310 PROCinPutfield
10320 REPEAT
10330   PRINT"What value (";minPitch%;" to ";maxPitch%;")";
10340   INPUTi%
10350   UNTILi%>=minPitch% AND i%<=maxPitch%
10360 ?FNparam(Pitch%)=i%*.763+.5:?FNparam(Pitch%+1)=(i%*.763+.5)/256
10370 ENDPROC
10500 DEFPROCduration
10510 PROCinPutfield
10520 REPEAT
10530   PRINT"What value (";mindur%;" to ";maxdur%;")";
10540   INPUTi%
10550   UNTILi%>=mindur% AND i%<=maxdur%
10560 ?FNparam(dur%)=i%
10570 ENDPROC
10700 DEFPROCnext
10710 IFsound%=lastsound% THEN PRINT"No room left":ENDPROC
10720 sound%=sound%+1
10730 IF?FNparam(frequencytp%)=0 THEN PROCnewsound
10750 ENDPROC
10800 DEFPROClast
10810 IFsound%=0 THEN ENDPROC
10820 sound%=sound%-1
10830 ENDPROC
10900 DEFPROCdelete
10910 IFsound%=lastsound%THENPROCnewsound:ENDPROC
10920 FORx%=sound% TO lastsound%-1
10930   FORy%=0 TO noofParams%-1
10940     ?FNbyte(tune%,x%,y%)=?FNbyte(tune%,x%,y%+noofParams%)
10950     NEXTy%
10960   NEXTx%
10970 PROCclearsound(lastsound%)
10975 IF?FNparam(frequencytp%)=0 THEN PROCnewsound
10980 current%=?FNparam(typE%(current%))
10990 ENDPROC
11100 DEFPROCinsert
11110 IF?FNbyte(tune%,lastsound%,frequencytp%)<>0 THEN PRINT"No room":ENDPROC
11120 FORx%=lastsound%TOsound%STEP-1
11130   FORy%=0 TO noofParams%-1
11140     ?FNbyte(tune%,x%,y%)=?FNbyte(tune%,x%,y%-noofParams%)
11150     NEXTy%
11160   NEXTx%
11170 PROCnewsound
11180 current%=?FNparam(type%(current%))
11190 ENDPROC
11200 DEFPROCclear
11210 k%=type%(current%)
11215 IFk%=tunetp%THEN PROCnewtune
11220 IFk%=frequencytp% THEN PROCset(&80)
11230 IFk%=envelopetp% THEN PROCset(0)
11240 IFk%=controltp% THEN PROCset(4)
11250 IFk%=wavetp% THEN PROCset(&80):current%=current%+1:PROCset(0):current%=cur
rent%-1:FORx%=0TO255:store(x%)=0:NEXTx%
11255 IFk%=emptytp% THEN PROCset(0)
11260 ENDPROC
11500 DEFPROCrename
11510 REPEAT
11520   INPUT"Do you want to rename the tune (Y or N) ",i$
11530   UNTILLEFT$(i$,1)="Y" OR LEFT$(i$,1)="N"
11540 REPEAT
11550   INPUT"New name (not more than 8 chars) ",j$
11560   UNTILLEN(j$)<=8
11570 IF LEFT$(i$,1)="Y" THEN name$(tune%)=j$ ELSE name$(current%)=j$
11580 PROCdisplaystatus
11590 ENDPROC
11700 DEFPROCharmonic
11710 IFtype%(current%)<>wavetp% THENPRINT"Waveform not selected":ENDPROC
11720 PROCinPutfield
11730 REPEAT
11740   PRINT"Which harmonic (1 to ";noofharmonics%;", or 0 for noise) ";
11750   INPUTi%
11760   UNTILi%>=0 AND i%<=noofharmonics%
11770 PRINT"Strength of component ";i%;" is ";!FNelem(256+i%*4)
11780 INPUT"New strength (integer)",j%
11790 IFstorecontents%=current% THEN PROCchangeharmonic:ENDPROC
11795 storecontents%=current%
11800 !FNelem(256+i%*4)=j%
11810 FORx%=0TO255:store(x%)=0:NEXTx%
11820 FORy%=1TOnoofharmonics%
11830   strength=!FNelem(256+y%*4)
11840   FORx%=0TO255
11850     store(x%)=store(x%)+strength%sin(x%*y%MOD256)
11860     NEXTx%
11870   NEXTy%
11875 x%=RND(-1):FORx%=0TO255:store(x%)=store(x%)+strength%(RND(1)%2-1):NEXTx%
11880 PROCchangewave
11885 PROCdisplaytable
11890 ENDPROC
11900 DEFPROCsegment
11910 IFtype%(current%)<>controltp%THENPRINT"inappropriate command":ENDPROC
11920 PROCinPutfield
11930 REPEAT
11940   INPUT"Start Position (0 to 255)",i%
11950   UNTILi%>=0AND i%<=255
11960 PRINT"Value at ";i%;" is ";?FNelem(i%)
11970 IFtype%(current%)<>controltp%THENREPEAT INPUT"New value (0 to 255)",j%:UNT
IL i%>=0AND j%<=255
11980 IFtype%(current%)=controltp%THENPROClistall:PROCinPutfield:REPEAT PRINT"Ne
w value (0 to ";nooftables%-1;")";:INPUTj%:UNTILj%>=0AND j%<=nooftables%-1AND type
%(j%)=wavetp% PROCdisplaytable:PROCinPutfield
11990 REPEAT
12000   PRINT"End Position (";i%+1;" to 255)";
12010   INPUTk%
12020   UNTILk%>=i%+1AND k%<=255
```

MUSIC MICRO PLEASE

frequency, while the note sounds. The control table like the envelope and frequency tables has 256 values numbered 0 to 255. Each value determines the waveform for 1/256th of the time the note sounds. These values are changed by means of the SEGMENT, command. The user specifies which value to start with, which to end on and the table numbers of the waveform to be used. The final value and modulation equation are no longer necessary.

An example

Let's now see how a particular sound is synthesised using a violin tone as an example. The violin is quite difficult to imitate and so our first attempt may not sound too accurate. However, it is easy to modify the tables and to hear what the difference is.

The strengths of the harmonics for a violin tone can be found in the *Computer Music Journal Lexicon of Analysed Tones* (April 1977). Unfortunately, the strengths of the harmonics change as the note sounds. For the moment we won't worry too much about this and will use one waveform for the whole of our tone. Later, we can define different waveforms for (say) the beginning of the note.

The harmonic amplitudes chosen will correspond to the peak amplitudes of the harmonics. They are given in Fig 3.

Firstly select spectrum display of the waveform 'firstwave' using the TABLE (<f0>) command. RENAME the table "violin.w". Now use the HARMONIC (<f1>) command to specify the harmonic strengths in any convenient order. If a mistake is made simply use the HARMONIC command to change the strength. After 15 harmonics have been specified the display should be as shown in Fig 5a. Check the time display by using the TABLE command again selecting "violin.w" and time display. The waveform should appear as shown in Fig 5b.

Now set up the envelope for the violin. Select 'firstenv' with the TABLE command and RENAME it 'violin.e'. As we want a fairly smooth envelope we will use some trigonometric functions as modulation equations rather than use simple straight lines with the SEGMENT

Listing 3. SYN.BAS program (continued)

```
12030 IFtyPe%(current%)=controltP%THEN FORx%=i%TOk%:?FNelem(x%)=j%:NEXTx%:PROCdi
sPlaytable:ENDPROC
12040 PRINT"Value at ";k%;" is ";?FNelem(k%)
12050 REPEAT
12060   INPUT"New value (0 to 255)",i%
12070   UNTILi%>=0ANDi%<=255
12075 INPUT"Modulation equation ",i$
12080 FORx%=i%TOk%:?FNelem(x%)=j%+(x%-i%)*(j%-j%)/(k%-i%)+EVAL(i$):NEXTx%
12090 PROCdisPlaytable
12100 ENDPROC
20000 REM**********SUPPORT PROCEDURES***
20010 DEFFNParam(Param%)=FNbyte(tune%,sound%,Param%)
20020 DEFFNbyte(tune%,sound%,Param%)=tables%+256*tune%+noofParams%*sound%+Param%
20030 DEFFNelem(elemno%)=elemno%+256*current%+tables%
20040 DEFPROCnewsound
20050 ?FNParam(frequencytP%)=1
20060 ?FNParam(envelopetP%)=2
20070 !FNParam(controltP%)=3
20080 ?FNParam(Pitch%)=130
20100 ENDPROC
20300 DEFPROCInstall
20310 PROCtitle("Tables Available")
20320 PROCmainfield
20330 FORx%=0 TO nooftables%-1STEP2
20335   PRINTx%;name$(x%),FNtyPe(tyPe%(x%)),,
20340   IFx%(nooftables%-1THENPRINTx%+1;name$(x%+1),FNtyPe(tyPe%(x%+1))
20350   NEXTx%
20360 ENDPROC
20500 DEFFNtyPe(x%)
20510 IFx%=0THEN="frequency"
20520 IFx%=1THEN="envelope"
20530 IFx%=2THEN="control"
20540 IFx%=3THEN="waveform"
20550 IFx%=4THEN="tune"
20560 IFx%=5THEN="used"
20570 IFx%=6THEN="empty"
20580 =""
20700 DEFPROCnewtable
20710 PROCinPutfield
20720 REPEAT
20730   PRINT"New table; type (0=frequency,1=envelope"
20740   INPUT"2=control,3=waveform,4=tune",i%
20750   UNTILi%<=4 AND i%>=0
20755 IFi%=wavetP%ANDi%=nooftables%-1THENPRINT"No room":i%=current%:ENDPROC
20760 REPEAT
20770   INPUT"New name (not more than 8 chars) ",i$
20780   UNTIL LEN(i$)<=8
20790 name$(i%)=i$
20800 tyPe%(i%)=i%
20810 IF tyPe%(i%)<>tunetP% THEN current%=i%:PROCclear ELSE tune%=i%:sound%=0:PR
OCnewtune
20820 IFtyPe%(i%)=wavetP%THENname$(i%+1)="":tyPe%(i%+1)=usedtP%
20830 ENDPROC
21300 DEFPROCnewtune
21305 sound%=0
21310 FORx%=0TO255
21320   ?FNbyte(tune%,0,x%)=0
21330   NEXTx%
21335 PROCnewsound
21340 ENDPROC
21500 DEFPROCdisPlaystatus
21510 PROCtablefield
21520 PRINTname$(?FNParam(frequencytP%))name$(?FNParam(envelopetP%)),name$(?FNP
aram(controltP%)),TAB(30);name$(tune%);
21530 PROCParafield
21540 PRINT"Sound: ";sound%;"  Pitch: ";(?FNParam(Pitch%)+256*?FNParam(Pitch%+1
)*1.31/"  Duration: ";?FNParam(dur%);
21550 ENDPROC
21700 DEFPROCset(value%)
21710 FORx%=0TO255
21720   ?FNelem(x%)=value%
21730   NEXTx%
21740 ENDPROC
21900 DEFPROCclearsound(sound%)
21910 FORx%=0TOnoofParams%-1
21920   ?FNParam(x%)=0
21930   NEXTx%
21940 ENDPROC
22100 DEFPROCdisPlaytable
22110 IFtyPe%(current%)>wavetP%THEN ENDPROC
22120 PROCtitle(name$(current%))
22130 PROCmainfield
22140 MOVE48,944:DRAW48,304:DRAW1208,304
22150 IFtyPe%(current%)=wavetP%THEN PROCdisPlaywave:ENDPROC
22160 IFtyPe%(current%)=controltP%THEN PROCdisPlaycontrol:ENDPROC
22170   FORx%=0TO255STEP10:MOVE32,304+x%/640/256:DRAW40,304+x%/640/256:NEXTx%
22180 FORx%=0TO255STEP100:MOVE32,304+x%/640/256:DRAW48,304+x%/640/256:NEXTx%
22190 PROCxscale
22200 MOVE64,304+?FNelem(0)/640/256:FORx%=0TO255:DRAW64+x%/1120/256,304+?FNelem(
x%)/640/256:NEXTx%
22210 ENDPROC
22500 DEFPROCxscale
22510 FORx%=0TO255STEP10:MOVE64+x%/1120/256,288:DRAW64+x%/1120/256,296:NEXTx%
22520 FORx%=0TO255STEP100:MOVE64+x%/1120/256,288:DRAW64+x%/1120/256,304:NEXTx%
22530 PRINTTAB(8,21);"  0     50    100    150    200    250";
22540 ENDPROC
22700 DEFPROCdisPlaywave
22710 IF LEFT$(disPlay$,1)="T" THEN MOVE64,384+?FNelem(8)/640/256:FORx%=0TO255:D
RAW64+x%/1120/256,384+?FNelem(x%)/640/256:NEXTx%:ENDPROC
22720 PRINTTAB(0,21);"  N 1   3   5   7   9   11  13   15";
22730 y%=0
22740 FORx%=0TOnoofharmonics%
22750   IFx%(!FNelem(x%*4+256)THEN y%=!FNelem(x%*4+256)
22760   NEXTx%
22770 IFy%=0THEN ENDPROC
22780 FORx%=0TOnoofharmonics%
22790   MOVE64+x%*1120/noofharmonics%,304:DRAW64+x%*1120/noofharmonics%,304+!FNe
lem(x%*4+256)/640/y%
22800   NEXTx%
22810 ENDPROC
22900 DEFPROCdisPlaycontrol
22910 FORx%=38TO0STEP-2
22912   IFx%(nooftables%THENPRINTx%MOD10 ELSEPRINT
22914   NEXTx%
22920 PROCxscale
22930 MOVE64,336+?FNelem(0)*16:FORx%=0TO255:DRAW64+x%*1120/256,336+?FNelem(x%)*1
6:NEXTx%
22940 ENDPROC
23100 DEFPROCchangeharmonic
23110 strength=i%-!FNelem(256+i%*4)
23120 !FNelem(256+i%*4)=i%
23125 IFi%=0 THEN x%=RND(-1):FORx%=0TO255:store(x%)=store(x%)+strength%*(RND(1)*2
-1):NEXTx%
23130 IFi%<>0 THEN FORx%=0TO255:store(x%)=store(x%)+strength%*sin(x%*i%MOD256):NE
XTx%
23140 PROCchangewave
23145 PROCdisPlaytable
23150 ENDPROC
23200 DEFPROCchangewave
23210 max=0
23220 FORx%=0TO255
23230   IFABS(store(x%))>max THEN max=ABS(store(x%))
23240   NEXTx%
23250 FORx%=0TO255
23260   ?FNelem(x%)=store(x%)*127/max+128
23270   NEXTx%
23280 ENDPROC
30000 REM**GRAPHICS SUPPORT ROUTINES***
30010 DEFPROCtitle(a$)
30020 VDU28,0,0,39,0
30030 CLS
30040 PRINTTAB(20-LEN(a$)/2);a$;
30050 ENDPROC
30200 DEFPROCmainfield
30210 VDU28,0,23,39,2
30220 CLS
30230 ENDPROC
30400 DEFPROCInPutfield
30410 VDU28,0,31,39,30
30420 CLS
30430 ENDPROC
30600 DEFPROCtablefield
30610 VDU28,0,26,39,26
30620 CLS
30630 ENDPROC
30800 DEFPROCParafield
30810 VDU28,0,28,39,28
30820 CLS
30830 ENDPROC
31000 DEFPROCscreen
31010 CLS
31040 MOVE 0,976:DRAW 1279,976
31050 MOVE0,240:DRAW1279,240
31060 MOVE0,144:DRAW1279,144
31070 MOVE0,80:DRAW1279,80
31080 PRINTTAB(17,24);"TABLES"
31090 PRINT"FREQUENCY ENVELOPE  CONTROL   TUNE"
31100 ENDPROC
```

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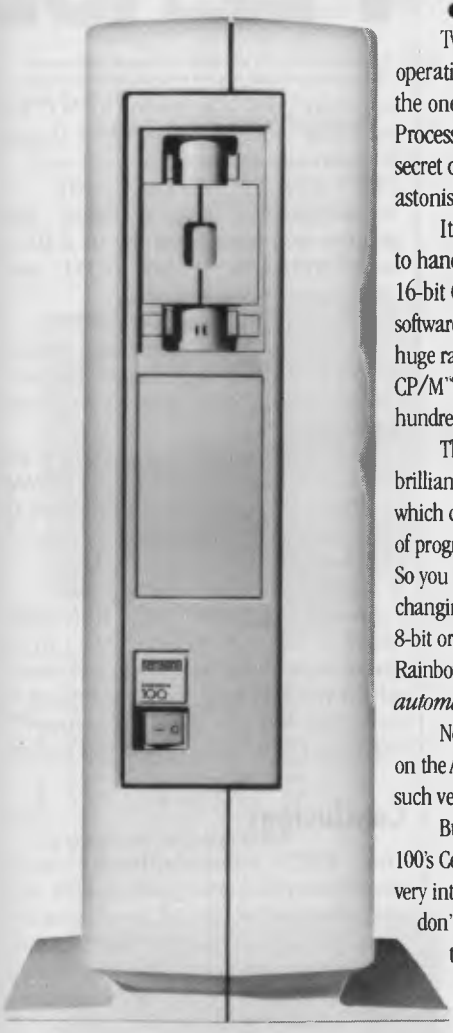

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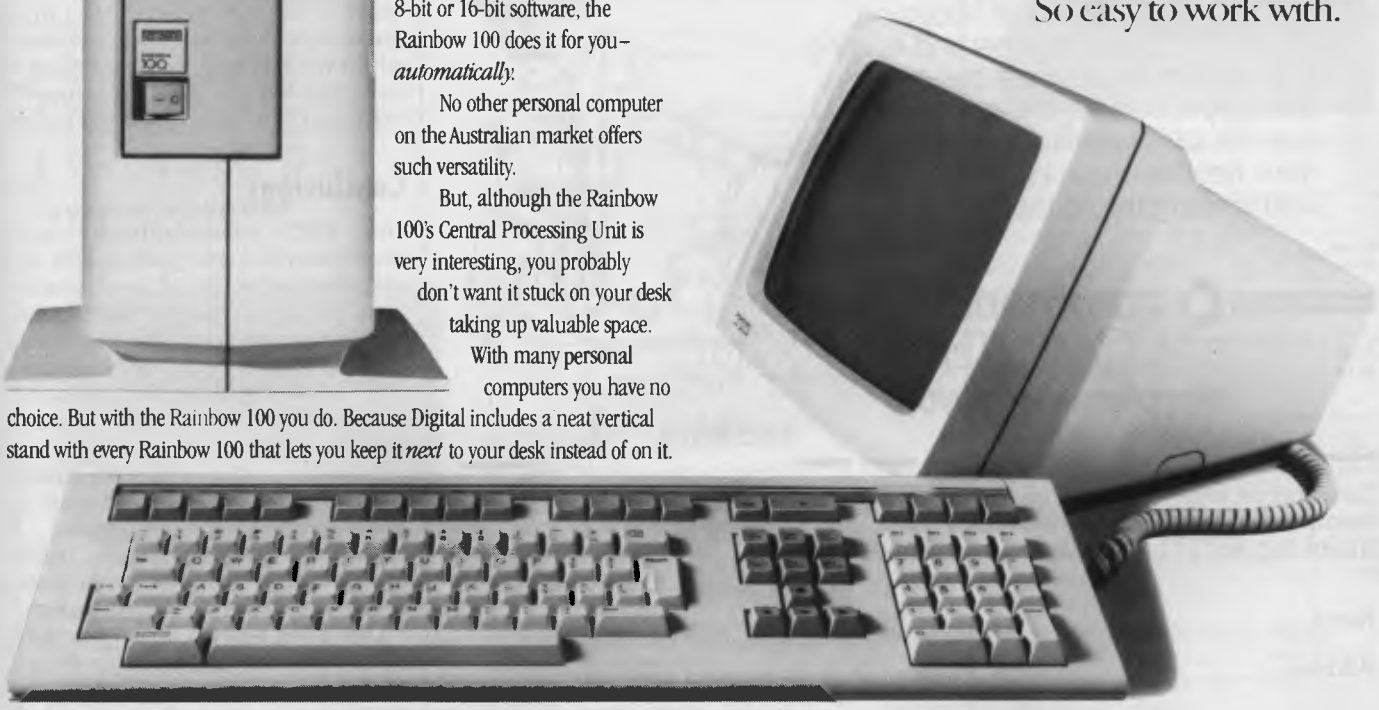

MUSIC MICRO PLEASE

command. Try a segment from 0 to 50 with start and end values of 0, and a modulations equation of
255 * SIN) 2 * PI * x% / 200)
To produce a natural decay define another segment from 50 to 230 with start and end values of 0 and a modulation equation of
255 * EXT((50 - x%) / 100).

Finish the envelope with a segment from 230 to 255 with a start value of 42, an end value of 0 and a modulation equation of 0.

Last of all we will try adding a bit of *Vibrato.* Select "firstfreq" and RENAME if "Violin.f". Add a segment from 0 to 255 with start and end values of 128 and a modulation equation of
5 * SIN(2 * PI * x% / 10).

Select 'firstcont' and RENAME it 'violin.c'. Set the PITCH (<f7>) to 220, (there is no need to change the duration which will still be 0 since this gives 256 units, the longest duration). Now PLAY the note (<f9>) and hear the result.

Conclusions

The BBC computer-based system described produces good quality sound digitally synthesised. A small amount of extra hardware enables the full power of the micorprocessor to be used to produce sound. Most of the important parameters characterising a sound — harmonic content, volume and frequency — can be changed while the note is sounding. In theory, the quality of sound should be comparable with professional computer music synthesisers although such systems produce many channels rather than the single channel of the micro system.

Using the system is not too difficult and a very wide range of sounds can be produced. Information is available to synthesise accurately orchestral instruments as well as completely new sounds.

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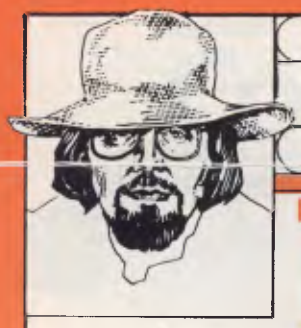


BANKS'

The Party's Over...

The spirit of '1984' is closer than ever with IBM looming ominously over the computer industry. Martin Banks reminisces.

Sometimes, in the early hours of the morning when I lie abed betwixt consciousness and the oblivion of sleep, I get these strange nostalgic feelings come over me. I think back to the good old days, days when men were men and personal computers were personal computers, and then I start to wonder where it all went wrong.

In those early days of Altair and Imsai, when the Apple was but a seedling in the minds of Wozniak and Jobs, personal computers were called that because they were small enough to be carried by one person — just. They didn't do too much, and broke down a good deal; they had to be hand-booted with toggle switches and just adored the feel of a hot soldering iron inside them.

One person and a soldering iron could become a computer company almost over night, and many did as they discovered that there were enough nutty people out there willing to help them turn a hobby into a business. Many of them, the aforesaid Wozniak and Jobs being no exception, grew to become extremely successful and weathy as their businesses grew and refused to fall over in the financial mire that many predicted for them.

This, of course, was their downfall. Their very success, proving that there was a long-term market for personal computers of many different types, ultimately attracted the interest of more old-fashioned computer people. These elders had, up until that time, assumed a divine right to the computer industry and markets, yet the little upstarts had shown it was not so. Something had to be done.

Not unnaturally, these 'other people' decided to do it. Thus it was that IBM, the jolly blue giant of Armonk, decided to launch the IBM PC. At that point in time, personal computing, and the industry it had spawned, stopped being fun. It became a business, a big business, and unfortunately, a boring business. It's always the same of course, when something stops being fun anymore.

It may be an over-simplistic view, but the arrival of IBM on the scene has been a major contributor to the arrival of the long-expected shake-out in the personal computer business. By the time the shake-out has finished, the number of companies still making significant quantities of computer hardware will have been drastically reduced. While you might comment 'so what?', the end result for the users is not likely to be the best thing that ever happened to them.

Why? — Well, consumer choice will become restricted to the point of constriction. Not only will there be fewer companies making machines, the difference between those machines will become increasingly negligible. For better or worse, now that IBM is in the business the others are all followers, devout and humble. Doing something different in hardware design or philosophy may well mark a company as socially deviant and therefore the target for the ultimate sanction — terminal financial ruin.

> *'. . . the arrival of IBM on the scene has been a major contributor to the arrival of the long-expected shake-out in the personal computer business.'*

Ironically, of course, IBM is actually what the users (or the majority of them in America, anyway) want to have in the market. To them the name IBM means respectability and reliability. They know that the company will still be around next year if something goes wrong with the machine. For many business users this is a vital consideration, one that prejudices their decisions when it comes to buying a small computer system. They might like the appearance and specification of another make of machine, but will the company survive? After all, microcomputing is still a very young industry, with very young and inexperienced companies making it up; such worries are understandable for business managers looking to a long-term future (especially their own).

The end result, however, is that such caution does not easily square with a competitive market-place: something has to give. In this case it is competition that is giving, and for the end user that is sad. It will be sad to see a time when there are a dozen or so makes of computer on the world market, and each one a clone of the products of that one big company, IBM.

If the machine had been produced by any other manufacturer it would have been taken on its merits, praised where needed, abused where required and that would have been an end to it. Many companies have produced systems just as sensible and 'worthy' as the IBM PC. They have (or have not) found their niche in the market-place, served their users more or less as expected and that has been an end to the matter. Now there is the matter of the little silver badge on the little cream box. IBM is in the business and all the manufacturers are scared. Even the mighty Apple, for all its standing in the industry, has felt the ground shaken beneath its feet.

If IBM had made Apple's Lisa it would not only have been hailed as a product, it would also have taken the business apart. But it didn't and Apple is now beginning to feel the predictable chill of falling profits that comes from a market where leadership has been lost.

And now IBM is turning its sights onto new markets, other areas of the computer business in which some companies are doing well and which the jolly blue giant has not previously bothered about. The target is the home/personal computer market, until now the chief stamping ground of Commodore and Tandy.

It will be interesting to see how it survives in this particular nest of vipers,

STATEMENT

for some other big names (which one assumes generally know what they are doing) have been bitten hard, long and painfully. Some, notably Texas Instruments and Mattel, have decided on amputation rather than let the poison spread and become terminal.

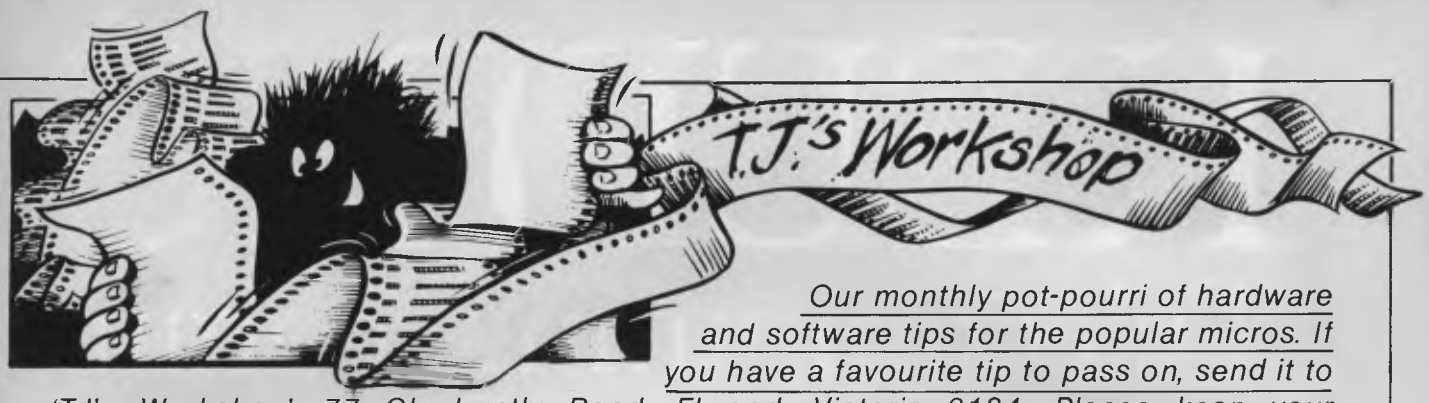
For other, smaller companies, there has been nothing available to amputate. This has started to result in plenty of ritual disembowelments.

It will also be interesting to see whether IBM can repeat its initial success in the small business market down at the home/personal level. It has already shown itself an exception to the maxim that you can't teach an old dog new tricks, but whether it can learn another set of new ones remains to be seen. The Commodore, for example, has shown that the product does not have to be that sensational or sexy. An ordinary little computer will do, just make sure it has some software available then pile it high and sell it aggressively.

From early indications, IBM would seem to have once again learned the first part of this trick. The PC Junior(*née* Peanut) appears to be a not drastically exciting cut-down of the PC with one or two novelties thrown in (the infra-red remote keyboard sounds a smart idea). It remains to be seen whether the company will learn how to sell the beasts in the necessary manner. It is not averse to a bit of cut-throat commercialism, but IBM has never sullied into the consumer market-place before, and consumers are a funny bunch, aren't they!!

Next year, therefore, could be the one in which all interest finally disappears from the computer market — when it stops even remotely being 'fun'. IBM will take over everything remotely digital in nature and will become rich enough to buy India as a holiday resort for jaded executives. On the other hand . . .

END



Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to 'TJ's Workshop', 77 Glenhuntly Road, Elwood, Victoria 3184. Please keep your contributions as concise as possible. We will pay $10—$30 for any tips we publish. APC can accept no responsibility for any damage caused by using these tips, and readers should be advised that any hardware modifications may render the maker's guarantee invalid.

Diskette directory

When I first had my Atari disk drive, I found it very irritating to have to load DOS every time I wanted to see what was on any of my disks. After a little experimentation I discovered how to access the disk's directory from Basic. The program that follows is the result.

I now store this program on all my new disks (it only takes up four sectors), so that every time I want to see what files I have on disk, I can just type RUN"D:DIR and then enter the file spec when requested, to list those files. (Enter *.* for all files).

To end the program, just press RETURN when asked for the file spec; the program will then new itself.

A word of warning: if you have just written the world's greatest program then save it on the disk before running the directory program, as it will ZAP any program currently in memory.

```
5 DIM A$(17),F$(14),
FN$(12)
10 ?"crrrrrrrdddDISKETTE
DIRECTORY"
20 ?:?:?:"ENTER
FILESPEC . . . ";:NF=0
30 INPUT
FN$:FNL=LEN(FN$):IF
FNL=0 THEN NEW
40 ?:F$(1,2)=
"D:":F$(3)=FN$: TRAP 100
50 OPEN#1,6,0,F$
60 INPUT#1,A$:?A$:
NF=NF + 1
70 IFA$(5)<> "FREE
SECTORS" THEN 60
80 CLOSE#1:?:?"NO. OF
FILES:";NF-1:GOTO 20
100?:?:?"bERROR--TRY
AGAIN":CLOSE#1:GOTO
20
```

NB. In the listing: 'c' is the clear screen character; 'r' is the cursor right character; 'd' is the cursor down character; and 'b' is the bell character (CTRL-2)

Each of these characters should be preceded by the ESCAPE key.

Simon Hunt.

Speed up your Atari's Basic

To speed up (most) Basic programs and save memory on the Atari, check whether the following forms of the IF THEN statement are in use.

1 IF A <>0 THEN statement
2 IF A=0 THEN statement

Replace these with:

1 IF A then statement
2 IF NOT A THEN statement

In Atari Basic the average times saved by the second method are 25 per cent and 14 per cent respectively.

Atari Basic can be made to go faster (about 3 per cent) by using POKE 66,1. Note this has the effect of partially disabling the keyboard so POKE 66,0 after the fast section to return to normal.

Nick Pearce.

Microsoft Basic random numbers

Nearly every Microsoft Basic program that owners write utilises a random number generator. Often it is used in different parts of the program. In Microsoft Basic, its use generally takes the form:

```
X=INT(100*RND(1)+1)
```

where 100 is the range.

This is rather cumbersome and can be improved by defining the expression as a function:

```
10DEF FNR (X)=INT
(X*RND (1)+1
```

To obtain random numbers, simply use R=FNR(100). Throwing two dice can be reduced to D=FNR(6)+FNR(6). The method is not only shorter, but faster as well.

Paul Roper.

CP/M life saver

With reference to CP/M Hints (Alan Secker, October TJ's), suppose you have typed in a program in Microsoft Basic and you then type the Basic command system without first saving the program. System returns you to CP/M from MBasic and you have apparently lost your Basic program. Not so!

If you have previously created a directory entry for a zero length file by SAVE 0 GO.COM, you can now type go in response to CP/M> prompt. The MBasic prompt OK now appears. Type LIST to see your long lost program and then type SAVE.

Paul Kelly.

System 80 one liner

For users with APC-80 added to their system:

```
10 MOVE 14336 TO
   15360 FOR 1024 :
   GOTO 10
```

will transfer the contents of the memory-mapped keyboard directly to the screen. Both the screen and the keyboard use the same amount of memory. Try holding down lots of keys at once; some interesting patterns can be made. Bound to keep the kids amused.

For users without APC-80, this short program will give exactly the same result:

```
10 POKE 16562,126 :
   CLEAR 50 :'RESERVE
   SOME MEMORY
20 N=32750 :
   H=INT(N/256) :
   L=N-256*H :
   'location for M.L. rtn.
30 POKE 16526,L :
```

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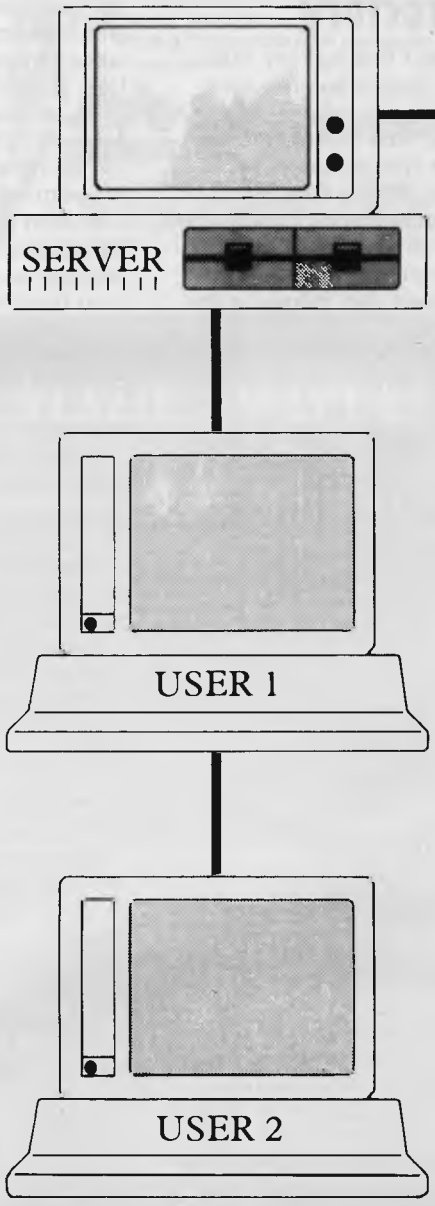

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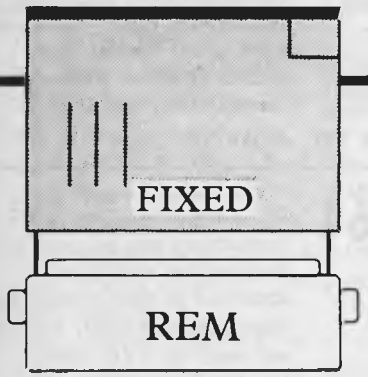

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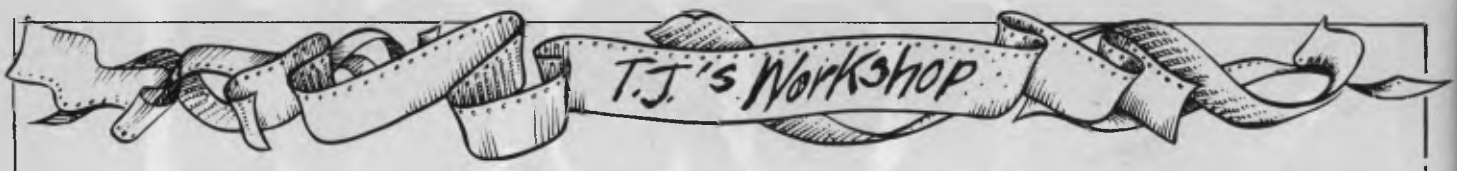



```
    POKE 16527,H :
    'pointer to user routines
40 FOR X=N TO N+11 :
    READ Y : POKE X,Y :
    NEXT X
50 Data 33,0,56,17,0,60,1,
    0,4,237,176,201

100 W=USR(0) : GOTO 100
```

The machine language routine is a simple block-transfer.

```
LD    HL,3800   ;source
LD    DE,3C00   ;destination
LD    BC,0400   ;count
LDIR            ;block-move
RET             ;return
```

Andrew Lamb

Random numbers for the 64

Register 27 of the Commodore 64's sound chip allows the user to read the output of the waveform generator of voice 3. The noise waveform is produced by random oscillations. Because of this waveform's structure it is possible to produce random integers within the range of 0-255 by simply reading register 27 (location 54299).

Before PEEKing register 27 the following POKEs should be executed to turn on voice 3 and set up the noise waveform. These lines need only be executed once in a program that does not use voice 3.

```
POKE 54290, 129:POKE
    54287, 1:POKE 54296, 1
```

After executing these lines all that is needed to obtain random is to execute the line R=PEEK(54299) where R is any variable that is to contain the random number.

This procedure for random number generation is more efficient than conventional Basic methods and is quicker since it involves little Basic interpretation. It also provides a method by which machine language programmers may generate random numbers for fast games action.

Michael Thomson

Hints on PEEKing and POKEing the VIC-20

I have found the following routines very useful on my VIC-20.

PRINT PEEK(183) will give the number of characters in a file's name.

PRINT PEEK(186) will give the number of open files.

PRINT PEEK(646) will give the current colour; it will always be one less than on the keyboard.

POKE 657,128 will disable switching cases.

POKE 657,0 will enable switching cases.

If you have the super expander you may like to try the following.

SYS 64850 disables the function key definitions.

SYS 58232 disables extra commands.

To tune the super expander into a temporary 3k RAM pack type:

```
SYS 64850
 POKE641,0:POKE642,4:
 POKE643,0:POKE644,30:
 POKE648,30:SYS64824
```

Nicky Sloan.

When data must be updated constantly

The following may help readers who save data on tape. It is especially useful when data must be constantly updated.

Use one tape for each set of data. This is used to hold two versions of the data; the most recent copy and the second most recent copy. One set of data is recorded on each side of the tape, to ensure a recent version of the data is available despite accidents.

Each time the tape is used, load the most recent data and save over the second most recent version. When data is saved, rewind the tape to the beginning of the newest data. This saves time when loading and shows which is the most recent side.

R Walton.

Commodore 64 jiffies in the bag

Recently a reader explained how Commodore 64 owners could obtain the time in Jiffies (1/60 of a second).

However, no reference was made to the fact that the jiffy clock can be PEEKed. It is at locations 160, 161 and 162. This means the time can be altered by POKEing these locations and read by PEEKing them. The WAIT instruction can be used in conjunction with these locations to time delays. e.g.

```
TI$="000000":WAIT 162,128
```

will wait for 128 jiffies (approx 2 seconds)

```
TI$="000000":WAIT 161,2
```

will wait for 256*2 JIFFIES (APPROX EIGHT SECONDS).

The clock can be switched off at any time with:

```
POKE 788,PEEK(788)+3
```

and switched on again with:

```
POKE 788, PEEK (788)-3
```

(Disabling the clock disables the RUN/STOP key).

D Gristwood.

Fooled VIC-20

As a VIC-20 owner I have noticed that sometimes on an unexpanded VIC you will get out of memory errors for no apparent reason. This can be frustrating and it can cut debugging time in half because you have to turn the micro off and start again with extra memory.

This problem can be eliminated with a simple POKE statement. You can actually fool the VIC into thinking it has extra RAM available thus eliminating errors.

The statement is:

```
POKE 56,N
```

where N is an integer between 0 & 255.

The most memory you can achieve on a 5k VIC is 32765 bytes by making N 144- higher numbers will give a negative number such as -32765.

While this POKE will not actually increase RAM it will fool the VIC.

Darren Crocker

Locking your listing on the Commodore

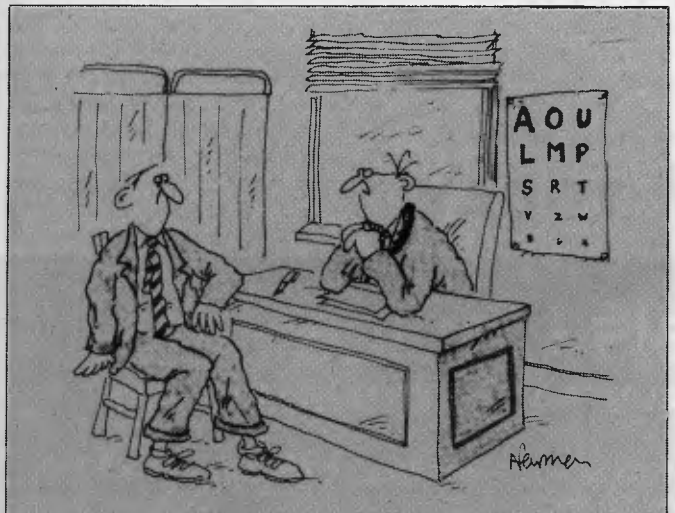
A sneaky way to stop people listing your program is to include the following sub-routine in your program. Not only does it disable the listing, it will produce a message whenever you try to list.

To use simply set M$ to contain the required message and call the subroutine with GOSUB100.

To return the listing to normal, use the following two POKES:POKE774,26: POKE775,167.

D Gristwood.

```
10 REM DEMO
20 M$=" SCROOFS IN SPACE 'C)1984"
30 GOSUB 100:LIST:END
40 REM
100 REM DISABLE THE '.IST
110 M$=CHR$(157)+CHR$(157)+
    CHR$(157)+M$
120 FOR T=1 TO LEN(M$)
130 POKE 847+T,ASC(MID$(M$,T,1))
140 NEXT T
150 POKE 847+T,0
160 FOR T=828 TO 837:READ A:POKE
    T,A:NEXT
170 DATA 169,80,160,3,32,30,171,
    76,116,164
180 POKE 774,60:POKE 775,3
190 RETURN
```



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Bricklin's Vision

Dan Bricklin is one of the most influential software writers of all times. So what does he think of the current state of the art? Well, the days of menu-driven software are numbered . . . Mike Liardet reports.

Dan Bricklin is one of the two authors of what is the world's most successful software package. With a few intensive months of coding back in the late seventies he and his partner, Bob Frankston, wrote VisiCalc. This introduced a new type of software — the spreadsheet, giving the computer industry the biggest 'kick in the pants' since the introduction of the micro. The outcome of their work is that now no self-respecting micro-manufacturer will release a machine without spreadsheet software available.

Dan Bricklin recently spoke on the 'State of the Art', and I rushed along to hear what he had to say and fill in the gaps with an interview.

He began by defining mainframes, minis and micros. The important point is that minis are really scaled-down mainframes, but micros are not just scaled-down minis. In fact if you try to use them that way, then the results can be disappointing. What micro-technology has to offer is 'high-bandwidth' VDUs — screens that can be completely redrawn in an instant by a processor which can be almost exclusively dedicated to doing just that.

The high-speed VDU technology simply didn't exist at a reasonable price until recently, and it is only a few 'state of the art' software packages that really try to maximise the advantages of it.

Bricklin chose the following as worthy of special mention.

***VisiCalc.** The software that began spreadsheet systems would not really be feasible without a screen that is immediately responsive. With VisiCalc the screen acts as a 'window' on a large sheet of numbers. The window can rapidly be moved from place to place only because dedicated micros can attain the necessary speed to redraw the screen frequently and at the whim of the user.

***TK!Solver.** This is Software Arts' latest product (reviewed in this issue) and it uses similar interactive techniques to VisiCalc. As with all the products Bricklin mentioned, the concept of windowing is central to the interaction.

But TK!Solver also introduces a new

Above: Dan Bricklin

interactive feature, almost like adding a third dimension to the windowing concept. Bricklin terms this new feature 'diving', following the TK!Solver terminology. The idea is that in general an area of the screen may contain only a title or brief summary on some point. By pointing at it, and giving the appropriate command, we can 'dive into' that area and find out much more, as the new screen display will be wholly devoted to it.

***Lisa.** Moving away from Software Arts' products, Bricklin introduced some of the interactive concepts underlying Apple's Lisa software (See *APC*, August '83). Like the previously mentioned products, Lisa uses 'diving' and 'windowing' and it introduces other new concepts. Instead of screen displays with just words, images or 'icons' are used. Visually, pictures are more stimulating than text, and may be easier to work with, but the windowing/diving is essentially unchanged.

***The Mouse.** A mouse is a small box which slides across the desk, causing the screen marker or cursor to move along with it. Bricklin thinks it should be equipped with a full integral numeric keypad instead of the .two or three buttons which are the current standard. He also reckons the current hostility to mice directly stems from the name, which 'simply is not macho enough!'

***Visi On and MS-Windows.** Two further software products mentioned by Bricklin, but so 'state of the art' that they are not yet available: Visicorp's Visi On (see *APC*, December '83) and Microsoft's MS-Windows. Both these products will place the above-mentioned facilities at the beck and call of your average programmer. This is no small matter, because although the above-mentioned concepts are easy for a user to grasp they are extremely hard to code-up from scratch. Bricklin cited genuinely portable computers (as opposed to 'luggables', touch screens and electronic mail) as the state of the art in hardware. Lap-held portable machines such as the NEC and Tandy are extensively used by Software Arts for note-taking at meetings.

Not surprisingly Bricklin described his own company as state of the art. Having grown from two people in an attic in January 1979, it now employs 130 people and five Prime 850 computers in palatial premises on Boston's technology highway: route 28.

Last year, Software Arts received $8 million in payments for VisiCalc. Bricklin objects to the term royalties for this.

The Future

Bricklin is tight-lipped about any future direction that Software Arts may take, although clearly it is committed to TK!Solver and we can look forward to a plethora of solver-packs and wide-ranging implementations of it.

Did he have any predictions? Well yes, menu-driven software will be extinct in another 10 years — the concept originated with a generation of programmers sustaining themselves with the numbered options in Chinese take-aways. Instead of menus we can look forward to seeing all the options hovering at the top of the screen, and the next generation of users will, with unerring accuracy, simply shoot down the one they want! END

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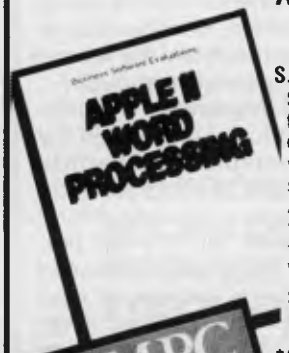

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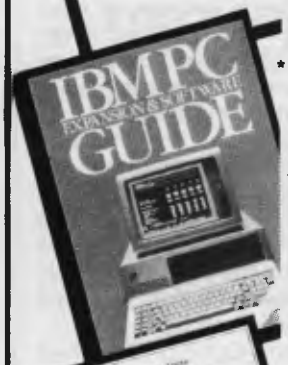

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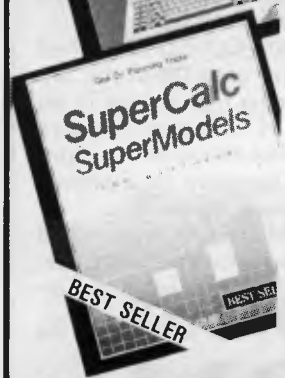

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APC 4/84

NEWCOMERS START HERE

This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in APC. While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!

Probably the first thing you noticed on picking up this magazine for the first time was the enormous amount of unintelligible-looking jargon. Well, in the words of *The Hitch-hikers' Guide to the Galaxy*, don't panic! Baffling as it may sound, the jargon does actually serve a useful purpose. It's a lot easier to say VDU, for example, than 'the screen on which the computer's output is displayed'. This guide is intended to help you find your way around some of the more common 'buzzwords' you're likely to come across in the pages of *APC*.

For those completely new to computing, let's start with the question: what is a microcomputer? We can think of a micro as a general-purpose device as opposed to a typewriter which can only be used for typing, a calculator to perform calculations, a filing-cabinet to file information and so on. A micro can do all those things and more.

If it is to be of any use, a general-purpose device needs some way of having a function assigned to it. We do this by giving the computer a set of logical instructions called a **program**. The general term for computer programs is **software**. Every other part of a microcomputer system is known as **hardware**. 'If you can touch it, it's hardware.'

Programs must be written in a form the micro can recognise and act on — this is achieved by writing the instructions in a code known as a **computer language**. There are literally hundreds of different languages around, the most popular of these being **Basic**. Basic is an acronym of **B**eginners' **A**ll-purpose **S**ymbolic **I**nstruction **C**ode. Although originally intended only as a simple introductory language, Basic is now a powerful and widely-used language in its own right.

Other languages you're likely to come across in *APC* include **Forth, Pascal, C** and **Comal**. These are known as **high-level** languages because they approach the sophistication of a human language. You'll also see references to the **low-level** languages, **assembly language** and **machine code**. We'll look at high and low-level languages in a moment.

The heart of a micro, the workhorse, is the **processor** or **Central Processing Unit (CPU)**. The processor usually consists of a single silicon chip. As with computer languages, there are a number of different types of processor around, the Z80, 6502 and 8088 being the three most common. The processor is nothing magical — it's just a bunch of electronic circuits. It's definitely not a 'brain'.

Being electronic, the processor's circuitry can be in one of two states: on or off. We represent these two states by **binary** (base two) notation, the two binary digits (known as **'bits'**) being 0 and 1. It is possible to program computers in binary notation, otherwise known as **machine code** (or machine language) programming.

Machine code is called a low-level language because it operates at a level close to that 'understood' by the processor. (Languages like Basic are known as high-level languages because they are symbolic, operating at a level easily understood by people but not directly understood by the processor.)

Between high-level languages and machine code is a low-level language known as **assembly language** or, colloquially, **assembler**. This is a mnemonic code using symbols which the processor can quickly convert to machine code.

Since there is no binary equivalent of a comma or the letter 'a', for example, we need some sort of code to represent each character to be processed by the computer. In order to simplify communication between computers, a number of standard codes have been agreed on. The most widely used of these codes is the **A**merican **S**tandard **C**ode for **I**nformation **I**nterchange, **ASCII**. This system assigns each character a decimal number which the processor can then convert to its binary equivalent.

There are two types of program to do this translation for us. The first of these is a **compiler** which translates our whole program permanently into machine code. When we compile a program, the original high-level language version is called the **source code** while the compiled copy is called the **object code**. Compiled programs are fast to run but hard to edit. (If we want to change a compiled program, we either have to edit it in machine code (extremely difficult) or we have to go back to a copy of the source code.) For this reason there is a second translation program: an **interpreter**. An interpreter waits until we actually run (use) the program, then translates one line at a time into machine code — leaving the program in its original high-level language. This makes it slower to run than a compiled program, but easier to edit.

There are two strange-sounding Basic words you're likely to come across: **POKE** and **PEEK**. When you program in a high-level language, you are normally unable to choose which part of the machine's memory the processor will use to store things. This makes programming easier as you don't need to worry about memory locations, but slows down the program since the processor has to 'look up' addresses for you. Using the POKE command, however, you can 'POKE' a value directly into a desired memory address. 'POKE 10000,56', for example, puts the value 56 into memory location 10000. PEEK allows you to examine the content of a particular memory address. If you were to follow the above POKE with 'PEEK 10000', the computer would respond by displaying the value 56. (POKEing and PEEKing is normally done to increase program speed. It's a compromise between Basic and machine code.)

So far, we have a processor and a program. Since a computer needs somewhere to store programs and data, it needs some kind of memory. There are two types of memory known as **R**ead **O**nly **M**emory (**ROM**) and the badly-named **R**andom **A**ccess **M**emory (**RAM**). ROM is so-called because the processor can **'read'** (get things out of) its contents, but is unable to **'write** to' (put things in) it.

ROM is used to store **firmware**, which consists of software permanently available on the machine. An interpreter is a typical example of firmware (stick with it: it gets easier!).

RAM differs from ROM in two important ways. Firstly, you can write to it as well as read from it. This means that the processor can use it to store both the program it is running and data (information). The second important difference is that RAM needs a constant power-supply to retain its contents: as soon as you switch the computer off, you lose your program and data.

Memory is described in terms of the number of characters we can store in it. Each character is represented by an 8-bit binary number. 8 bits make one byte and 1024 bytes make one **kilobyte** or **1k**. 32k, for example means that the computer can store about 32000 characters in its memory. If 1024 sounds like an odd number, remember that everything is based on the binary system, thus 1,2,4,8,16 ... 1024 being the nearest binary multiple to 1000.

There are numerous forms of **permanent** or **backup** storage, but by far the most common are the **floppy disk** and **cassette**.

Floppy disks or diskettes are circular pieces of thin plastic coated with a magnetic recording surface similar to that of tapes. The disk, which is enclosed in a protective card cover, is placed in a **disk drive**. Disk drives comprise a high-speed motor to rotate the disk and a read/write head to record and 'playback' programs and data.

The disk is divided into concentric rings called **tracks** (similar to the tracks on an LP) which are in turn divided into small blocks by spoke-like divisions called **sectors**.

There are two methods for dividing the disk into sectors. One method is called **hard-sectoring**, where holes punched in the disk mark the sectors, and the other is **soft-sectoring** where the sectors are marked magnetically. (The reason that disks from one machine can't be read by a different make is that each manufacturer has its own way of dividing up the disk. Recently, however, manufacturers do seem to have begun to acknowledge that this situation can't go on forever, and they are working on making their disks compatible with each others.')

Since the computer needs some way of tracking the whereabouts of everything on the disk, we have a program called a **Disk Operating System**, more usually known simply as the **Operating System (DOS** or **OS)**. The operating system does all the 'house-keeping' of the disks, working out where to put things, letting the user know what is on the disk, copying from one disk to another and so on. As you might expect by now, there are lots of different operating systems available (each with its own advantages and disadvantages). The two most popular OSs are **CP/M** (Control Program for Micros) and **MS-DOS** (MicroSoft Disk Operating System).

Floppy disks provide a reasonably fast and efficient form of secondary storage and are cost-effective for business machines. For home computers, however, the usual form of program and data storage is on ordinary cassette tape using a standard cassette recorder. This method of storage is slow and unreliable, but is very cheap and is adequate for games and the like.

Another type of disk you'll see referred to is the **hard disk**. This is an extremely efficient method of storing large amounts of programs and data. Hard disk capacity generally starts at around 10 **Mbytes** (10 million bytes) and rises to . . . well, you name it. Besides offering a much greater capacity than floppies, hard disks are more reliable and considerably faster. They are, however, much more expensive than floppy drives.

Since computers need some way of communicating with the outside world, we need input and output devices. Input and output devices include all manner of things from hard disk units to light-pens, but the minimum requirement for most applications is a typewriter-style **keyboard** for input and a tv-like **Visual Display Unit** for output. The Visual Display Unit is variously referred to as a **VDU, Cathode Ray Tube (CRT)** and **monitor**.

The various component parts of a computer system (processor, keyboard, VDU, disk drives, etc) may all be built in to a single unit or they may be separate, connected by cables.

Take this paragraph slowly and it makes sense! When a computer communicates with an outside device, be it a printer or another computer, it does so in one of two forms — **parallel** or **serial**. **Parallel input/output (I/O)** requires a number of parallel wires. Each wire carries one bit, so with 8 wires we can transmit/receive information one byte at a time (8 bits = one byte, remember). **Serial I/O**, in contrast, uses a single wire to transmit a series of bits one at a time with extra bits to mark the beginning and end of each byte.

To enable different devices to communicate with each other in this way, standards have been agreed for different **interfaces**. An interface is simply a piece of circuitry used to connect two or more devices. The most common standard serial interface is the **RS232** (or **V24**) while the **Centronics** standard is popular for parallel interfaces.

When two computers want to communicate with each other over a distance, there are again two ways of doing it. Both methods use the public phone network. The simplest and cheapest method is to use a device known as an **acoustic coupler**. This simply plugs into your computer, and has a receptacle into which you place your telephone handset. However an acoustic coupler is slow and not exceptionally reliable.

A more sophisticated (and correspondingly more expensive) method is to use a **modem**. Unlike an acoustic coupler, a modem is wired into the telephone system and you should get permission for this from Telecom.

So, now you know!

BENCHTEST

Sharp MZ-700

First launched in Japan back in October 1982 as part of the MZ-700 series, the MZ-711 by the time of its unveiling in Australia had incorporated all the embellishments of the complete range. Surya assesses Sharp's most recent development in the home computer field.

Sharp has taken a strange route to arrive at its latest machine, the MZ-700. First came the MZ-80K which was never sold in Australia. It was a PET look-alike, and survived for a surprisingly long time in international markets considering the extremely limited graphics and its incredible 'block' keyboard. After a couple of business machines and a pocket computer, Sharp attempted to replace the 'K' with the MZ-80A.

The MZ-80A had 48k RAM (unexpandable) and was also not sold in Australia. The combination of unexpandable memory, MZ-80K graphics and a price tag equivalent to about $1,000 meant that the machine perched uncomfortably between the top end of the home market price-wise, and the bottom of the business market feature-wise. To date, it appears to have made little impact on either market. Sharp's MX-80B was sold in Australia, aimed at a similar market to that of the 'A', but also did not enjoy earth-shattering sales.

The MZ-700 is aimed squarely at the home market. Priced at $499, it appears to be a hybrid machine: clearly retaining its MZ-80K roots, but with some of the improved features of the MZ-80A.

One of the first things to sort out is the confusion over the name of the machine. It was launched in Japan (October 1982) as the MZ-700 series. This series comprised four machines — the 710, 711, 721 and 731. The 710 is the unadorned machine; the 711 has an RF signal jack (for TV use) and a composite signal output (for composite video monitors); the 721 a built-in cassette unit; and the 731 a built-in plotter/printer. I asked a Sharp spokesman if he could explain the rationale behind all these model names, but it appears that there isn't one. I did also wonder about the bottom-of-the-range machine running only an RGB monitor, and Sharp couldn't come up with an explanation for this either.

Anyway, someone at Sharp evidently decided that this strategy was unnecessarily complicated. When the machine was launched (in September 1983) only the 721 was sold; the printer was sold as separate peripherals, and the 710 disappeared into obscurity. The manual, however, still refers to the four so, for simplicity's sake, I'm going to call it the 700 from now on.

Like its predecessors, the 700 is what Sharp refers to as 'clean'. This means that there is no high-level language on-board in ROM form. High-level languages are loaded either from cassette or disk, but more about this later.

Hardware

The review machine had the built-in cassette unit and printer/plotter included (making it the equivalent of an MZ-731). The machine measures 44 x 31 x 9cm and weighs 3.6kg without cassette unit and printer, 4.6kg with both.

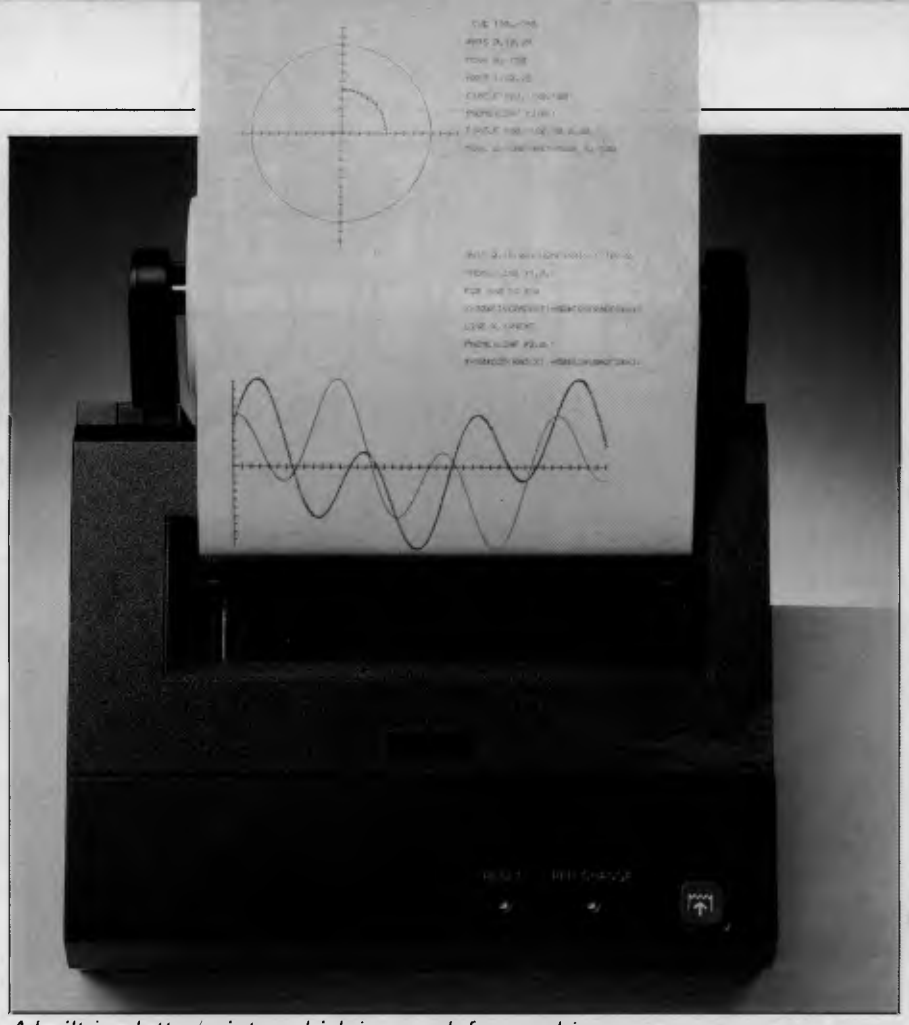
Styling is somewhat ungainly. Lots of sharp (sorry!) angles and an odd colour scheme: black and white with beige function keys and blue user-definable keys.

Keyboard

The keyboard has 69 keys laid out in a standard configuration. The INS and DEL keys, familiar to Sharp owners, are in their usual place at the top right hand corner, and below them are four cursor keys, sensibly positioned in a diamond shape. Five user-definable function keys sit above the main keyboard on the left. There is a space, protected by a transparent plastic cover, to place the sticky labels supplied with the machine to identify the functions.

The qwerty keys have graphics symbols printed on the underside. These are utilised by pressing the GRAPH key; pressing ALPHA restores the keyboard to alphanumeric use.

The keyboard feel is a little 'spongy', but I encountered no problems with it.



A built-in plotter/printer which is superb for graphics

The purpose-designed cassette recorder is included in the price

My only real complaint about the keyboard is that unshifted letters generate upper-case while shifted letters generate lower-case. This was obviously done because S-Basic rejects lower-case commands and statements with a syntax error, but a far more sensible arrangement would have been either to have produced a Basic which ignored case, or to have fitted a CAPS LOCK key. As it is, entering text in PRINT statements is

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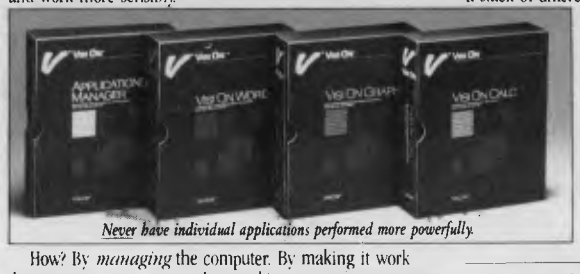

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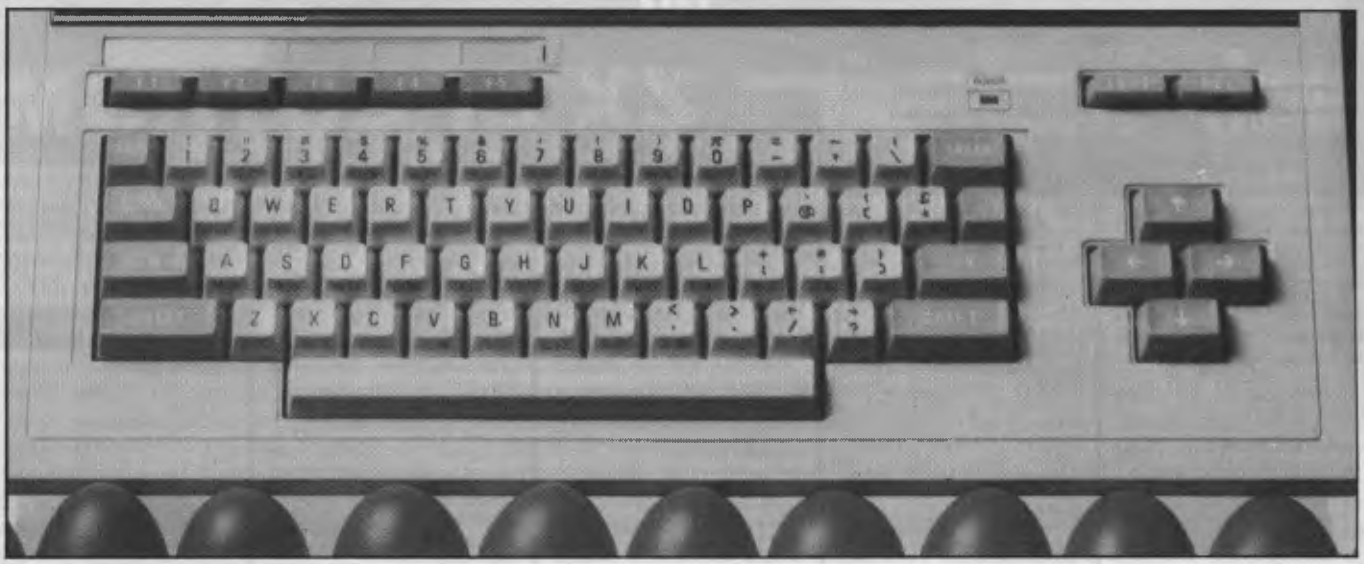

One niggling point: unshifted letters generate upper-case while shifted letters generate lower-case letters

very tedious.

All keys auto-repeat.

Interfaces

Sharp is notorious for providing non-standard interfaces, and the 700 is no exception. There is no RS232 port, and the parallel printer port is of a design unique to Sharp.

All the interfaces are at the back of the machine. Moving from left to right, the 700 has sockets for three forms of video output: a standard TV signal, composite video output and RGB video output. The RGB and TV signals can be switched between monochrome and colour, but the composite video line is monochrome only. A TV lead is the only one supplied with the machine.

Below the video output sockets are the external tape sockets, marked READ and WRITE. These are standard 3.5mm jack sockets; no 'remote' facility is available. Next to these sockets are the joystick interfaces. The joysticks are not available at the time of writing, nor as yet is there any software to support them.

The I/O bus and the printer port to the right of these are covered by thin metal plates. These are removed by undoing two crosshead screws. The printer port is intended for Sharp's own MZ-80P5 and MZ-80P6 80-column, dot matrix printers. The P5 is a tractor-fed printer retailing at $910, while the P6 offers friction feed at $1,150. Sharp apparently only produces cables for these printers, so you'll have to make up a special cable if you want to use other brands.

Next is the volume control for the machine's built-in speaker, and the reset button. Unlike the reset switch on many machines, this one is dangerous! Pressing it drops you unceremoniously into the monitor — no warning, no check, no program. Since the button is not recessed or otherwise protected and requires only a light touch, putting it next to the volume control is bad design.

Finally, there is the power socket, on/off switch and an earth connection marked FG (Frame Ground). Quite why a machine of this sort of size and power should require a frame ground is a mystery to me.

Inside

Getting into the machine is no mean feat. Three screws must be removed from underneath the front of the machine. Next, the cassette unit and printer and/or dummy boxes must be

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removed, together with the clips holding them in place. I found the connections from the printer and cassette unit to the circuit board very difficult to pull out without damaging either the connector or the board. Following this, the cover has to be levered off with a screwdriver, or similar. The keyboard is then lifted out and you can — at last! — get at the circuit board.

The circuit board is extremely well designed. The various parts of the circuit are logically situated, all the chips are numbered and the main ones are labelled — no patches or alterations are in evidence. Detailed circuit diagrams are provided in the manual, so those of you who do most of your programming with the aid of a soldering iron will have little difficulty with this machine.

The CPU is a Z80A, and the processor's full complement of 64k RAM is on-board. The chips are a varied assortment of Sharp, Mitşubishi, Toshiba, NEC and others. An interesting chip is the video processor; this has pins extending from all four sides — a technique being used on new 32-bit CPUs to avoid the necessity for tracks to 'jump' each other. I was surprised to find this design of chip lurking inside an 8-bit home micro, but it is a very sensible idea.

The built-in speaker is an 8 ohm, 1 watt audio speaker, which is hefty for a micro. Other than the non-standard printer port mentioned earlier, the rest of the circuitry is much as you'd find in any Z80-based micro.

Data recorder

The primary advantage of using Sharp's 'data recorder' (cassette recorder to you and me) in preference to any other is that of reliability. Since the unit is wired directly into the main circuit board via a pin-connector and is purpose-designed, you should't experience any problems loading and saving programs. The unit proved 100% reliable during this review, which is certainly not the case with all the machines we test.

I like the cassette handling on the 700. When you type LOAD, the computer checks whether the Play button on the cassette unit is depressed. If not, it responds with a little downward-pointing arrow and the message 'PLAY'. If you type SAVE and the Record and Play buttons are not depressed, it responds with the same arrow and the words 'RECORD.PLAY'.

Equally, when it has finished LOADing or SAVEing, it switches off the cassette motor. But, if you now press the Stop button followed by Rewind, Ffwd or Play, it switches the motor back on for you. All very friendly — note that these features are not available when using an external cassette recorder.

Colour printer/plotter

This printer/plotter gets everywhere! It appears in various cases under various names. I own one myself (in a Tandy case) and, since I paid the full retail price for it, I don't have any ulterior motive for stating that I think it's an amazing little machine. In its Sharp guise, it's an optional extra costing $190.

Since the paper width is a fraction under 11.5cm, it's obviously quite useless for word processing (though I receive a fair few programs accompanied by letters written on it!). However, it is quite adequate for listings, and superb for graphics.

Although described as a printer/plotter, it can't actually print at all: it's a plotter which has been taught to write. The device has four pens in a cylindrical holder that moves horizontally across the roll of paper. Vertical movement is achieved by scrolling the paper. To change colour, the pen holder is rotated to select a different pen.

In text mode, letters are quite literally drawn onto the paper. This is painfully slow (approximately 10cps), but the effect is of very neat, hand-drawn letters. Since everything is drawn rather than printed, text can be any size from 80 characters/column right up to a single character/column. Unfortunately, Sharp does not appear to have given software support to this particular feature of the printer, S-Basic restricting you to one of three sizes. Text can be printed sideways, or even upside down. All the parameters (size, pen colour, direction) are under software control.

In graphics mode, the plotter has its own set of commands quite independent of those used for screen graphics. A set of control-codes and statements added to S-Basic is used for this purpose.

The procedure for fitting the plotter is almost identical to that for the data-recorder, and is well-documented in the manual. A switch is used to select plotter or external printer.

Software

The MZ-700 is supplied with a cassette containing Sharp MZ-700 Basic Version 1.0A (S-Basic). This is upward compatible with Sharp Basic SP-5025 supplied with the MZ-80K. The 700 will also run Basic SP-5025, together with any other Basics and high-level languages written for the MZ-80K. Both facts mean there is a large stock of software

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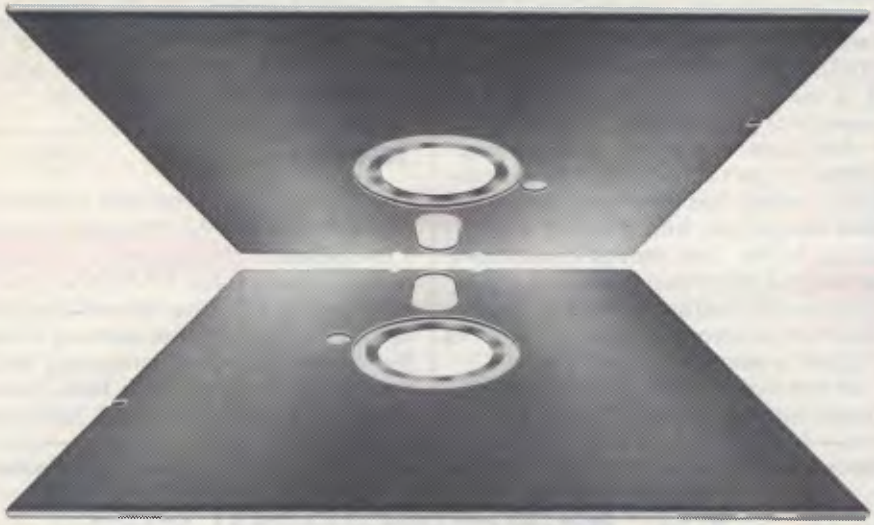

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BENCHTEST

available in international markets which will run on the machine even before people get around to producing software specifically for the 700.

Unlike the MZ-80K, the 700 does support colour — eight foreground and eight background colours. Glancing through the manual and/or reading the promotional material, an innocent could be deceived into believing that the 700 also supports full colour high resolution graphics. It doesn't. It supports pseudo-graphics (that is, block graphic characters), except that you can print them in whatever colour and on whatever colour background you choose, together with low resolution (80 x 50) Set and Reset.

On playing with the COLOR statement, used to change foreground and background display colours, I discovered what appeared to be a major bug in the review machine.

I wrote a little program to step through every possible combination of fore- and background colours, pausing between each. When attempting to display certain combinations of colours (or shades of grey, since I was using a composite video monitor), the display went haywire — the screen 'scrolled' upwards incontrollably, and could only be stopped by switching to a different combination.

A great many combinations appeared to cause this problem. Whether this is something which afflicts all 700s or just applied to the machine I had for review, I don't know. I suggest prospective purchasers ask their dealer to run the following program to find out:-

```
100 FOR A=0 TO 7
120   FOR B=0 TO 7
140     IF A=B THEN NEXT B
160     REM — If foreground = background, skip this combination
180     COLOR,,A,B
200     CLS
220     PRINT"COLOR,,";A;",";B
240     GET A$:IF A$="" THEN200
260   NEXT B
280 NEXT A
300 PRINT"END":END
```

Pressing the space bar (or any key) will step through each of the different combinations of colours. If the display remains steady and clear throughout, there are no problems with the machine.

The reason the unsuspecting could be deceived into thinking the machine supports high resolution graphics is that the colour plotter does. You can achieve some quite detailed and attractive designs on the plotter — as one of the supplied demonstration programs illustrates; what you can't do is produce high resolution graphics on the screen.

The 700 has five user-definable function keys. These are programmed in more-or-less Microsoft standard format: 'DEF KEY (n)="string"', where n is the function key number and string is the statement assigned to the key. Use of the Shift key gives access to another five function keys, making ten in all. So SHIFTed F1 is interpreted as F6 and so on. This may have been a last-minute addition to the interpreter, since the function keys do not have the F6 to F10 markings on the underside of the keys — the method used on the rest of the keyboard to represent the SHIFTed function.

Benchmarks

BM1	0.4
BM2	3.5
BM3	9.5
BM4	8.6
BM5	9.4
BM6	17.7
BM7	32.7
BM8	82.7
Average	20.6

All timings in seconds. For a listing of the Benchmark programs see 'Direct Access'.

Aside from the colour statements and those used to control the plotter, S-Basic differs little from Basic SP-5025. It is as I have come to expect from Sharp: adequate and unexciting. I had hoped it might have made at least a token attempt at some semblance of structure — a REPEAT-UNTIL or WHILE-WEND loop, if not user-defined functions and procedures. Sharp, it seems, is not an advocate of structured Basic, but I have seen far worse Basics.

Of course, the beauty of a 'clean' machine is that if you don't like the interpreter supplied, no problem: just throw it away and buy another one. The MZ-80K inspired software houses to produce endless dialects of Basic, together with versions of Forth, Pascal and almost any other language you care to name. All of these will run on the 700, and I'll offer you very good odds that the same software houses will see the extra money of the 700 as an opportunity to produce better versions of their existing interpreters especially for the machine. Sharp in Australia intends to import a range of this software.

Having to load an interpreter before you can write or run a program can be irritating on a cassette-based machine, since the process is a relatively lengthy one (S-Basic, for example, takes just under three and a half minutes to load). But some would argue that a few minutes delay is a small price to pay for

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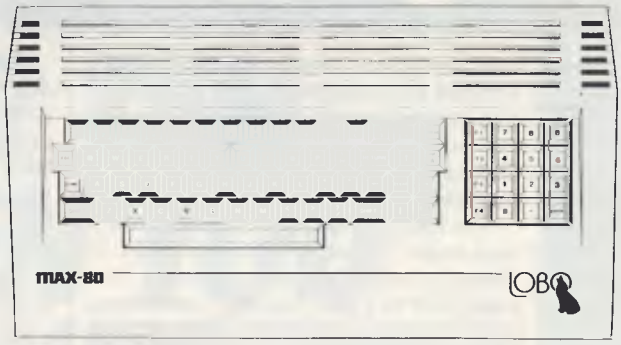

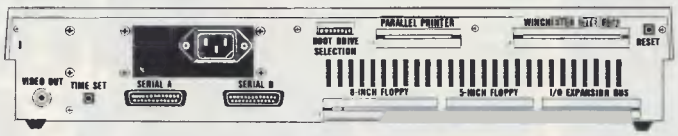

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BENCHTEST

the freedom to choose the language most suited to your current application. And you have only to look at the mess some companies (I'll mention no names) get into when they try to improve/correct/update Basics supplied in ROM form.

Editor

When it comes to editing, most manufacturers still appear to be living in the age of teletypes, when the only way to tell the (distant) computer what you wanted to edit was to specify the line number. Now that most of us work with these new-fangled VDUs, there really is no excuse for forcing people to edit in this incredibly tedious way.

Sharp provided a full-screen editor even on the MZ-80K, which was launched not so very long after the teletype days, and the 700 has the same sensible, easy to use editor.

APC Benchtesters get a pretty good idea of how good an editor the machine supports when they come to run the Benchmark programs. Since each program is a modification of the previous one, a good editor should allow the appropriate change to be made quickly and easily. In the case of the 700, the combination of the full screen editor and the RENUMber command made the whole process extremely simple. The Sharp editor is a delight to use.

PLOT ON mode

The statement MODE TH (CR) (to place the plotter in 40-column mode) followed by PLOT ON (CR) instructs the machine to echo all screen output to the plotter. Provided you have the plotter, therefore, it is conceivably possible to use the 700 without a TV or monitor—at a push. Sharp tells me that some people in Japan are using the machine as a 'semi-portable' in this way. It does work, but at 10cps I think you'd have to be very patient to use the machine in this way for any length of time! PLOT OFF switches it off again.

Documentation

The MZ-700 Owner's Manual is a smartly presented 200-page, A4 book. The manual doesn't seem to have decided whether it's a beginners' tutorial or a reference handbook for experienced users. My feeling was that it hovered rather uneasily between the two and didn't quite succeed as either.

The documentation is thorough — right down to the circuit diagrams mentioned earlier — but the explanations read awkwardly. Perhaps Sharp has taken all those comments about literal translations from the Japanese a little too much to heart: the grammar is painfully correct, to the extent of sounding stilted and antiquated in parts.

Included in the manual is a full assembler listing of the monitor program, together with a summary of the Z80A instruction set. This is not quite as useful as it might have been, since the monitor listing given differs somewhat from the monitor program included in the S-Basic interpreter.

Soak test

I left the review machine running from 10pm one evening to 11.30pm the following day, counting from zero upwards in steps of 0.00000001 (less than original, admittedly, but it kept the machine occupied.) It was still counting away quite happily when I returned, and was only slightly warm with the effort.

Prices

Sharp MZ-721	$499
Colour printer/plotter	$190
Data recorder	incl.
Joysticks (each)	approx. $25
MZ-80P5 dot-matrix printer	$910
MZ-80P6 dot-matrix printer with friction feed	$1150

Conclusions

I have three main complaints about the Sharp MZ-700.

The first concerns the graphics. A more charitable reviewer might describe the resolution as medium rather

Technical specifications

Processor	Z80A running at 3.5MHz
ROM	6k
RAM	64k (including memory used by interpreter)
Keyboard	69 keys, ASCII
Video output	PAL (TV), composite video, RGB
Screen resolution	40x25 text, 50x80 graphics, 8 fore- and 8 background colours
Clock	Built-in 24-hour clock without battery back-up
Colour plotter/printer	Four colours, 80-column, 115 ASCII characters, approx 10cps
Data recorder	Standard compact cassette, 1200 baud, Sharp PWM standard

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than low, but whichever word you use, the MZ-700 doesn't offer anything like the resolution found on most machines in this price bracket. The graphics statements are crude, even when compared to machines selling at half the price — I would certainly have expected sprites.

My second complaint concerns the keyboard. If there is a way of persuading unshifted keys to return lower-case letters, it is not mentioned in the manual — it is extremely annoying having to hold down the shift key when entering text into PRINT and DATA statements.

And thirdly, S-Basic is remarkably unremarkable. Sharp could have chosen from any one of dozens of other Basics produced for the MZ-80K, but these won't support all the features of the 700. I feel that the software doesn't do justice to the hardware.

These points made, I was generally impressed by the machine. It has a solid, dependable feel about it; I didn't feel I had to make any concessions to its mortality, unlike some machines which virtually demand that you treat them like bone china.

Given the limited graphics, you can't produce the sort of flashy programs which are possible on an Atari or '64, but Sharp machines have traditionally been used more for practical applications than for 'zap-bang' type games.

So far as the interpreter is concerned, there is a wide choice available and many of these are likely to be adapted to make full use of the 700's features. Most of the interpreters for the MZ-80K sell at a price which makes it possible to buy them either out of pure intellectual interest, or simply to experiment with a number of languages to find the one which best suits you. This choice means that the quality of the supplied Basic is nowhere near as important as it would be on a ROM interpreter machine. I'd probably throw S-Basic away and buy one of the Pascal interpreters available for the 'K'.

At present, the MZ-700 is virtually the only home micro to offer such a wide range of languages, and is worth considering for this reason alone. I enjoyed reviewing the machine and will continue to use it. Not having had the chance to experiment on any other 700s, I do recommend that you check the display using the program given above. But assuming this was just a fault in the review machine, the Sharp MZ-700 is worthy of serious consideration. END

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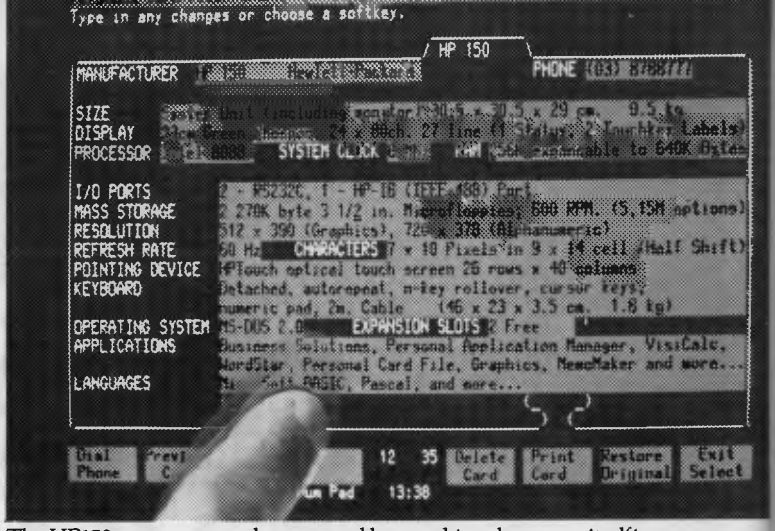

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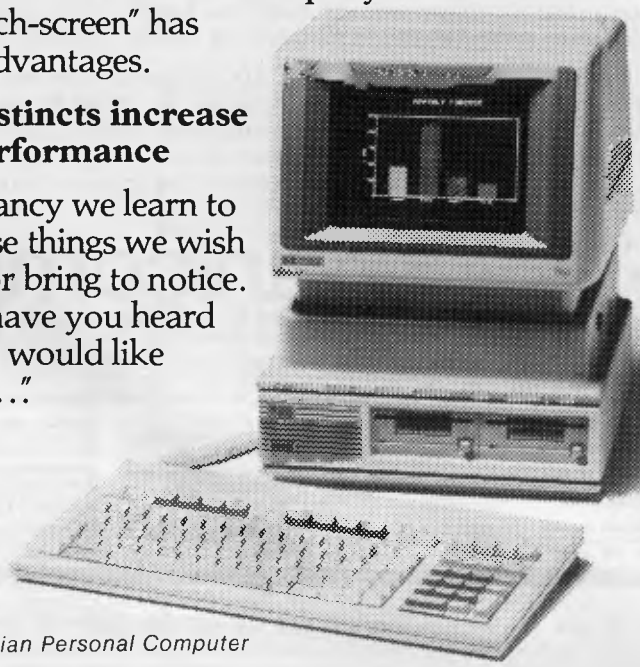

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6502 SUPERSET

Andrew Johnson has sent in a long list of unspecified 6502 op codes – far too many to print them all here, but below is a healthy sample.

Some sub-setters do not approve of our bothering with op codes that should not be used in serious software. But one of the purposes of the series is to discover all we can about the popular processors and to share these discoveries with each other. Much serious computing involves discovering what the equipment supplier fails to reveal (either by neglect or design) so ferreting out unspecified op codes can be good practice for more serious work. Let us know if any of Andrew's instructions do not work on your 6502 processor.

The first group of instructions (Fig. 1) operates on the byte in the page zero address zz, or the address as modified by the X or Y register:

In the next group (zz,X). Fig. 2 refers to the byte at the 16-bit address at zero page zz modified by the X register and (zz), Y refers to the byte at the 16-bit address as modified by Y at zero page zz.

Op Code	Effect
07 zz	ASL zz ORA zz
17 zz	ASL zz,X ORA zz,X
27 zz	ROL zz AND zz
37 zz	ROL zz,X AND zz,X
47 zz	LSR zz EOR zz
57 zz	LSR zz,X EOR zz,X
67 zz	ROR zz ADC zz
77 zz	ROR zz,X ADC zz,X
87 zz	SAX zz (store A ANDed with X)
97 zz	SAX zz,Y (store A ANDed with X)
A7 zz	LDX zz LDA zz
B7 zz	LDX zz,Y LDA zz,Y
C7 zz	DEC zz CMP zz
D7 zz	DEC zz,X CMP zz,X
E7 zz	INC zz SBC zz
F7 zz	INC zz,X SBC zz,X

Fig 1

The next group (Fig. 3) operates on either the byte at the absolute address zz zz, modified where shown by X or Y, or the number nn immediately following the op code:

Op Code	Effect	
03 zz	ASL (zz,X)	ORA (zz,X)
13 zz	ASL (zz),Y	ORA (zz),Y
23 zz	ROL (zz,X)	AND (zz,X)
33 zz	ROL (zz),Y	AND (zz),Y
43 zz	LSR (zz,X)	EOR (zz,X)
53 zz	LSR (zz),Y	EOR (zz),Y
63 zz	ROR (zz,X)	ADC (zz,X)
73 zz	ROR (zz),Y	ADC (zz),Y
A3 zz	LDA (zz),X	LDX (zz),X
B3 zz	LDA (zz),Y	LDX (zz),Y
C3 zz	DEC (zz,X)	CMP (zz,X)
D3 zz	DEC (zz),Y	CMP (zz),Y
E3 zz	INC (zz,X)	SBC (zz,X)
F3 zz	INC (zz),Y	SBC (zz),Y

Fig 2

Op Code	Effect
OF zz zz	ASL zz zz ORA zz zz
1F zz zz	ASL zz zz,X ORA zz zz,X
2F zz zz	ROL zz zz AND zz zz
3F zz zz	ROL zz zz,X AND zz zz,X
4F zz zz	LSR zz zz EOR zz zz
5F zz zz	LSR zz zz,X EOR zz zz,X
6F zz zz	ROR zz zz ADC zz zz
7F zz zz	ROR zz zz,X ADC zz zz,X
8F zz zz	SAX zz zz
9F zz zz	SAX zz zz,X
AF zz zz	LDX zz zz LDA zz zz
BF zz zz	LDX zz zz,Y LDA zz zz,Y
CF zz zz	DEC zz zz CMP zz zz
DF zz zz	DEC zz zz,X CMP zz zz,X
EF zz zz	INC zz zz SBC zz zz
FF zz zz	INC zz zz,X SBC zz zz,X
OB nn	AND #nn
1B zz zz	ASL zz zz,Y ORA z zz,Y
2B nn	AND #nn (again)
3B zz zz	ROL zz zz,Y ORA zz zz,Y
4B nn	AND #nn LSR A
5B zz zz	LSR zz zz,Y EOR zz zz,Y
6B nn	AND #nn ROR A
7B zz zz	ROR zz zz,Y ADC zz zz,Y
8B nn	TXA AND #nn
CB nn	SBX (A.X) #nn (subtract without carry nn from A ANDed with X)
DB zz zz	DEC zz zz,Y CMP zz zz,Y
EB nn	SBC #nn
FB zz zz	INC zz zz,Y SBC zz zz,Y

Fig 3 *Fig 5*

1. LDA #0		A900
(ASL zzzz,Y	ORA zzzz,Y	1Bzzzz
(ASL (zz),Y	ORA (zz),Y	13zz
(ASL (zz,X)	ORA (zz,X)	03zz
2. LDA #$FF		A9FF
(ROL zzzz,Y	AND zzzz,Y	3Bzzzz
(ROL (zz),Y	AND (zz),Y	33zz
(ROL (zz,X)	AND (zz,X)	23zz
3. LDA #0		A900
(LSR zzzz,Y	EOR zzzz,Y	5Bzzzz
(LSR (zz),Y	EOR (zz),Y	53zz
(LSR (zz,X)	EOR (zz,X)	43zz

Fig 4

The new instructions that combine a shift with a logical operation give, in effect, new addressing modes to the shift instructions. The new addressing modes are absolute indexed by Y, indirect indexed by Y and indexed by X indirect. For the flags to be set as for the shift operation, the codes used are shown in Fig. 4.

In all cases, C, N and Z flags are set correctly and the A register, as well as the memory location, holds the result of the shift operation.

Additional single byte NOP's, are given by op codes 1A, 3A, 5A, 7A, DA and FA. Two byte NOP's. with the second byte ignored, are given by 80xx, 04xx, 34xx, 44xx, 54xx, 64xx, 74xx, F4xx and 89xx. Three byte NOP's with the second and third bytes ignored, are given by OCxxxx, 1Cxxxx, 3Cxxxx, 5Cxxxx, 7Cxxxx, DCxxxx and FCxxxx.

There are also HALT instructions which cause the processor to stop executing instructions until reset or possibly interrupted. They are as follows: 02, 12 32, 42, 52, 62, 72, 82, 92, B2, C2, D2, E2, F2.

And finally, you try any of these instructions at your own risk.

Z80 OWN SPACE TRANSPOSE

John Hardman started the ball rolling in August with his Z80 routine MATRAN. This reconfigures an in-RAM matrix from row-by-row storage to column-by-column (or vice versa) but puts it in a new area of memory.

In January, Vernon Webb gave us TRANS – a 6502 routine to transpose a matrix in its own space. Apart from a few bytes of page zero memory for variable storage, no other workspace is used by TRANS during the process.

Now Brian Prescott-Decie has written with a Z80 own-space transposition routine, OSMTRN. Interestingly, at 35 bytes, it is the same length as MATRAN.

Although Brian wrote OSMTRN before seeing TRANS, the two routines are based on a similar method. This involves a great deal of memory shifting just to move one element of the matrix. The time taken to transpose a large matrix could not be inconsiderable, even in OSMTRN which uses the very powerful Z80 block transfer instruction LDIR.

Fig 5 shows the action of OSMTRN on a 3 by 4 matrix. Brackets enclose the sequence of elements about to be left rotated.

Cols	Rows	
4	3	(a1 a2 a3 a4 b1 b2 b3 b4 c1 c2 c3 c4)
4	2	a2 a3 a4 (b1 b2 b3 b4 c1 c2 c3 c4 a1)
4	1	a2 a3 a4 b2 b3 b4 (c1 c2 c3 c4 a1 b1)
3	3	(a2 a3 a4 b2 b3 b4 c2 c4 c4 a1 b1 c1)
3	2	a3 a4 (b2 b3 b4 c2 c3 c4 a1 b1 c1 a2)
3	1	a3 a4 b3 b4 (c2 c3 c4 a1 b1 c1 a2 b2)
2	3	(a3 a4 b3 b4 c3 c4 a1 b1 c1 a2 b2 c2)
2	2	a4 (b3 b4 c3 c4 a1 b1 c1 a2 b2 c2 a3)
2	1	a4 b4 (c3 c4 a1 b1 c1 a2 b2 c2 a3 b3)
1	3	(a4 b4 c4 a1 b1 c1 a2 b2 c2 a3 b3 c3)
1	2	(b4 c4 a1 b1 c1 a2 b2 c2 a3 b3 c3 a4)
1	1	(c4 a1 b1 c1 a2 b2 c2 a3 b3 c3 a4 b4)
0		a1 b1 c1 a2 b2 c2 a3 b3 c3 a4 b4 c4

Fig 5

DATASHEET

```
;= OSMTRN - Own-space matrix transposition
;/ CLASS:  2 (registers not saved)
;/ TIME CRITICAL?:  No
;/ DESCRIPTION:  Converts an in-RAM matrix from sequential row
;/               to sequential column storage in same space.
;/ ACTION:  FOR each column
;/             FOR each row
;/               Rotate left from element at (row,col) to
;/               end of matrix.
;/         NEXT row.
;/ NEXT column.
;/ SUBr DEPENDENCE:  None
;/ INTERFACES:  RAM containing matrix.
;/ INPUT:  DE = matrix start, HL = matrix end
;/         B = no. of rows, C = no. of columns
;/ OUTPUT: Transpose of matrix in source matrix space.
;/         DE, HL & B unchanged, C = 0, A = matrix last byte.
;/ REGs USED: AF B C DE HL
;/ STACK USE: 8
;/ LENGTH: 35
;/ PROCESSOR: Z80

NXTROW:  LD      A,C        ;address next byte to be moved      79
         DEC     A          ;to matrix end by adding no. of     3D
         ADD     A,E        ;columns left to do.  Minus 1 to    83
         LD      E,A        ;account for last rotation moving   5F
         LD      A,+0       ;elements down 1.                   3E 00
         ADC     A,D        ;                                   8A
         LD      D,A        ;                                   57
NXTCOL:  LD      A,(DE)     ;get byte to be moved to end.       1A
         PUSH    DE         ;save source pointer and row        D5
         PUSH    BC         ;and column counters.               C5
         AND     A          ;clear Cy and calculate no. of      A7
         SBC     HL,DE      ;bytes to be shifted down,          ED 52
         LD      B,H        ;matrix end - source point,         44
         LD      C,L        ;into BC as block move count.       4D
         LD      H,D        ;HL becomes block move source,      62
         LD      L,E        ;and DE block move destination,     6B
         INC     HL         ;move elements above (row,col)      23
         LDIR               ;down 1 byte to fill space.         ED B0
         POP     BC         ;restore counters and next          C1
         POP     DE         ;element pointer.                   D1
         DEC     HL         ;HL back to matrix end and          2B
         LD      (HL),A     ;put byte to matrix end.            77
         DJNZ    NXTROW     ;repeat for all rows this col.      10 E5
         POP     BC         ;restore counters and restore       C1
         POP     DE         ;pointer to matrix start.           D1
         DEC     C          ;repeat till all columns done       0D
         RET     Z          ;then return.  Else not done so     C8
OSMTRN:  PUSH    DE         ;start: save matrix start pointer   D5
         PUSH    BC         ;and row and column counters.       C5
         JR      NXTCOL     ;go process this column.            18 E5
```

6809 GRAND PRIX

PRX from Jeff Shepherd converts a binary value input in the 16-bit X-register into an unsigned decimal value and prints it out with leading zeros suppressed.

DATASHEET

```
;=PRX - Print the value from X.
;/ CLASS: 1
;/ TIME CRITICAL?: No
;/ DESCRIPTION:  Prints the binary value from X as an unsigned
;/               decimal number with leading zeros suppressed.
;/ ACTION:   A = $80
;/           REPEAT:
;/              PUSH A
;/              X = X/10; A = REMAINDER
;/           UNTIL X = 0
;/           REPEAT:
;/              PRINT A AS ASCII DECIMAL DIGIT
;/              PULL A
;/       UNTIL A' = $80
;/ SUBr DEPENDENCE:  'CHROUT', a subroutine to print the ASCII
;/                   character in A.
;/ INTERFACES:  Any output device used by CHROUT
;/ INPUT:  X = binary value to be output.
;/ OUTPUT: Value of X printed in decimal form.
;/ REGs USED:  X
;/ STACK USE:  8 min./13 max.  + CHROUT stack use.
;/ LENGTH:     40
;/ PROCESSOR:  6809

PRX:    PSHS   CC,A,B,X       ;save regs.                    34 17
        LDA    #$80           ;initialise to terminator.     86 80
NXTDG:  STA    ,-S            ;push digit (term. 1st time).  A7 E2
        LDB    #16            ;16 bit counter for rotate.    C6 10
        CLRA                  ;clear accumulator and Carry.  4F
ROLL:   ROLA                  ;divide X by 10 using binary   49
        ADDA   #$F6           ;long division, shifting X one 8B F6
        BCS    SUB            ;bit at a time into A and      25 02
        SUBA   #$F6           ;subtracting 10 which sets     80 F6
SUB:    EXG    D,X            ;C if sub goes, else add 10    1E 01
        ROLB                  ;back and reset C. Rotating X  59
        ROLA                  ;by means of A & B both shifts 49
        EXG    D,X            ;X bits into A and shifts      1E 01
        DECB                  ;result bits into X. Do 17     5A
        BPL    ROLL           ;times to get last result bit. 2A F0
        LEAX   ,X             ;test X and repeat if          30 84
        BNE    NXTDG          ;X is not zero.                26 E7
PRDG:   ORA    #$30           ;make into ASCII digit, call   8A 30
        JSR    CHROUT         ;CHROUT to print digit in A.   BD XX XX
        LDA    ,S+            ;pull next digit off stack and A6 E0
        BPL    PRDG           ;repeat if not terminator.     2A F7
        PULS   CC,A,B,X,PC    ;restore regs and return.      35 97
```

YANKEE DOODLES

From Stateside Sol Libes reports on software broadcasting, Microsoft's MSX-DOS and Commodore's new home micro.

Random news bits

Zilog Inc, creator of the popular Z80 microprocessor chip, has disclosed that, after nine years of consistent losses, it had a quarter with an operating profit. Hooray! Zilog is a wholly owned subsidiary of Exxon Corp . . . Microsoft has announced that it has licensed its MS-DOS operating system to nearly 100 companies. Digital Research, however, is still the leader with about 300 companies licensed . . . STM Electronics, Menol Park, CA has announced the STM-PC; a 17lb IBM-compatible with a 16 line × 84 character display (540×200 pixels), 40-column printer, built-in modem (300/1200 baud auto dial/answer), speaker phone and dual disk drives (1.6Mbytes of storage) for $3000. And, as if that were not enough, it also features a Centronics printer port, two serial ports, video output, SASI hard disk I/O, bus expansion connector and software for word processing, spreadsheet, database management, modem communications, utilities and MS-DOS 2.0. All I can say is—wow!

★ ★ ★ ★ ★ ★ ★ ★

Apple news

Apple will soon introduce a high resolution graphics printer made by C Itoh Electronics Inc, Japan. Also due is a cluster controller that will allow up to seven Lisa, Apple III or IIe computers to communicate with an IBM host mainframe as 3270 terminals.

In late January Apple Computer introduced its much vaunted 'Macintosh' computer, a much lower cost version of the Lisa. First year sales of the Lisa have been disappointing and are estimated to have been only 15,000 units. Thus, the success of the 'Mac' becomes even more critical than previously introduced products. As one industry pundit put it 'as Mac goes, so goes Apple.'

John Sculley, Apple president, has indicated that the industry shakeout is fully under way and that '84 will be a critical year. Also, the Lisa has demonstrated that leading-edge technology does not sell computers. Even Apple's cutting of the Lisa price from $9995 to $8190 has not stimulated sales. Some of the Lisa's problems were that despite its introduction in January '83 shipments to dealers did not get under way until June and even then there was a distinct lack of software support.

Apple appears to have learned from the Lisa experience. Thus, dealer shipments of the Mac are expected very soon after its introduction. (Prototype units have been in the hands of software developers for many months so that ample software support is expected soon after introduction.) It is estimated that Apple expects to sell over 200,000 units a year.

Apple has also quietly reduced the price of the Apple IIe by $150 down to $1145. Dealer cost is $895. A dealer here was advertising the Apple IIe in the local paper for $885. I can't figure out how he stays in business!

Apple Computer continues to enforce its Apple II copyrights. Together with the US Customs service it recently implemented an undercover investigation that led to the seizure of about 400 alleged Apple II copies being sold in California. Apple hired private investigators who posed as large-volume buyers in a 'sting' operation.
Previously, the Customs service had seized Apples entering the US. This is the first time machines have been seized in the domestic market. The seized machines, selling for about one third of the list price of the IIe, were copies of the Apple II, which is no longer made by Apple.

Apple says these machines were imported into the US with dummy ROM chips that did not violate Apple's copyright. The importers then replaced the ROM chips with ROMs which were duplicates of Apple's copyrighted ROMs.

Apple Computer currently has about 50 copyright infringement cases pending in 16 countries.

In another action a federal district court has upheld a prohibition by Apple of mail-order sales of Apple computers. The case was brought, in 1981, by six former Apple dealers who charged that it was illegal restraint of trade under the Sherman Act.

★ ★ ★ ★ ★ ★ ★ ★

Rumours and gossip

Olivetti Corp is rumoured to be readying an IBM-PC compatible made by Corona Data Systems . . . Japan's Kyocera Corp is rumoured to be developing an IBM-PC compatible battery operated 'lap' unit for Tandy . . . Apple is said to be working on a wireless mouse using an infra-red link . . . Apple is also rumoured to be working on a new version of the IIe based, the new, 16-bit version of the 6502 discussed in this column last month. It will be able to address 16Mbytes of RAM and have a new high resolution graphics display . . . Sony Corp is expected shortly to announce a 5Mbyte version of its 3.5in microfloppy drive. The current version stores 1Mbyte . . . Commodore will announce a new $500 home computer with built-in word processor, spreadsheet and graphics software. The unit is expected to have a built-in voice synthesiser and a Lisa-like user interface. The system is intended to compete with the Coleco Adam and IBM PC Junior. The machine is not expected to be compatible with the C-64 or VIC 20. Also rumoured coming soon from Commodore is a new improved version of the VIC 20 to be called the VIC 20-II . . . Digital Research is expected to release, near the end of the year, a new version of Concurrent CP/M-86 with full-colour windows.

★ ★ ★ ★ ★ ★ ★ ★

IBM news

Demand for the IBM PC and XT systems continues to be very high with about 60% of the PCs and 80% of the XTs being purchased by major corporations. It is estimated that about one million IBM and IBM-clone personal computers were made by the end of 1983.

The PC Junior is already in dealer's hands (Benchtested in this issue). Well, at least one per dealer for demo use. Initial shipments for sale were expected in late

YANKEE DOODLES

January with the supply being tight through June. The success of the PC Junior is still unclear as the machine is considered very expensive for a home machine . . . a single drive system with display and modem is close to $2000, substantially more than other home systems. IBM appears to be pinning its hopes for the machine on IBM PC/XT owners who want a lower-cost machine at home to back up the one in the office.

It should be noted that IBM has also introduced versions of the PC/XT which emulate an IBM 3270 intelligent terminal and a single-user IBM-370 mainframe. Demo units of the 3270/PC are already in IBM offices with delivery to customers expected soon. The unit has a colour display and windows. Thus, up to four tasks can be run concurrently on the host with a PC-DOS task run on the 3270 while each is viewed in separate windows on the display.

The 370/XT is a standard XT with the addition of three PC cards (with 68000 processors) that allow running the IBM VMS operating system and most IBM-370 software. A standard XT may be upgraded to the 370/XT by purchasing the additional boards. Demo units are not yet in the hands of IBM offices and thus delivery to customers is not expected until around mid-1984. Both the 3270/PC and 370/XT are in the same price range as the Apple Lisa and are thus considered to be direct competition.

It should be noted that IBM, through its scientific instruments division, is currently selling a 68000-based machine with the Microsoft Xenix operating system. Xenix is a version of the popular Unix operating system.

IBM appears to be meeting its competition on all fronts.

★ ★ ★ ★ ★ ★ ★ ★

Microsoft's MSX-DOS

The Microsoft MSX operating system for home computers has received a less than enthusiastic response by US home computer makers and Japanese companies planning to ship units to the US. This is due to the fact that MSX relies on ROM cartridge software rather than disk-based software. And Digital Research has introduced the 'Personal CP/M' operating system for low-cost home computers.

But never fear Microsoft is not one to give up a market to DR and has just announced a disk-based home computer DOS to be called MSX-DOS. Like MSX it will run on a Z80-based, 8-bit computer. Microsoft promises that it will run standard CP/M-80 software. Thus the users will be able to run Microsoft's Multiplan, Cobol-80, Fortran-80 and MBasic. The DOS is claimed to take up only 8k of memory.

★ ★ ★ ★ ★ ★ ★ ★

CP/M-86 version 3.1

Digital Research has announced that it expects to start shipping an enhanced version of CP/M-86. The new version, designated version 3.1, will add window-like structures to terminal screens. Furthermore, it will have the capability of running MS-DOS and IBM-PC-DOS based software. The question now is: will Microsoft add the capability to run CP/M-86 software to MS-DOS and

YANKEE DOODLES

PC-DOS? The Microsoft MSX-DOS operating system for low-cost, Z80-based home computers can run CP/M-80 software.

★ ★ ★ ★ ★ ★ ★ ★

Software broadcast

Atari and Activision have formed a joint venture to broadcast video game and home computer software via radio. The user would plug an adaptor/receiver into his/her video game console or computer to receive the software with pay-as-you-play charges. Atari is planning a test involving its 2600 video game units.

Control Video Corp, Vienna, VA, is currently transmitting video game and home computer software via telephone and modems. Coleco and AT&T have also announced a telephone-based distribution project. And Romox Inc is currently offering a system to transmit software via phone to retailers for installation into cartridges.

Furthermore, Playcable, a TV cable distribution company, has been furnishing games software for Mattel Intellivision games for three years. However, Mattel is expected to halt its participation shortly.

★ ★ ★ ★ ★ ★ ★ ★

Osborne to reorganise

Osborne Computer Corp has filed a bankruptcy reorganisation plan which is expected to put the company back in business. The company still owes more than $41 million. The company will get a new president with current president, Robert Jaunich, and chairman of the board, Adam Osborne, being relegated to directors. Creditors will be paid in stock and additional financing is being provided by three banks. The company will contract out production and R&D. It intends to concentrate on bringing out the products now in development and enhancements for the after-sale market and specific market niches.

★ ★ ★ ★ ★ ★ ★ ★

Osborne's venture

Adam Osborne has launched a new venture called Software Seed Capital Corp ('SSCC') which will fund start-up software companies and market their products. Adam promises that SSCC, of which he is chairman and chief executive, will invest $10 to $15 million in these start-ups and hopes to have 50 to 60 programs on the market in about 12 months. SSCC will do the manufacturing, marketing and distribution leaving the developers free to concentrate on software development.

Osborne is still chairman of the board of Osborne Computer which is still operating under Chapter 11 of the bankruptcy law (see below) and claims that his day-to-day involvement in OC ended last February and 'after that I really wasn't certain of what was going on.' Furthermore, he has stated that 'with the damage done from March to September there's really nothing left of the company I created.' And that 'there's not much point in me going in to pick up the pieces.' He described the OC situation as 'a tragedy' that was 'totally unnecessary' and that OC 'went down the tubes when I

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commodore 64

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YANKEE DOODLES

brought someone else in to run it.' Here he was referring to Robert Jaunich, former president of Consolidated Foods, whom he hired to be president of OC.

★ ★ ★ ★ ★ ★ ★ ★

Software report

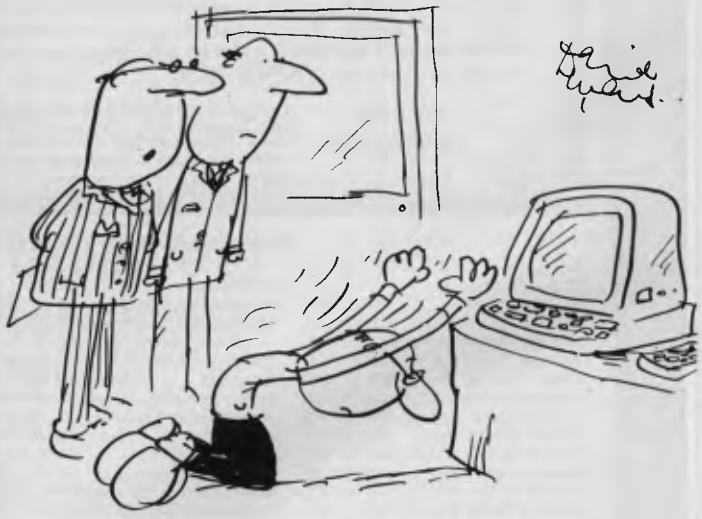
According to a report released by Future Computing ('FC'), a Richardson TX marketing research organisation, Microsoft was the largest independent personal computer software publisher last year, with revenues of about $70 million. FC estimates that IBM and Radio Shack each sold about $110 million worth of software and that Apple sold close to $70 million. Second on the list of independents was Visicorp which sold about $55 million worth of VisiCalc. Here is how FC projects the ten leading software publishers for the last year:

IBM	$110m
Radio Shack	$110m
Apple Computer	$68m
Microsoft	$68m
Visicorp	$54m
MicroPro	$52m
Digital Research	$46m
Lotus Development	$40m
Ashton-Tate	$35m
Peachtree	$22m

The following are the most popular programs, listed by category, with the FC estimated monthly shipments. The list excludes software bundled with computers.

Spreadsheets	
Lotus 1-2-3	24,000
VisiCalc	21,000
Multiplan	17,000
SuperCalc	7,000
Word Processors	
WordStar	17,000
Apple Writer	15,000
Easy Writer	6,000
Database Managers	
PFS: File	10,000
dBase II	8,000
PFS: Report	7,000
Accounting	
Home Accountant	13,000
BPI General Accounting	7,000
Peachtree General Ledger	4,000

END



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EDUCATIONAL GAMES

By Kevin Murphy

Meteor Multiplication

Captain's log, Star date 4044. Galaxy of Orion. "See that Scotty? A meteor is approaching on heading one zero three. Estimated impact — ten seconds. Mr Spock! Mr Spock! If you don't calculate 7 x 9 and shoot soon, we're done for! Think man, think! It's up to you, Spear Ears."

This is the scene of the educational game from DLM, Meteor Multiplication. Meteors come from all directions, displaying simple multiplications. By using the keyboard, the player must aim his spaceship at the closest meteor, work out the answer, type it in, then shoot and move on to the next closest meteor until the screen is empty. The objective is to knock out as many meteors as possible in the time provided. At the end of the given time, a score sheet appears. It shows the player's current score in numbers of hits and misses. It also shows the highest and lowest score so far.

It sounds simple, but it really is excellent. It makes education fun and exciting. I found myself tensing up, really concentrating on beating the previous high score. During one rest, I thought "Wait a minute — this is meant to be educational and boring." Educational, yes, but Meteor Multiplication is anything but boring.

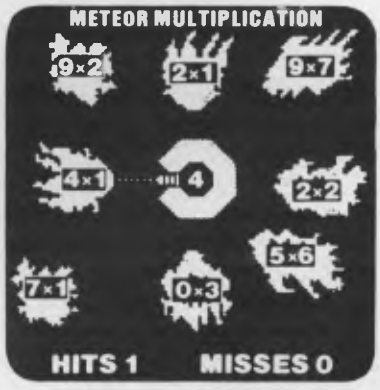
Meteor Multiplication is a must for all primary school children, as the speed is adjustable, teachers would find it useful for the slowest students to advanced students. A chart is provided, so progress can easily be shown.

The other five titles in the set are: Alien Addition, Minus Mission, Demolition Division, Alligator Mix, and Dragon Mix. At around $39.95 for Commodore 64 and Atari, and $49.95 for IBM and Apple, the whole set is excellent value for money. I never knew education could be so much fun.

Use of graphics:	★★★★
Addictive quality:	★★★★★
Use of colour:	★★★
Use of sound:	★★★
Value for money:	★★★★★

Spelling Whiz

Spelling Whiz is a program designed to assist students in correctly spelling commonly misspelt words. A "Wizard" appears at the side of the screen and uses his wand to zap missing letters into



Scenes from a variety of educational games.

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Volume 3, Number 1, 1984

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HARDWARE REVIEWS

ING NEWSAGENCIES NOW

a word that appears at the top of the screen. Four sets of letters appear opposite the Wizard. The player must select the correct letters to spell the word, aim the Wizard's wand at the letters, and fire. If the player is too slow, then bubbles from the words reach the magic wand knocking it from the Wizard's hand. If it happens, the game resets. If this happens three times during play, the game is immediately over and a score appears.

Just after turning the system on, the player can choose the menu option and adjust the speed, content option (0 is for common and 6 is for difficult words), word list, difficulty, and length of game to cater for all ages and abilities. It is the type of game that could be used all year round for all classes of a primary school. There are several different word lists, and, if the speed is set at fast, even the best speller would be making excuses.

A comprehensive manual is provided with the software. This includes worksheets and student progress charts. It is an excellent teacher aid.

The game is educationally very good, and is entertaining and fun to play.

Use of graphics:	★★★
Addiction quality:	★★★
Use of colour:	★★★★
Use of sound:	★★★
Value for money:	★★★

Other software titles from DLM include Verb Viper, Word Man, Word Invasion, Word Radar and Word Master. All the programs are well presented, come with a colourful booklet, and at between $40.00 and $56.00 represent good value for money, both for home use and in the classroom.

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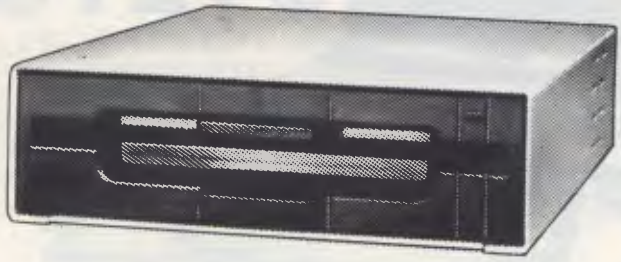

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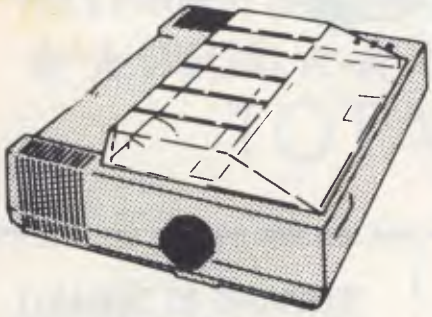

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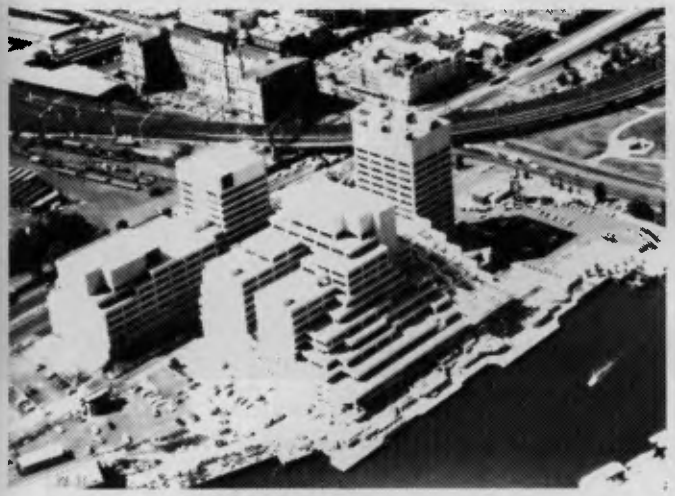

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Volume 1 No 4, 1980
Benchtests: Hewlett Packard's HP85, Texas Instruments TI 99/4/Gateways to Logic Part 1: Teaching others about micros/Face to Face, Part 1: Life at the man-machine interface/Adding a different family of chip to your micro/Random numbers — and how to generate them/Computer Games, Part 4: David Le on speeding up tree searching/Book review: Alvin Toffler's "The Third Wave"/The Complete Pascal, Part 4: Data types, arrays and sets/Programs: 3D Noughts and Crosses (TRS-80), PET Back-gammon.

Volume1 No 6, 1980
Benchtests: Commodore 8032, SuperBrain/Overview of chess machines and micro programs/Writing machine independent Basic programs/Printer review/Programs: Lunar Lander (TRS-80), PET Fighter Pilot, Apple Plotting, LPrint to Print utility (TRS-80), ZX80 Breakout, Graph (TRS-80).

Volume 1 No 7, 1980
Checkout:Super 80 hi-res board/Robotics discussed/Three micro tournaments reviewed/Computer Games: "Guessing the odds" in game programming/APC-80: First ever instalment/The Complete Pascal, Part 6: Records and Files/Speeding up TRS-80 pocket computer programs/Free format dialogues at the man-machine interface/Programs: TRS-80 Tarot, PET Bloobers, PEEK and POKE for Apple Pascal, PET Demolition, Superboard Bug Bypass, String Function (Microsoft Basic), Several Sorts (Microsoft Basic).

Volume 1 No 8, 1981
Benchtest: Atari 400 and 800/Benchmark timings for machines tested up to this issue/Developing a business program, Part 1/The Complete Pascal, Part 7: Procedures and Functions/Gateways to Logic, Part 3: How Computers Think/APC-80: single keyword entry/A look at a US company specialising in helping the handicapped/Formatted dialogues at the man-machine interface/Programs: Reading 'System' tapes into the System 80, Monster Multiplier (Apple II), Read-write routines without error (PET), Program formatter (for programs stored in ASCII).

Volume 1 No 9, 1981
Checkout: "The Last One" program generator/Multi-User Systems, Part 1: Introduction/Computer Games: Bluffing and psychology/Disks and disk drives explained/Recovering from a data tape disaster/Developing a business program,. Part 1/APC-80: String execution and block moves/Introduction to machine language/Gateways to Logic, Part 4: Binary arithmetic/Ultrafast tape storage for the Superboard/The Complete Pascal, Part 8: "Top-down" design of large scale text formatting programs/Review of the Forth language/Programs: TRS-80 Target Practice, TRS-80 Four in a Row, PET Anagram, PET Obstacle Course, Minefield (TRS-80).

Volume 1 No 12, 1981
Benchtest: Bigboard/Multi-user Benchtest: MVT Famos & WP Benchtest: Magic Wand/How printers work/Mainframe chess programs/Gateways to Logic, Part 5.2: Electronic Logic/TRS-80 Tiny Basic Compiler/What's Where in OSI ROM/Profile: Nigel Shepherd of Commodore/Building Parliament House with a micro/Solar System simulation/"Quarter-box" graphics on a PET/Single Key Keyword entry for the Superboard II, Part 2 (end)/Programs: PERT Replace, TRS-80 Demon Hunts, PET Chords, ZX80 Sliding Letters.

Volume 2 No 2, 1981
HP-85 Reviewed/EDP at the Spastic Centre of NSW/TRS-80 Tiny Compiler on larger memory machines/APC-80: Bill Anderson of ADE/Facing the Future by Barry Jones/User-defined formatting on the Apple/Improving the Superboard II/PET utility for replicating cassette files/Relocating OSI Basic-in-ROM/Programs: Bigboard Real Time Clock, APC-80 Alien Invasion, PET Radio Technician Course.

(Stocks in limited supply.)

Volume 2 No 3, 1981
Checkout: Sinclair ZX81/APC-80: Recovering lost programs, JUMP command (allows a GOTO "numeric expression")/Building a Bigboard/Keystroke reduction for EDTASM users/Sanders Printer reviewed/Profile of BS Microcomp/CP/M explained by Rodnay Zaks/The rapid bubble sort for the Apple/Encryption for any Microsoft Basic/An imagined 6502 "Dream Machine" specs/Vectors explained on the Challenger IP/Programs: TRS-80 flashing cursor and non-destructive backspace, Treasure Hunt (PET).

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Volume 2 No 4, 1981
Benchtest: VIC-20, Tandy TRS-80 III/TRS-80 Monitor software compared/Computer Games: Backgammon on micros/Tree access routines explained/Gateways to Logic, Part 8: Peripherals/How Computers Communicate, Part 1: What is I/O?/Profile Gary Blom of the Computer Company/Part 1 of 2: Defining program specification needs/6502 Assembler in Basic/Wordpower wordprocessor program for the PET/Programs: PET Arithmetic Test, Apple Mondrian.

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Volume 2 No 5, 1981
Benchtest: IBM Personal Computer, NEC PC8000/WP Benchtest: Spellbinder/Gate array design and firmware modules: an upcoming generation of chips/Winchester hard disks explained by Rodnay Zaks/Computer Games: Poker on micros/Gateways to Logic, Part 9 (end): Typical teaching projects/Artificial Intelligence/How Computers Communicate, Part 2: The I/O Bus/Storing alphanumeric records under CP/M/ Part 2 of 2: Defining program specification needs/Apple "booby trap" documented/Make PET disassembled pro-grams more readable/Explaining the WAIT function for OSI and PET machines/Putting a bell tone onto the Superboard/Programs: TRS-80 Sailing Simulation, ZX80 Eldorado, PET Gomoku.

Volume 3 No1, 1982
Benchtest: Tandy TRS-80 Color/Checkouts: Hitachi Peach, Sharp's Microtranslator, BBC Proton/Profile of Rodnay Zaks/Sorting alphanumeric codes from disk to disk/Computer games:GO-MOKU on micros/Generating Patterns with a computer, Part 3: The parallel interface/Review of Forth Language/A neat way to describe programs quickly and logically/Speech Synthesis for the TRS-80s, System 80s, Part 1/Cassette utility for System 80 on Eprom/An easy route to shape tables for the Apple/Rubik Cube Simulation for the Apple/How to implement "Turtle" graphics on an Apple/Programs: Get Simulation (Apple), Bug Bug (TRS-80), Cryptography (Microsoft Basic).

Volume 3 No 2, 1982
Checkout: Apple III/Fitting a smooth curve to complex data plots/Speech synthesis for TRS-80s, System 80s, Part 2/"Bridge" on micros/Relocating assembly language programs/Binary sort explained/Programmable rhythm generator project for PET/Large number calculations on micros/Basic interpreters explained/Checkout: ZX81 printer/APC-80 overview and debounce routine/Storing arrays on tape/Frames of Reference, Part 1: A DP manager's guide to micros/How Computers Communicate, Part 4: The IEEE interface/Overview of micro-computer databases/Programs: TRS-80 Alien Seabattle.

Volume 3 No 3, 1982
Benchtest: Hewlett Packard HP-125/WP Benchtest: Scripsit 2.0/Checkout: Dick Smith Votrax Type 'N Talk, The Australian Beginning/Videotext overview/Frames of Reference, Part 2: Hardware and Software Suppliers/Profile: Jim Warren of the West Coast Computer Faire/How Computers Communicate Part 5: The BCD Interface/Installing hires on the TRS-80/Bridge playing program reviewed/Programs: Galacti-Cube (3D Maze in fairly "standard" Basic), PET Fantasy, ZX80 Labyrinth, PET Juggle.

Volume 3 No 4, 1982
Benchtests: Osborne 01, Micro Bee/APC-80: Command mode syntax error recovery/How Computers Communicate Part 6: The RS232 interface/80 x 24 display controller project/Preview of the Commodore 64/Atari 400 games reviewed/Profile: Adam Osborne/ANS Basic's features/Solving the hidden surface problem in 3D graphics/Frames of Reference, Part 3: Micros in mainframe company/Hewlett Packard's networking capability/Programs: TRS-80 Reaction Timing, ZX81 Graphplot, PET Cheese, Superboard Spin-Fighter, TRS-80 Extra.

Volume 3 No 5, 1982
Benchtests: Texas Instruments TI 99/4A, Xerox 820/Database Benchtest: FMS-80/TRS-80 Model I games reviewed/Frames of Reference, Part 4: Software standards/How Computers Communicate, Part 7: Interrupts in micro systems/How to use 3D graphics/Equation solving program/80 x 24 display controller project, Part 2/"Logo" Overview/Printer survey/Casio's calculator printer/Programs: TRS-80 Double Precision Maths and Trig, Apple 3D Maze,Atari Sums for Kids, Apple Air Flight.

Volume 3 No 6, 1982
Benchtests: Sinclair ZX Spectrum, Sirius I/Database Benchtest: dBase II/7th West Coast (micro-computer Faire)/Checkout: F-10 Daisywheel printer, Arfon Expandaboard/How Computers Communicate, Part 8: Direct memory access/Frames of Reference, Part 5: Buying micro hardware in a DP department/Self learning program/80 x 24 display controller project, Part 3 (end)/How to get more on Apple disks/Lisp — an artificial intelligence language/VIC-20 games reviewed/Implementing CP/M system calls from Microsoft Basic/APC Subset (first on new monthly column for assembler language routines)/Programs: TRS-80 Invader, PET Mini-animate, VIC-20 Trailblazer, ZX81 Book Index, Weebug Monitor (TRS-80), VIC-20 Large Characters.

Volume 3 No 7, 1982
Benchtests: Sharp MZ80B, Monroe OC 8820/Checkout: Sharp PC1500, The Micro-Professor/Apple II games reviewed/APC-80: Various PEEKs and POKEs explained/Reversing images on computer screens/Frames of Reference, Part 6: Putting your micro to work/How Computers Communicate, Part 9: Character codes/Educational arcade-type game/Programs: ZX81 Hypocycloids, TRS-80 Truth, PET Doc, TRS-80 Screen Dump, PET Boxes, Atari Earth.

Volume 3 No 8, 1982.
Benchtest: Sord M23/Checkout: TI-83, Sony SMC-70/NCC Show Report/Sirius Graphics/Advanced graphics techniques/UCSD p-System overview, Part 1/IBM PC users talk/Taxonomic classification on an Apple/How Computers Communicate, Part

10: The software of I/O/Abbreviated execution version of APC-80/RS232 overview, Part 1/Checkout: Apple II Screenwriter/Programs: TRS-80 Quadrangle, PET Mopup, Randomization Tests (ZX81).

Volume 3, No 9, 1982
Benchtest: ICL Personal Computer/Checkout: E40(CP/M data compression utility) Daisywriter printer, HP 11C & 120 calculators/BBC micro graphics capability/Best of APC's cartoons/How to use Benchmarks/Logo Program (Microsoft Basic) Computer generated textures/RS232 overview, Part 2/Memory-saving utility for Apple/How Computers Communicate, Part 11: Interrupts and buffers/Programs: Sytem 80 Extended Basic, Apple Trees, ZX81 Alphabetising, PET File Companion, PET German Game.

Volume 3 No 10, 1982
Benchtests: Hewlett Packard HP-86, National Panasonic JB3000/Checkout: Sharp PC-1211/UCSD p-System overview, Part 3 (end)/How to implement 3D graphics on a micro/CP/M-86 vs MS-DOS: Relative merits of these 16-bit operating systems discussed/Designing your own database/Monitor for TRS-80/System 80/File searching method/"Laws of Form" — a novel form of logic/How Computers Communicate, Part 12 (end)/Benchmarking high level languages/Programs: TRS-80 Cardshuffler, PET Knockout, PET Trains.

Volume 3 No 11, 1982
Benchtests: Hewlett Packard HP75C, Kaypro II, DEC Rainbow/Programs for the HP41C and Casio fx702p/Algebra checking program/More on MS-DOS vs CP/M-86/Predictions in the micro industry/Clock/calendar card for the Apple II, Part 1/Benchmarks summary/Programs: Apple II Piano Computer, Moon Module (Apple II, correction in Vol 4 No 1), Walls (Atari, correction in Vol 3 No 12).

Volume 3 No 12, 1982
Benchtests: Epson HX-20/Database Benchtest: Cardbox/Checkout: E.T. Atari game, 80 column cards/Comparison of micro databases/Intelligence test for computers/Apple II clock card, Part 2 (end)/"Ada" language overview/Tiny printing on a Centronics 739/Arithmetic program for the Sharp PC1211/Programs: TI 99/4A Teepee Textpro, PET Firebird, Atari Colour Selector.

Volume 4 No 2, 1983
Benchtests: Sharp PC1251/Database Benchtest: Hi Data/Micros as best friends/A major boost to the standards of 'user friendliness'/Computing can be a health hazard/'Expert Systems' — part two: appraisal of 'intelligent' computers/Networks: Part 1/The Logo Turtle checked-out/Getting the most from the BBC's graphics/Are home computers just a passing fad?/The Prestige vs The human: micro chess/Programs: Apple Character Plotter, System Tape Copier (TRS-80/System 80).

Volume 4 No 3, 1983
Benchtest: Corvus Concept, IBM 9000/Checkout: IBM PC vs Columbia MPC, IBM vs Hitachi Success/Visi-On and Apple's Lisa compared/Visi-On: Visicorp's new general purpose program/CP/M '83: The first software product exhibition/Transforming unused RAM into pseudo disk drives/Pascal Benchmarks/Eprom/RAM board for the TRS-80/System 80/Direct graphics entry for the TRS-80/System 80/Networks: Part 2/The Consumer Electronics Show review in Las Vegas/Portable Computer World: Hexadecimal madness/Programs: Atari Animation.

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Volume 4 No 4, 1983
Benchtest: Dick Smith VZ-200/ Spread Sheet evaluations: Part 1/ Checkout: 1st APC Show/A look at 'C'/Networks: Part 3/Building your family tree on a micro/Low-cost System 80 memory expansion/Micro users get the upper hand/Pascal Benchmarks explained/How dentists can use micros/Programs: PET Billy (correction in Vol 4 No 6 Bludners), ZX81 Molecular Weight, Adventure in 1k, TRS-80 Word Scrambler.

Volume 4 No. 5, 1983
Benchtests: NEC Advanced Personal Computer, Commodore 64/Which Spreadsheet: Microsoft's Multiplan/Casio PB100 hand-held micro reviewed/ Screen-play: VIC-20 games under the spotlight/A visit to the Hanover computer faire/Check-out: Microsoft MS-DOS2/ Reliable Code: Programming tips/An introduction to the artificial intelligence program, LISP/Linking up a System 80 to a Tandy Lineprinter/Programs: Bricklayer (CBM 4032), Escape Maze (Atari 400/800).

Volume 4 No. 6, 1983
Benchtest: Texas Instruments' Professional/Checkouts: Comx 35 home computer, NEC's Spinwriter daisywheel printer/ Multi-Tool Word wordprocessor from Microsoft/Occam Occult: futuristic new language/The world of creative cross-figures/ MicroBee games reviewed/Are micros a good idea?/Programs: Construction Worker (System 80, TRS-80), Chicken Little (Micro-Bee), PET Zombies, Spectrum Blaster, Commodore 64 Sprite editor.

Volume 4 No. 8, 1983
Benchtests: Apple Lisa, DOT/ Checkouts: Osborne Executive, Epson FX-80 printer/Consumer Electronics Show Report/Will the Computer be the next dominant species on Earth/Milton Bradley's chess computer that moves its own pieces/Choosing suitable disks for your computer/ Cryptography on a micro/ Warnier Orr structured programming, Part I/How to use the six function keys on the PC1500/ Programs: ZX81 Least Squares, System 80 Loading tapes from an external cassette player, TRS-80/ System 80 Adventure program, Apple II Pascal menu generation.

Volume 4 No. 9, 1983
Benchtests: Sord M5/Checkout: Tandy Model 100, Lisawrite/ Screenplay: TI 99/4A games/ Steve Wozniak returns to Apple/ Choosing a home micro/Warnier Orr programming, Part 2/Graph plotting and curve fitting on the BBC Computer/Bemoaning the mechanical teller/Programs: VIC-20 Snake line, ZX81 Surround, Apple II Screenplay, PET Histogram.

Volume 4 No. 10, 1983
Benchtests: Archives PC/Home Computer Survey — 15 micros selling for less than $1000 checked out by Steve Withers in an exhaustive market survey/ Checkout: Simons Basic, T/Maker III — office tool for the IBM PC, Digital Research Personal Basic/Computerising Your Business — a light and practical guide/Beginners Guide to Basic Program Conversion/ Clever trick with TI Sprites/ Cocktail program/Warnier Orr programming, Part III/How portable is portable/Programs: Atari No-Trons, TRS-80/System 80 Multi-Maths, Apple Text Maker, VIC 20 Spider, Commodore 64 Sprite Clock.

Volume 4 No. 11, 1983
Benchtest: Apricot/Checkouts: Atari 600XL, Ashton Tate's Financial Planner, Condor database, Atari Writer/ Which Spreadsheet? PerfectCalc/ Profiles: Clive Sinclair, Nolan Bushnell/Set up your own computer learning centre/Basic Converter Chart/Warnier Orr Programming Part 4: Techniques (end)/Programs: PET Wave Simulation, Apple II Aplist, Microsoft Basic Calendars, TI99/4A Breakout, Commodore Testing Your Fingers, Apple Dotter Puzzle, VIC-20 Starship, Commodore Maths Test.

Volume 4 No. 12, 1983
Benchtest: TANDY MC-10/ Checkout: Executive 816, Lotus 1-2-3, VisiOn, Gemini 15X Printer/Computerising Your Business: Part 2, Setting up/Sort Trees for beginners/Printing hig on an Epson printer/Bulletin boards/Programs: VIC-20 Robotank, VZ-200 Missile Command, New 'Bee Screen, MicroBee Grooble Grab, Apple French Test Card, TRS-80 Road Rally

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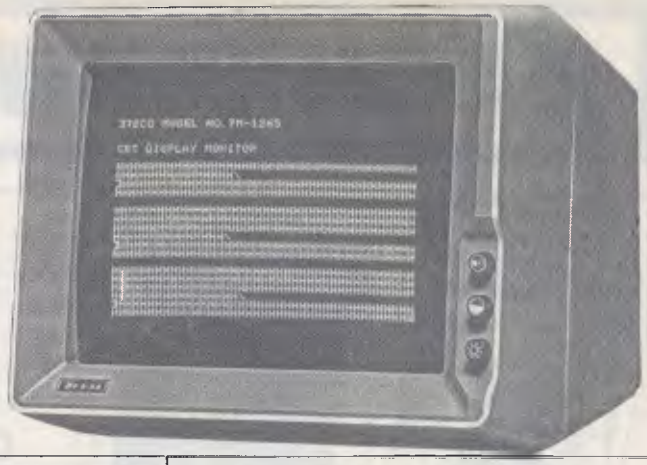

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NUMBERS COUNT

Kaprekar Numbers

New readers start here. The topics dealt with in this column attempt to reach the frontiers of knowledge in number theory with the minimal background information. The problems posed therefore have no complete solution known to the author, and readers are encouraged to submit their attempts at solution, however incomplete they may seem.

(1) The legendary number theorist, D R Kaprekar, of the Indian Institute of Science at Bangalore, is perhaps most famous for publicising the number 6174, which is the eventual result *(with certain exceptions)* of the subtraction of a four digit integer whose digits are arranged in ascending order from the same integer whose digits are arranged in descending order.

For example, given the four digit integer 8923 we proceed thus:

9832 − 2389 = 7443,
9963 − 3699 = 6264,
7641 − 1467 = 6174,
7443 − 3447 = 3996,
6642 − 2466 = 4176, the process repeats at this stage.

Question A. What are the certain exceptions referred to above?

Question B. What happens to integers with other than four digits?

(2) Kaprekar Numbers, however, are defined to be those n-digit integers, K, which are equal to the sum of the integer defined by the least significant (right-most) n-digits of their square plus the integer defined by the remaining digits.

Thus 142857 is a Kaprekar Number because here n = 6 and

(i) $(142857)^2 = 20408122449$

(ii) 122449 + 20408 = 142857

Question C. What are the Kaprekar Numbers less than 10^n for a given n?

Interest Note. The square of any cyclic permutation of a K-Number is also a cyclic permutation when the digits are added as required.

For example, $(428571)^2 = 183673102041$ and 102041 + 183673 = 285714.

Readers are invited to submit a program, or suite of programs, to answer the above questions. All submissions should include program listings, hardware descriptions, run times and output; they will be judged for accuracy, originality and efficiency (not necessarily in that order).

A prize of $20 will be awarded to the

NUMBERS COUNT

'best' entry received. Please address all entries, to arrive by 15 April, to Mr M R Mudge, C/- *APC*, 77 Glenhuntly Road, Elwood, Victoria 3184.

Review — October 83

The Partitions of a Positive Integer generated a very heavy, and varied response; the extremes being typified by an estimate of 15 years to find p(100) using a TI59 programmable calculator to an offer to calculate p(535) programming in Algol 68 — on an unspecified mainframe, one suspects.

A reference work in this field is provided by GE Andrews, *The Theory of Partitions, Encyclopedia of Mathematics and its Applications*, Volume 2, Addison-Wesley 1976. However, the presentation in Chapter XIX of the fifth edition of *An Introduction to the Theory of Numbers, by* GH Hardy and EM Wright, Oxford University Press 1979 is adequate to yield the recurrence relationship for p(n) without which realistic computing is virtually impossible.

$p(n) - p(n-1) - p(n-2) + p(n-5) + \ldots + (-1)^k\ p(n-\tfrac{1}{2}k(3k-1)) + (-1)^k\ p(n-\tfrac{1}{2}k(3k+1)) \ldots = 0$

To estimate the magnitude of the computation one may use the asymptotic formula of Hardy and Ramanujan 1917,

$$p(n) \sim \frac{1}{4n\sqrt{3}} \exp\left(\pi\sqrt{\frac{2n}{3}}\right)$$

The computational difficulties are referred to in *Computers in Number Theory* edited by AOL Atkin and BJ Birch, Academic Press 1971.

The prizewinning entry is from R B Shepherd using Pro-Pascal on a Sharp MZ80-B computer (64k bytes). This submission factorised up to p(300) in 44 hours 20 mins. It must be observed that the presentation of results by R B Shepherd, and indeed by numerous other contributors, was of the highest possible standard. Congratulations all round, and keep the entries flowing.

Note. Submissions will only be returned if a suitable stamped addressed envelope is provided.

END

Get it in one

Would you like to be able to pinpoint exactly where your program is on tape? Every time? Well, now you can. Clive Hood's idea is simplicity itself and you can put it into effect right away.

If you read the manual supplied with your micro, you'll quite possibly come across a line like 'Each time a cassette is used it must be fully rewound and the counter reset to zero . . . ' or else '. . . leave a large blank space between programs'.

It was when I was frustrated at this vagueness and time-wasting that I happened upon a radio programme. It was intended for the visually handicapped and mentioned that 'talking book' cassettes have page numbers on their flip sides. If you think about it, a book without page numbers is inconceivable, and that applies to talking books as well.

The result is that the working side of the tape runs one way and the index side flows in the opposite direction and so has to be numbered backwards.

Any length of cassette may be used, but for our purposes it is best to keep to this advice: go for good quality short tapes, the C12 size will hold a lot of information.

The spoken index takes up the whole of one side of the tape — which may at first appear a waste. But — as you will discover — the advantages of indexing far exceed one's expectations. In particular, there is no longer any need for length rewinds; one moves from wherever the tape was last used. Provided a simple routine is adhered to there is never the slightest doubt exactly where to record the next SAVE.

Preparing the index

Using the cassette player's built-in condenser microphone or, if you have one, a hand-held mike, dictate a descending series of numbers along one side of the tape. There are two ways you can do this without fluffing it. Using my Casio HL-807 pocket calculator, take advantage of its 'K' constant feature, I key 1 - - 360, whereupon each time I press 'equals' the display steps down one like this: 359 . . . 358 . . . 357 . . .

Another way is to use the micro itself (isn't that what you bought it for?). On a micro with a built-in real time clock, an index prompting routine (see Fig 1) will tell you not only which number to dictate, but when to dictate it. *(Editor's note: micros without clocks could use an interrupt-driven routine).* Notice that for our purpose the timing of the indexing is immaterial: aim for a new number every two seconds. The purists among you might object if the index dosen't count down to exactly nought, though this dosen't matter. However, for your benefit, first check how long it takes the tape to run from end to end.

An actual example is as follows: the tape ran for 7¾ minutes. Multiply by 60 gives 465 seconds. Divide by (= seconds per number) 1½ which gives 310 as the first number, so edit line 40 of the INDEX program to read:
40 FOR E=310 to 0 STEP-1.

What matters is, whether you count down to zero or not, that every one of the index numbers has an exactly corresponding spot on the working side of the tape.

It is worth doing this job clearly and well, because it only needs to be done once: all your other cassettes may be indexed for copying from the master index. This requires a second cassette player which you should be able to beg or borrow (I don't hold with stealing!). The two are linked by a cable with a plug at each end (use your computer's own cassette cable) taking the output from the transmitting machine's Monitor socket to the Record socket. To preserve good sound quality be sure to set the transmitting machine's output to a low

leve Care here will ensure that all your cassettes have equally good indices.

In use

To use the cassette, give the three plugs at the cassette player end the following treatment:

RECORD. (Stays put).

REMOTE. (This is the switching circuit that starts and stops the motor. Normally this plug should be partly withdrawn to allow the cassette to operate in playback mode. In fact, I have soldered a push-button switch (push for on) into the flex between the computer and the cassette player to give instant control).

MONITOR. (Partly withdraw this plug in order to read the index. Once again I have in fact shunted the jack circuit's terminals with a variable 'pot' resistance so as to leak a few milliamps to the speaker, so my plug stays put).

Keep a notebook in which one page is devoted to each cassette, or else write (neatly) on the cassette sleeve. To LOAD an indexed program, look up its index and position the tape two numbers below that. Invert the cassette, and there will then only be three or four seconds to wait before the VDU signals that it has found the program.

To SAVE, position the tape two numbers higher than the number following the end of the last run program. Turn the tape over and away you go (don't forget to make a note of the number).

I continue to experience what a great help this system is. Recently, I was expecting two knowledgeable friends to visit me so I could demonstrate three of my programs which were among other programs on three separate cassettes. Before my visitors arrived I was able, with very little effort, to pre-position each tape so that each load started within seconds of issuing the command. Apart from the great saving of time and the near impossibility of making a mistake, there is the satisfaction of a system that *looks* as efficient in practice as it sounds.

```
10  REM    INDEX PROMPT
20  REM    Edit line to whatever
           range
30  REM    of numbers. Edit
           line 50
35  REM    for a 1.5 second
           delay per number
40  FOR    E=12 TO 0 STEP -1
50  FOR    D=1 TO 10000
60  NEXT   D
70  CLS
80  PRINT  TAB(12);E
90  NEXT   E
100 END
```

Fig 1 Index prompting program

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making travel arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.

Hanover	Hanover Fair. Contact: (02) 29 3998	April 11-14, 1984
Sydney	Data '84 Contact: Graphic Directions (02) 212 4199	May 22-24, 1984
Perth	International Microcomputer Conference and Exhibition Contact: (09) 325 4427	May 22-24, 1984
Perth	Microcomputer Exhibition Contact: Jenna Ledgerwood (09) 325 0111	May 22-25, 1984
Hong Kong	Percom '84 Contact: Adsale Exhibition Services Tel: (Hong Kong) 5-892 0511	June 19-22, 1984

NETWORK NEWS

Peter Tootill and Steve Withers give their summary of what's new in the telephone networking world

We must apologise for a couple of wrong numbers that have slipped into Network News. Hopefully all is now correct, but if you know of any that are not, please let us know via *APC*.

Operating times of boards

All systems have set operating times and methods (for example, ring-back systems). Details of these are given in the listings with the various phone numbers and they will also be quoted on the board itself. Please take note of the details and don't call outside system hours unless you want to talk to the operator. Especially DO NOT CALL in the middle of the night unless you are sure the system works at this time. Remember most of the BBS are run as a hobby and being woken at 3am can put a strain on even the most harmonious of households! Take particular care when calling overseas BBS's for the first time – if you don't know the operating hours, try early evening (their time). Another thing that can be very annoying is to answer the phone, only for the caller to hang up without a word. If you call a BBS and a person answers there will be a reason for this, so hang on and ask, wait for the answer tone before you switch your modem on, or put the handset in the

coupler. If you're using an auto-dial and don't get through when you expect, ring back and check that you've got the right number and operating times.

Put your money where your modem is

Some BBS's are run by private individuals as a service to the micro community, and others by organizations that have spare capacity overnight and at weekends. Quite a few are operated by clubs and user groups for their members' benefit, although "visitors" are also allowed access. If you are a regular visitor to a club BBS, why not become a paid-up member? In many cases this will give you access to a broader range of facilities and your subscription will help keep the system running (mechanical items like disk drives have a tendency to wear out when used 24 hours a day). Increased revenue from subscriptions would allow some clubs to make significant changes to their systems, such as installing the necessary hardware for multi-user operation. Joining a club will cost you a fraction of what you are paying Telecom, so why hesitate?

German bulletin board

A German micro magazine has set up a bulletin board under the name 'TEDAS'. We believe that it's a 24-hour system, but you'll really need to be able to speak German to use it.

The telephone number from Australia is 0011 49 89 596 422.

Another system is planned in Germany with others in France and Finland. Any developments will be passed on as soon as news comes through.

Network jargon

You may have been wondering what the letters 'CCITT' refer to in the context of modern standards. Well, we can reveal that they stand for the *Comité Consultatif International Téléphonique et Télégraphique*, which in translation means the International Telephone and Telegraph Consultative Committee. It is a committee of the International Telecommunications Union, which is a United Nations agency. The CCITT is responsible for data transmission matters and produces among other things the standards for modems and the like. The V24 interface is an example, as is the V21 (300 bit/sec) modem which is the most popular for communications between terminals and mainframe computers. This is also the standard used by the microcomputer bulletin boards.

Another CCITT standard is the V23 standard which allows communication at 1200 bits/sec but in half duplex mode with one end transmitting at 1200 bits/sec and the other at 75 bits/sec. Normally you can turn the speeds round and the person who was receiving at 1200 can send at 1200 in turn, but not all systems provide this facility.

NETWORK NEWS

It's nice to think that there's such an international standards organisation in this context. Otherwise, each country would have its own set of standards and no one would be able to talk to anyone outside his own borders. That wouldn't be so much of a problem for many of us (you know the cost of international phone calls!), but it would be for businesses. However, having international standards means that a modem manufacturer can produce for a much bigger market than would otherwise be the case, and in theory prices will be lower. The existence of these standards has enabled the new generation of 'modems on a chip' to be produced. There is no point in producing a complicated IC that will only sell to a few people in one country; you need to sell thousands to make it economical.The only fly in this international ointment is the fact that the USA has its own standards for modems. For example, in North America, Bell 103 is the normal 300 bits/sec standard, and this is incompatible with V21. With more recent standards there has been an attempt to introduce some compatibility, and V23 and Bel 202 use the same frequencies at 1200 bits/sec, so that modems using one or the other should be able to communicate (does anyone know if it works?).

Next month we'll give details of the various frequencies used by the common standards.

Australian systems

Micro Design Lab RCPM Tel: (02) 663 0151. System Operator: Stephen Jolly. Hours: 5pm - 7am weekdays. 24 hours weekends.

Mi Computer Club BBS Tel: (02) 662 1686. Program downloading. Hours 24 hours daily.

Sydney Public Access RCPM Tel: (02) 808 3536. System Operators: Barrie Hull and David Simpson. Hours: 24 hours daily.

Software Tools RCPM Tel: (07) 378 9530. Hours: 24 hours daily.

MICOM CBBS Tel: (03) 762 5088. System Operator: Peter Jetson. Hours: 24 hours daily.

Gippsland RCPM Tel: (051) 34 1563. System Operator: Bob Sherlock. Hours: 24 hours daily.

Sorcerer Computer Users Association CBBS Tel: (03) 836 4616. System Operator: Bruce Alexander. Program downloading for SCUA members. Hours: 24 hours daily.

TARDIS RCPM Tel: (03) 67 7760. Hours: 6pm - 8am weekdays. 24 hours weekends.

Perth RMPM Tel: (09) 367 6068. Hours: 6pm - 9pm WST.

NETWORK NEWS

American/Canadian systems

TYPE	SYSTEM NAME	NUMBER	NOTES
Forum 80	HQ system	0011 1816 861 7040	
CBBS	HQ system	0011 1312 545 8086	
FBBS	HQ system	0011 1312 677 8514	
ABBS	Ottowa, Ontario	0011 1613 725 2243	
ABBS	HQ system	0011 1703 255 2192	
MABBS	Fort Walton Beach	0011 1904 862 1072	
Bull-80	Alabama	0011 1205 492 0373	
Conn-80	Colour Computer	0011 1212 441 3755	colour graphics for TRS-80 Colour

European systems

ELFA	ABC-MONITOR Sweden	00114.68 7300706	Half duplex
ABC-Banken	Halmstadt, Sweden	00114.63 5110771	
ABC-MONITOR	ABC Club of Sweden	00114.68 801523	Passwords required
CBBS	Gothenburg, Sweden*	00114.63 1292160	75/1200 baud
		00114.63 1690754	300 baud
TEDAS	Germany	0011 4989 596 422	

* After receiving the tone and connecting your modem, either type: <C/R> or type <COM C/R>. The system then asks for a password which is 'cbbs' *in small letters!!* If you only get '>' when you dial up the systems needs resetting and you type <I> C/R.

NETWORK NEWS

UK systems

CBBS	North East	0011 44 207 543555
CBBS	London	0011 44 1 399 2136
Forum-80	Hull	0011 44 482 859169
Forum-80	London	0011 44 1 902 2546
Forum-80	Milton	0011 44 908 613004
Mailbox-80	Liverpool	0011 44 51 428 8924
TBBS	London	0011 44 1 348 9400 ring-back system
TBBS	Blandford	0011 44 258 54494
BBS	Southern	0011 44 243 5111077 ring-back system

This information is correct and current to the best of our knowledge. Please send corrections and updates to: Steve Withers, C.- *Australian Personal Computer*, 77 Glenhuntly Road, Elwood. Vic 3184.

BENCHMARKS

A list of of Benchmarks used when evaluating micros is given below. An explanation can be found in the February '84. issue.

```
100 REM Benchmark 1
110 PRINT "S"
120 FOR K=1 TO 1000
130 NEXT K
140 PRINT "E"
150 END
```

```
100 REM Benchmark 2
110 PRINT "S"
120 K=0
130 K=K+1
140 IF K<1000 THEN 130
150 PRINT "E"
160 END
```

```
100 REM Benchmark 3
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/K*K+K-K
150 IF K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM Benchmark 4
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM Benchmark 5
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 GOSUB 190
160 IF K<1000 THEN 130
170 PRINT "E"
180 END
190 RETURN
```

```
100 REM Benchmark 6
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB220
170 FORL=1 TO 5
180 NEXTL
190 IF K<1000 THEN 140
200 PRINT "E"
210 END
220 RETURN
```

```
100 REM Benchmark 7
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB 230
170 FOR L=1 TO 5
180 M(L)=A
190 NEXTL
200 If K<1000 THEN 140
210 PRINT "E"
220 END
230 RETURN
```

```
100 REM Benchmark 8
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K^2
150 B=LOG(K)
160 C=SIN(K)
170 IF K<1000 THEN 130
180 PRINT "E"
190 END
```

PROGRAMS

APC is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs to APC please include the following:
(a) A cassette or disk of the program.
(b) A listing on plain, white paper (typewritten if no printer available).
(c) Comprehensive but brief documentation,
(d) A suitable SAE if you would like your materials to be returned after use.
Please mark (a), (b) and (c) with your name, address, program title, machine (state minimum RAM where appropriate) and — if possible — a daytime number.
All programs must, please, be fully debugged.
Programs are paid for at the rate of $20 per page of published listing. Send contributions to:
APC Programs, 77 Glenhuntly Road, Elwood, Vic 3184.

- *Games*
- *Scientific/mathematic*
- *Business*
- *Toolkit/utilities*
- *Educational/Computer Aided Learning*

Apple Stargo

by John Grieve

'Stargo' is a simple game for a 48k Apple II, DOS 3.2. It will not run under DOS 3.3 without a converter program.

Stars appear at random positions on the screen. Using the keys U for up, N for down, left arrow for left and RETYPE for right, you have to prevent these stars forming a row of five — horizontally or vertically — whereupon the game will end. The game is very simple and will appeal to children.

```
10  HOME : PRINT "RANDOMIZING-PRESS SPACE BAR"
15  POKE  - 16368,0
20 X =  RND (7)
25  IF  PEEK ( - 16384) > 128 THEN  GOTO 35
30  GOTO 20
35  FOR X = 768 TO 889: READ V: POKE X,V: NEXT X
40  HOME
45  POKE 32,0: POKE 33,39
50  HOME
55  POKE 32,20: POKE 33,19
60 ST = 170:SP = 160:CV = 32
65 CH = 12:CV = 12
70 HX =  INT ( RND (3) * 20)
75 VY =  INT ( RND (3) * 20)
80  POKE 5,HX: POKE 6,VY
85 CO = CO + 1
```

PROGRAMS

```
 90  POKE 776,ST
 95  CALL 768
100  POKE 2,0
105  CALL 780
110  CALL 839
115  IF  PEEK (2) > 4 THEN  VTAB 12: INVERSE : HTAB 2: PRINT "GAME OVER ":
      NORMAL : FOR X = 1 TO 5: PRINT  CHR$ (7);: NEXT X
120  IF  PEEK (2) > 4 THEN  HTAB 2: PRINT "YOUR SCORE IS ";CO * 10 + HX +
     VY: VTAB 23
125  IF  PEEK (2) > 4 THEN  POKE 5,HX: POKE 6,VY: POKE 776,106: CALL 768: DEL
     10,35
130  POKE 5,OH: POKE 6,OV
135  POKE 776,SP: CALL 768
140 K =  PEEK ( - 16384)
145  IF K = 149 THEN CH = CH + 1
150  IF CH > 19 THEN CH = 19
155  IF K = 136 THEN CH = CH - 1
160  IF CH < 0 THEN CH = 0
165  IF K = 213 THEN CV = CV - 1
170  IF CV < 0 THEN CV = 0
175  IF K = 206 THEN CV = CV + 1
180  IF CV > 19 THEN CV = 19
185 OH = CH:OV = CV
190  POKE 5,CH: POKE 6,CV
195  POKE 776,CV
200  CALL 768
205  GOTO 70
210  DATA    165,6,164,5,32,193,251
215  DATA 169,170,145,40,96
220  DATA  169,0,162,0,160,0,72,32,193,251,177,40,201,170,240,5,162,0,76,3
     8,3
225  DATA   232,224,5,176,21,200,192,20,240,4,104,76,18,3
230  DATA  104,24,105,1,201,20,240,3,76,14,3
235  DATA   96,134,2,104,96,0,0,0,0,0,0,0,0
240  DATA   160,0,162,0,169,0,72,32,193,251,177,40
245  DATA     201,170,240,5,162,0,76,97,3,232,224,5,176,21
250  DATA   104,24,105,1,201,20,240,4,72,76,78,3
255  DATA    200,192,20,240,3,76,78,3,96,134,2,104,96
```

PET Areas

by John Guy

'Areas' is an educational program for a 32k PET. It is intended to help children in the 7-12 years age group learn the methods of calculating areas of squares, rectangles and triangles.

Firstly, the program demonstrates the methods of calculation and, secondly, invites the user to attempt ten example problems. Once all ten have been attempted, the program gives a score and gives the user a second attempt at the ones he got wrong the first time. The correct solutions are then presented.

Following each of the three sections, a revision option is offered. Some of the wording will have to be changed for younger children, but the program as a whole should be useful to a fairly wide age range. There is a spelling mistake, incidentally, in line 4600 which needs to be corrected.

```
AREAS OF SIMPLE SHAPES
      BY
   JOHN GUY

1000 REM AREAS OF SIMPLE SHAPES
1010 REM   BY.    JOHN GUY.....
1020 REM
1030 OPEN 1,0:PRINT"□":DIMQUE(10,2):REP=0
1050 PRINT"■■■   ■■■ ■■■ ■■■ ■■■"
1060 PRINT "  ■ ■ ■ ■ ■   ■ ■   ■ "
1070 PRINT"   ■■■ ■■■ ■■   ■■■  ■■■"
1080 PRINT"   ■ ■ ■■  ■   ■ ■    ■"
1090 PRINT"   ■ ■ ■ ■ ■■■ ■ ■   ■■■"
1100 PRINT"■    ■OF SIMPLE SHAPES■"
1110 PRINT"■■■              BY"
1120 PRINT"                JOHN.GUY"
1130 FOR DELAY=1 TO 5000:NEXT DELAY
1140 REM  AREAS OF SQUARES                          :REM AREAS OF SQUARES
1150 WIN$="■■■■■■■■■■■■■■■■"
1160 PRINT"□          ■AREAS OF SQUARES■"
1170 GOSUB 1670                                     :REM FIRST SQUARE
1180 PRINTWIN$;'TO FIND THE AREA OF THE SQUARE ABOVE WE"
1190 PRINT"FIRST DIVIDE THE MAIN SQUARE INTO A"
1200 PRINT"NUMBER OF SMALLER SQUARES EACH 1 SQ UNIT";
1210 PRINT"IN AREA   IE.EACH SIDE OF THE LITTLE"
1220 PRINT"SQUARE IS 1 UNIT LONG."
1230 GOSUB 1760                                     :REM FILL SQUARE
1240 PRINTWIN$;"■■■■■■";
1250 PRINT"NOW WE COUNT THE NUMBER OF LITTLE"
1260 PRINT"SQUARES."
1270 GOSUB 1840                                     :REM COUNT SQUARES
1280 PRINTWIN$;"■■■■■■■■    ■PRESS A KEY TO CONTINUE■"
1290 GET KEY$:IF KEY$="" THEN 1290
1300 GOSUB 2120                                     :REM CLEAR TEXT WINDOW
1310 PRINTWIN$;"AS YOU CAN SEE THERE ARE 100 LITTLE"
1320 PRINT"SQUARES INSIDE THE BIG SQUARE."
1330 PRINT"    WE SAY THAT THE AREA OF THE BIG"
1340 PRINT"SQUARE IS ■100 SQ UNITS■"
```

PROGRAMS

```
1350 PRINT"     PRESS A KEY TO CONTINUE"
1360 GET KEY$:IF KEY$="" THEN 1360
1370 PRINT"            AREAS OF SQUARES"
1380 GOSUB 1780                                        :REM FILL SQUARE
1390 PRINT"10"
1400 PRINT"10"
1410 PRINTWIN$;"IF YOU LOOK AT THE SQUARE AGAIN YOU WILL";
1420 PRINT"SEE THAT THE 100 SQUARES ARE ARANGED"
1430 PRINT"INTO 10 ROWS OF 10 SQUARES"
1440 PRINT"    THEREFORE WE CAN SAY"
1450 PRINT"       AREA = 10 X 10"
1460 PRINT"               - 100 SQ UNITS
1470 PRINT"     PRESS A KEY TO CONTINUE"
1480 GET KEY$:IF KEY$="" THEN 1480
1490 GOSUB 2120                                        :REM CLEAR TEXT WINDOW
1500 PRINTWIN$;"             UNITS"
1510 PRINT"IF EACH LITTLE SQUARE IS OF SIDE 1CM"
1520 PRINT"THEN THE AREA OF EACH LITTLE SQUARE"
1530 PRINT" IS  1CM2"
1540 PRINT"UNIT FOR ALL AREAS IS UNITS2"
1550 PRINT"     PRESS A KEY TO CONTINUE"
1560 GET KEY$:IF KEY$="" THEN 1560
1570 PRINT"            AREAS OF SQUARES"
1580 GOSUB 2030                                        :REM SQUARE OF SIDE B
1590 PRINTWIN$;"     GENERAL FORMULA"
1600 PRINT" IF WE HAVE A SQUARE OF SIDE B CM"
1610 PRINT"THEN AREA = B X B"
1620 PRINT"           = B2 CM2"
1630 PRINT"           ____ "
1640 PRINT"     PRESS A KEY TO CONTINUE"
1650 GET KEY$:IF KEY$="" THEN 1650
1660 GOTO 2180                                         :REM TEST SECTION
1670 REM  FIRST SQUARE                                 :REM FIRST SQUARE
1680 PRINT"
1690 FOR A=1 TO 8
1700 PRINT"
1710 NEXT A
1720 PRINT"
1730 PRINT"                10"
1740 PRINT"        10
1750 RETURN
1760 REM  FILL  SQUARE                                 :REM FILL SQUARE
1770 FOR A=1 TO 8000:NEXTA
1780 PRINT"";:FOR A=1 TO 10
1800 PRINT" "
1810 NEXT A
1820 PRINT"
1830 RETURN
1840 REM  COUNT SQUARES                                :REM COUNT SQUARES
1850 FOR DELAY=1TO3000:NEXT DELAY
1860 PRINT"";: COUNT=0
1890 FOR A=1TO10:FOR B=1TO10:PRINT"";
1900 FORX=1TOA:PRINT"";:NEXT X
1930 FOR Y=1TOB:PRINT"";:NEXT Y:PRINT"":COUNT=COUNT+1
1980 PRINT""TAB(28)"COUNT=";COUNT
1990 FOR DELAY=1TO90:NEXT DELAY:NEXT B:NEXT A:RETURN
2030 REM  SQUARE OF SIDE B                             :REM SQUARE OF SIDE B
2040 PRINT"              B "
2050 PRINT"         B"
2060 PRINT"
2070 FOR A=1TO8
2080 PRINT"
2090 NEXT A
2100 PRINT"
2110 RETURN
2120 REM CLEAR TEXT WINDOW                             :REM CLEAR TEXT WINDOW
2130 PRINTWIN$;"";
2140 FORA=1TO9
2150 PRINT"
2160 NEXTA
2170 RETURN
2180 REM  TEST SECTION                                 :REM TEST SECTION
2190 FOR TEST=1TO10
2200 PRINT"           AREAS OF SQUARES"
2210 PRINT"                 TEST"
2220 GOSUB 2060                                        :REM SQUARE
2230 SIDE=INT(RND(1)*10)+1
2235 IF REP=1 THEN RETURN
2240 PRINT"               "SIDE
2250 PRINT"         'SIDE
2260 PRINTWIN$;"QUESTION NUMBER"TEST""
2270 PRINT"WHAT IS THE AREA OF THE SQUARE"
2280 PRINT"ABOVE? ";:INPUT#1,AREA$
2290 AREA=VAL(AREA$)
2300 IF AREA=0 THEN 2260
2305 IF REP=1 THEN RETURN
2310 IF AREA=(SIDE*SIDE)THEN PRINT"        CORRECT" SC=SC+1:QUE(TEST,1)=0
2315 IF AREA=(SIDE*SIDE) THEN 2330
2320 PRINT"           WRONG":QUE(TEST,1)=SIDE
2330 FOR DELAY=1TO1000:NEXTDELAY
2340 NEXT TEST
2370 PRINT"          AREAS OF SQUARES"
2380 PRINT"                TEST"
2390 PRINT" OUT OF 10 QUESTIONS YOU ANSWERED"
2400 PRINTSC;" QUESTIONS CORRECTLY"
2410 PRINT"YOU WILL NOW HAVE ANOTHER CHANCE TO"
2420 PRINT"ANSWER THE QUESTIONS YOU GOT WRONG IN"
2430 PRINT"THE TEST.IF YOU GET THE QUESTIONS"
2440 PRINT"WRONG AGAIN YOU WILL BE GIVEN THE"
2450 PRINT"CORRECT ANSWER"
2460 PRINT"      PRESS A KEY TO CONTINUE"
2470 GET KEY$:IF KEY$="" THEN 2470
2475 REP=1
2480 FOR TEST=1 TO 10
2490 IF QUE(TEST,1)=0 THEN 2580
2500 GOSUB 2200
2510 SIDE=QUE(TEST,1):GOSUB 2240
2520 GOSUB 3560                                        :REM CLEAR TEXT WINDOW
2530 IF AREA=(SIDE*SIDE) THENPRINTWIN$,AREA;" IS THE CORRECT ANSWER":GOTO 2560
2540 IF AREA<>(SIDE*SIDE) THEN PRINTWIN$;AREA;" IS THE WRONG ANSWER"
2550 PRINT"THE CORRECT ANSWER IS";SIDE*SIDE
2560 PRINT"      PRESS A KEY TO CONTINUE"
2570 GET KEY$:IF KEY$="" THEN 2570
2580 NEXT TEST
2590 REP=0
```

PROGRAMS

```
2630 PRINT"██DO YOU WISH TO REVISE (Y/N)█"
2640 GET KEY$:IF KEY$=""THEN2640
2650 IF KEY$="Y" THEN 1160                                   :REM START OF LESSON
2660 IF KEY$="N" THEN 2680                                   :REM NEXT LESSON
2670 GOTO 2640
2680 REM      NEXT LESSON                                    :REM NEXT LESSON
2690 REM  AREAS OF RECTANGLES                                :REM AREAS OF RECTANGLES
2700 WIN$="████████████████"
2710 PRINT"█           █AREAS OF RECTANGLES█"
2720 GOSUB 3120                                              :REM FIRST RECTANGLE
2730 PRINTWIN$;"IF WE DIVIDE THE RECTANGLE INTO A"
2740 PRINT"NUMBER OF SMALL SQUARES EACH OF"
2750 PRINT"█AREA 1 CM█2█"
2760 GOSUB 3210                                              :REM FILL RECTANGLE
2770 PRINTWIN$;"████";
2780 PRINT"WE CAN COUNT THE NUMBER OF SQUARES."
2790 PRINT"FROM THIS WE CAN GET THE AREA"
2800 GOSUB 3290                                              :REM COUNT SQUARES
2810 PRINTWIN$;"████████    █PRESS A KEY TO CONTINUE█"
2820 GET KEY$:IF KEY$="" THEN 2820
2830 GOSUB 3560                                              :REM CLEAR TEXT WINDOW
2840 PRINTWIN$;"IN THIS RECTANGLE THERE ARE 40 SMALL"
2850 PRINT"SQUARES. THIS MEANS THAT THE AREA IS"
2860 PRINT"█40 CM█2█"
2870 PRINT"██    █PRESS A KEY TO CONTINUE█"
2880 GET KEY$:IF KEY$="" THEN 2880
2890 PRINT"█           █AREAS OF RECTANGLES█"
2900 GOSUB 3230                                              :REM FILL RECTANGLE
2910 PRINT"█████          10"
2920 PRINT"███      4"
2930 PRINTWIN$;"IF YOU LOOK AT THE RECTANGLE AGAIN"
2940 PRINT"YOU WILL SEE THAT THE SQUARES"
2950 PRINT"ARE ARRANGED IN 4 ROWS OF 10 SQUARES"
2960 PRINT"THERFORE WE CAN SAY THAT"
2970 PRINT"        AREA = 4 X 10
2980 PRINT"█           = 40 CM█2█"
2990 PRINT"            ─────── "
3000 PRINT"    █PRESS A KEY TO CONTINUE█"
3010 GET KEY$: IF KEY$="" THEN 3010
3020 PRINT"█           █AREAS OF RECTANGLES█"
3030 GOSUB 3480                                              :REM RECTANGLE B BY C
3040 PRINTWIN$;"██          █GENERAL FORMULA█"
3050 PRINT"█FOR THIS RECTANGLE OF SIDES B UNITS  AND";
3060 PRINT"C UNITS"
3070 PRINT"█        AREA = B X C UNITS█2█"
3080 PRINT"             ─────────────"
3090 PRINT"    █PRESS A KEY TO CONTINUE█"
3100 GET KEY$:IF KEY$="" THEN 3100
3110 GOTO  3620                                              :REM TEST SECTION
3120 REM FIRST RECTANGLE                                     :REM FIRST RECTANGLE
3130 PRINT"███████          ┌──────────┐"
3140 FOR A=1 TO 2
3150 PRINT"          │          │"
3160 NEXT A
3170 PRINT"          └──────────┘"
3180 PRINT"██████          10 CM"
3190 PRINT"███     4 CM"
3200 RETURN
3210 REM FILL  RECTANGLE                                     :REM FILL RECTANGLE
3220 FOR DELAY=1 TO 8000:NEXT DELAY
3230 PRINT"████████";
3240 FOR A=1 TO 4
3250 PRINT"██████████┬┬┬┬┬┬┬┬┬┬'
3260 NEXT A
3270 PRINT"          ──────────"
3280 RETURN
3290 REM COUNT SQUARES                                       :REM COUNT SQUARES
3300 FOR DELAY=1 TO 3000:NEXT DELAY
3310 PRINT"████████";:COUNT=0
3340 FOR A=1 TO 4:FOR B=1 TO 10:PRINT"████████████████"
3350 FORX=1 TO A:PRINT"█";:NEXT X
3380 FOR Y=1 TO B:PRINT"█";:NEXT Y
3410 PRINT"███":COUNT=COUNT+1:PRINT"███"TAB(28)"COUNT=";COUNT
3440 FOR DELAY=1TO90:NEXTDELAY:NEXT B:NEXT A:RETURN
3480 REM RECTANGLE B BY C                                    :REM RECTANGLE B BY C
3490 PRINT"█████          B"
3500 PRINT"███       C"
3510 PRINT"███████          ┌──────────┐"
3520 FOR A=1 TO 2
3530 PRINT"██████████          │"
3540 NEXT A
3550 PRINT"          └──────────┘"
3560 REM CLEAR TEXT WINDOW                                   :REM CLEAR TEXT WINDOW
3570 PRINTWIN$;"█";
3580 FOR A=1 TO 10
3590 PRINT"                                       ";:NEXT A:RETURN
3620 REM TEST SECTION                                        :REM TEST SECTION
3630 SC=0:FOR TEST=1TO10
3640 PRINT"█           █AREAS OF RECTANGLES█"
3650 PRINT"                 █TEST█"
3660 GOSUB 3510                                              :REM RECTANGLE
3670 B=INT(RND(1)*10)+1
3680 C=INT(RND(1)*10)+1
3685 IF REP=1 THEN RETURN
3690 IF C>B THEN P=B:B=C:C=P
3700 IF B=C THEN 3670
3710 PRINT"█████         "B
3720 PRINT"███      "C
3730 PRINT WIN$;"█QUESTION NUMBER";TEST;"█"
3740 PRINT"██WHAT IS THE AREA OF THE RECTANGLE"
3750 PRINT"ABOVE? ";:INPUT#1,AREA$
3760 AREA=VAL(AREA$)
3770 IF AREA=0 THEN 3730
3775 IF REP=1 THEN RETURN
3780 IF AREA=(B*C) THEN PRINT"        █CORRECT█":SC=SC+1:QUE(TEST,1)=0
3785 IF AREA=(B*C) THEN GOTO 3800
3790 PRINT"           █WRONG█":QUE(TEST,1)=B:QUE(TEST,2)=C
3800 FOR DELAY=1 TO 1000:NEXT DELAY
3810 NEXT TEST
3820 PRINT"█           █AREAS OF RECTANGLES█"
3830 PRINT"              █TEST█"
3840 PRINT"███ OUT OF 10 QUESTIONS YOU ANSWERED"
3850 PRINTSC;" QUESTIONS CORRECTLY"
3860 PRINT"███YOU WILL NOW HAVE ANOTHER CHANCE TO"
3870 PRINT"ANSWER THE QUESTIONS YOU GOT WRONG IN"
```

PROGRAMS

```
3880 PRINT"THE TEST.IF YOU GET THE QUESTIONS"
3890 PRINT"WRONG AGAIN YOU WILL BE GIVEN THE"
3900 PRINT"CORRECT ANSWER"
3910 PRINT"■■■    ■PRESS A KEY TO CONTINUE■"
3920 GET KEY$:IF KEY$="" THEN 3920
3930 REP=1
3940 FOR TEST=1 TO 10
3950 IF QUE(TEST,1)=0 THEN 4040
3960 GOSUB 3640
3970 B=QUE(TEST,1):C=QUE(TEST,2):GOSUB 3710
3980 GOSUB 3560                                   :REM CLEAR TEXT WINDOW
3990 IF AREA=(B*C) THENPRINTWIN$;AREA;" IS THE CORRECT ANSWER":GOTO 4020
4000 IF AREA<>(B*C) THEN PRINTWIN$;AREA;" IS THE WRONG ANSWER"
4010 PRINT"THE CORRECT ANSWER IS";B*C
4020 PRINT"■■    ■PRESS A KEY TO CONTINUE■"
4030 GET KEY$:IF KEY$="" THEN 4030
4040 NEXT TEST
4050 REP=0
4100 PRINT"■■DO YOU WISH TO REVISE (Y/N)■"
4110 GET KEY$:IF KEY$="" THEN 4110
4120 IF KEY$="Y" THEN 2710                        :REM START OF PROGRAM
4130 IF KEY$="N" THEN 4150                        :REM LOAD NEXT PROGRAM
4140 GOTO 4110
4150 REM NEXT LESSON                              :REM NEXT LESSON
4160 REM
4170 REM  AREAS OF TRIANGLES                      :REM AREAS OF TRIANGLES
4180 WIN$="■■■■■■■■■■■■■■■■■■"
4190 PRINT"┐          ■AREA'S OF TRIANGLES■"
4200 GOSUB 4650                                   :REM FIRST TRIANGLE
4210 PRINTWIN$;"IF WE DIVIDE THIS TRIANGLE INTO A"
4220 PRINT"NUMBER OF SMALL SQUARES WE FIND"
4230 PRINT"THAT THERE ARE A SERIES OF TRIANGLES"
4240 PRINT"LEFT ALONG THE HYPOTENUSE."
4250 GOSUB 4800                                   :REM FILL TRIANGLE
4260 PRINTWIN$;"■■■■■IF WE PUT THESE TRIANGLES TOGETHER WE"
4270 PRINT"CAN MAKE SQUARES"
4280 GOSUB 4960                                   :REM MAKE SQUARES
4290 PRINTSWIN$;"■■■■■■■■■■■■PRESS A KEY TO CONTINUE■"
4300 GET KEY$:IF KEY$="" THEN 4300
4310 GOSUB 5380                                   :REM CLEAR TEXT WINDOW
4320 PRINTWIN$;"NOW IF WE COUNT THE NUMBER OF SQUARES"
4330 GOSUB 5090                                   :REM COUNT SQUARES
4340 PRINTWIN$;"■WE CAN SEE THAT ARE 50 SQUARES.THIS"
4350 PRINT"■MEANS THAT THE AREA = 50 CM□2■"
4360 PRINT"■■PRESS A KEY TO CONTINUE■"
4370 GET KEY$:IF KEY$="" THEN 4370
4380 PRINT"┐          ■AREAS OF TRIANGLES■"
4390 GOSUB 5440                                   :REM DRAWTRIANGLE+SQUARE
4400 PRINTWIN$;"IF WE LOOK AT THE TRIANGLE AGAIN WE"
4410 PRINT"CAN SEE THAT IT IS HALF OF THE SQUARE"
4420 PRINT"■    THE AREA OF THE SQUARE IS 100 CM□2■"
4430 PRINT"AND THE AREA OF THE TRIANGLE IS HALF"
4440 PRINT"THAT OF THE SQUARE THEREFORE"
4450 PRINT"■AREA = 50 CM□2■"
4460 PRINT"■PRESS A KEY TO CONTINUE■"
4470 GET KEY$:IF KEY$="" THEN 4470
4480 GOSUB 5380                                   :REM CLEAR TEXT WINDOW
4490 PRINTWIN$;"AS THE AREA IS HALF WE CAN SAY THAT"
4500 PRINT"      ■AREA = HALF X (BASE X HEIGHT)■"
4510 PRINT"■■■■PRESS A KEY TO CONTINUE■"
4520 GET KEY$:IF KEY$="" THEN 4520
4530 GOSUB 5380                                   :REM CLEAR TEXT WINDOW
4540 PRINT"┐          ■AREAS OF TRIANGLES■"
4550 GOSUB 5270                                   :REM GENERAL TRIANGLE
4560 PRINTWIN$;"          ■GENERAL RULE■"
4570 PRINT"IF HEIGHT IS THE PERPENDICULAR HEIGHT"
4580 PRINT"FROM THE BASE TO THE VERTEX THEN THE"
4590 PRINT"RULE FOUND FOR THE OTHER TRIANGLE"
4600 PRINT"APLIES TO ALL TRIANGLES"
4610 PRINT"■   I.E. ■AREA = HALF X (B X H)■"
4620 PRINT"■    ■PRESS A KEY TO CONTINUE■"
4630 GET KEY$:IF KEY$="" THEN 4630
4640 GOTO 5670                                    :REM TEST SECTION
4650 REM FIRST TRIANGLE                           :REM FIRST TRIANGLE
4660 PRINT"■■■■          /\"
4670 PRINT"          | \"
4680 PRINT"          |  \"
4690 PRINT"          |   \"
4700 PRINT"   10 CM |    \ (HYPOTENUSE)"
4710 PRINT"(HEIGHT) |     \"
4720 PRINT"          |      \"
4730 PRINT"          |       \"
4740 PRINT"          |        \"
4750 PRINT"          ┌─────────\"
4760 PRINT"
4770 PRINT"            10 CM"
4780 PRINT"         (BASE)":RETURN
4800 REM FILL TRIANGLE                            :REM FILL TRIANGLE
4810 FOR DELAY=1 TO 5000: NEXT DELAY
4820 PRINT"■■■■          /\"
4830 PRINT"          ┌┐\"
4840 PRINT"          ┌┐┐\"
4850 PRINT"          ┌┐┐┐\"
4860 PRINT"   10 CM ┌┐┐┐┐\ (HYPOTENUSE)"
4870 PRINT"          ┌┐┐┐┐┐\"
4880 PRINT"          ┌┐┐┐┐┐┐\"
4890 PRINT"          ┌┐┐┐┐┐┐┐\"
4900 PRINT"          ┌┐┐┐┐┐┐┐┐\"
4910 PRINT"          ┌┐┐┐┐┐┐┐┐┐\"
4920 PRINT"          ──────────"
4930 PRINT"            10 CM"
4940 PRINT"         (BASE)":RETURN
4960 REM MAKE SQUARES                             :REM MAKE SQUARES
4970 FOR DELAY=1 TO 5000: NEXT DELAY
4980 PRINT"■■■■          ┌┐"
4990 PRINT"■■■■■■■■■■■■ "
5000 PRINT"■■■■■■■■■■■■┌┐"
5010 PRINT"■■■■■■■■■■■■■■ "
5020 PRINT"■■■■■■■■■■■■■■┌┐"
5030 PRINT"■■■■■■■■■■■■■■■■ "
5040 PRINT"■■■■■■■■■■■■■■■■┌┐"
5050 PRINT"■■■■■■■■■■■■■■■■■■ "
5060 PRINT"■■■■■■■■■■■■■■■■■■┌┐"
5070 PRINT"■■■■■■■■■■■■■■■■■■■■ ■■ ┌┐":RETURN
5090 REM COUNT SQUARES                            :REM COUNT SQUARES
```

PROGRAMS

```
5100 COUNT=0:TRI$="■TTTTTTTTTT"
5110 FOR A=1 TO 10 STEP 2:FOR B=1 TO 2:FOR X=1 TO A
5140 PRINT"■■■■■■■■■■■■";:FOR Y=1 TO A:PRINT "■";
5180 NEXT Y:IF B=1 THEN PRINT"□";
5190 PRINTLEFT$(TRI$,X+1):FOR DELAY=1 TO 120:NEXT DELAY
5220 COUNT=COUNT+1:PRINT"■■■"TAB(28)"COUNT="COUNT
5230 NEXT X:NEXT B:NEXT A:RETURN
5270 REM GENERAL TRIANGLE                          :REM GENERAL TRIANGLE
5280 PRINT"■■■■          VERTEX   "
5290 PRINT"                      "
5300 PRINT"                    I "
5310 PRINT"                    I "
5320 PRINT"                     H(PERP HEIGHT) "
5330 PRINT"                    I "
5340 PRINT"          (BASE)    I "
5350 PRINT"                      "
5360 PRINT"                  B ":RETURN
5380 REM CLEAR TEXT WINDOW                         :REM CLEAR TEXT WINDOW
5390 PRINTWIN$;"□";:FOR A=1 TO 10
5410 PRINT"
5420 NEXT A:RETURN
5440 REM TRIANGLE+SQUARE                           :REM TRIANGLE + SQUARE
5450 PRINT"■■■          ____________"
5460 PRINT"            |\           |"
5470 PRINT"            | \          |"
5480 PRINT"            |  \         |"
5490 PRINT"            |   \        |"
5500 PRINT"    10 CM   |    \       |"
5510 PRINT"            |     \      |"
5520 PRINT"            |      \     |"
5530 PRINT"            |       \    |"
5540 PRINT"            |        \   |"
5550 PRINT"            |_________\  |"
5560 PRINT"                       ":RETURN
                                                   :REM TRIANGLE
5580 REM TRIANGLE
5590 PRINT"■■■  ____________"
5600 PRINT"    |\           |"
5610 PRINT"    | \          |"
5620 PRINT"    |  \         |"
5630 PRINT"    |   \        |"
5640 PRINT"    |    \       |"
5650 PRINT"    |_____\______|":RETURN
                                                   :REM TEST SECTION
5670 REM TEST SECTION
5680 SC=0:FOR TEST=1 TO 10
5690 PRINT"□          ■■AREAS OF TRIANGLES■"
5700 PRINT"                    ■■TEST■"
5710 GOSUB 5580                                    :REM TRIANGLE
5715 IF REP=1 THEN RETURN
5720 B=INT(RND(1)*10)+1
5730 H=INT(RND(1)*10)+1
5735 IF REP=1 THEN RETURN
5740 PRINT"■■■■■■■■■■H
5750 PRINT"■■■■■■■■■B"CM"
5760 PRINTWIN$;"■■QUESTION NUMBER ";TEST;"■"
5770 PRINT"■■■WHAT IS THE AREA OF THE TRIANGLE"
5780 PRINT"ABOVE? ";:INPUT#1,AREA$
5790 AREA=VAL(AREA$)
5795 IF REP=1 THEN RETURN
5800 IF AREA=0 THEN 5760
5810 IF AREA=(0.5*(B*H)) THEN PRINT"      ■■CORRECT■":SC=SC+1
5815 IF AREA=<0.5*(B*H))THEN QUE(TEST,1)=0:GOTO 5830
5820 PRINT "          ■■WRONG■":QUE(TEST,1)=B:QUE(TEST,2)=H
5830 FOR DELAY=1 TO 1000:NEXT DELAY
5840 NEXT TEST
5850 PRINT"□          ■■AREAS OF TRIANGLES■"
5860 PRINT"                    ■■TEST■"
5870 PRINT"■■■ OUT OF 10 QUESTIONS YOU ANSWERED"
5880 PRINTSC," QUESTIONS CORRECTLY"
5890 PRINT"■■■YOU WILL NOW HAVE ANOTHER CHANCE.TO"
5900 PRINT"ANSWER THE QUESTIONS YOU GOT WRONG !N"
5910 PRINT"THE TEST.IF YOU GET THE QUESTIONS"
5920 PRINT"WRONG AGAIN YOU WILL BE GIVEN THE"
5930 PRINT"CORRECT ANSWER"
5940 PRINT"■■■    ■■PRESS A KEY TO CONTINUE■"
5950 GET KEY$:IF KEY$="" THEN 5950
5960 REP=1
5970 FOR TEST=1 TO 10
5980 IF QUE(TEST,1)=0 THEN 6070
5990 GOSUB 5690
6000 B=QUE(TEST,1):H=QUE(TEST,2):GOSUB 5740

6010 GOSUB 3560                                    REM CLEAR TEXT WINDOW
6020 IF AREA=(0.5*B*H) THENPRINTWIN$;AREA;" IS THE CORRECT ANSWER" GOTO 6070
6030 IF AREA<>(0.5*B*H) THEN PRINTWIN$;AREA;" IS THE WRONG ANSWER"
6040 PRINT"THE CORRECT ANSWER IS";0.5*B*H
6050 PRINT"■■    ■■PRESS A KEY TO CONTINUE■"
6060 GET KEY$:IF KEY$="" THEN 6060
6070 NEXT TEST
6080 REP=0
6130 PRINT"■■DO YOU WISH TO REVISE (Y/N)■"
6140 GET KEY$:IF KEY$="" THEN 6140
6150 IF KEY$="Y" THEN 4190
6160 IF KEY$="N" THEN 6180
6170 GOTO 6140
6180 :REM END OF PROGRAM
6190 PRINT"□          ■■AREAS OF SIMPLE SHAPES■"
6200 PRINT"■■■■YOU HAVE FINISHED THIS LESSON"
6210 PRINT"AND YOU HAVE FINISHED THIS PROGRAM"
6220 PRINT"■DO YOU WISH TO REVISE THE WHOLE"
6230 PRINT"PROGRAM ?"
6240 GET KEY$:IF KEY$="" THEN 6240
6250 IF KEY$="Y" THEN 4160
6260 IF KEY$="N" THEN 6280
6270 GOTO 6240
6280 PRINT"■■THANK-YOU FOR RUNNING THIS PROGRAM"
6290 PRINT"■AND I HOPE YOU HAVE BENEFITED FROM IT"
6300 PRINT"■■■■      GOOD BYE"
6310 CLOSE1:END
READY.
```

Spectrum Jackpot

by D C Hawkins

'Jackpot' is a fruit machine program for a 16 or 48k Spectrum.

The program is short and simple, the graphics leaving little free memory on a 16k machine. Owners of 48k machines may like to add other facilities such as a 'nudge' feature.

The wheels are spun by pressing 0 (zero), and held — when the HOLD option is available — by pressing 1, 2 and/or 3 to hold the respective wheel/s. Although simple, the children who tested it (aged nine) enjoyed it and that's what counts.

As the program stands, the odds are stacked in the player's favour. To alter the odds against the hold facility, change the value of three in line 320; to alter the odds against a jackpot, change the value five in 1080.

```
    2 REM  FRUIT MACHINE
    4 REM © D.C.Hawkins 1983
    6 BORDER 2
    8 PRINT AT 16,3;"++++++++++++
++++"
   10 PRINT AT 1,3;"++++++++++++++
+++"
   12 FOR n=2 TO 15: PRINT AT n,3
;"+": PRINT AT n,18;"+": NEXT n
   14 PRINT AT 7,5;"-------------"
   16 PRINT AT 10,5;"-------------
"
   18 PRINT AT 6,20;"SCORE": LET
sc=0
   20 PRINT AT 19,3;"PRESS 0 TO R
UN": PRINT AT 20,3;"PRESS 9 TO C
ANCEL HOLD"
   28 FOR i=97 TO 112: PRINT AT 0
,ABS ((104-i)*2)+3;"©": BEEP .01
25,0: FOR n=0 TO 7
   30 PRINT AT 0,ABS ((104-i)*2)+
3;" ": READ x: POKE USR CHR$ i+n
,x
   32 NEXT n: NEXT i
   34 DIM j(18,18)
   36 DIM k(15): DIM l(15): LET l
(5)=1: LET l(10)=2: LET l(15)=3
   38 LET p=5: LET q=15: LET r=5
   40 BEEP .0125,40: BEEP .0125,4
0: BEEP .0125,40: PRINT AT 15,22
;"      ";AT 17,5; INK 1;"1    2
   3": LET sc=sc-10: PRINT AT 9,2
0;"      ";AT 9,20;sc
   50 FOR x=p TO q STEP r
   55 LET k(x)=INT (RND*5)+1
   60 IF k(x)=l(x) THEN GO TO 55
   65 LET l(x)=k(x): LET y=3*k(x)
   70 INK 4: LET j(y,x)=1: BEEP .
01,-10
   75 PRINT AT y,x;"▀"
   80 PRINT AT y-1,x;"▄"
   85 IF y=15 THEN LET y=0
   90 INK 2: LET j(y+3,x)=2: BEEP
 .01,-10
   95 PRINT AT y+3,x;"▀"
  100 PRINT AT y+2,x;"▄"
  105 IF y=12 THEN LET y=-3
  110 INK 6: LET j(y+6,x)=3: BEEP
 .01,-10
  115 PRINT AT y+6,x;"▀"
  120 PRINT AT y+5,x;"▄"
  125 IF y=9 THEN LET y=-6
  130 INK 2: LET j(y+9,x)=4: BEEP
 .01,-10
  135 PRINT AT y+9,x;"▀▀"
  140 PRINT AT y+8,x;"▄"
  145 IF y=6 THEN LET y=-9
  150 INK 3: LET j(y+12,x)=5: BEE
P .01,-10
  155 PRINT AT y+12,x;"▀"
  165 PRINT AT y+11,x;"▄"
  170 NEXT x
  300 LET p=5: LET q=15: LET r=5:
 PRINT AT 15,22;"      ";AT 17,5;
INK 1;"1    2    3"
  305 LET a1=0: LET a2=0: LET a3=
0
  310 IF j(9,5)=j(9,10) AND j(9,1
0)=j(9,15) THEN GO SUB 1000
  320 IF INT (RND*3)<2 THEN GO TO
 360
  325 BEEP .05,10: PRINT FLASH 1;
AT 15,22;"HOLD"
  335 IF INKEY$="0" THEN GO TO 80
0
  340 IF INKEY$="9" THEN LET a1=0
: LET a2=0: LET a3=0: PRINT AT 1
7,5; INK 1;"1    2    3"
  345 IF INKEY$="1" THEN LET a1=1
: PRINT AT 17,5; INK 1;"H": BEEP
 .05,20: PAUSE 20
  350 IF INKEY$="2" THEN LET a2=1
: PRINT AT 17,10; INK 1;"H": BEE
P .05,27: PAUSE 20
  355 IF INKEY$="3" THEN LET a3=1
: PRINT AT 17,15; INK 1;"H": BEE
P .05,34: PAUSE 20
  360 GO TO 335
  380 IF INKEY$="0" THEN GO TO 40
  400 GO TO 380
  800 IF a1=1 AND a2=1 AND a3=1 T
HEN BEEP .0125,40: BEEP .0125,40
: BEEP .0125,40: GO TO 300
  805 IF a1=1 AND a2=1 THEN LET p
=15: GO TO 40
  810 IF a2=1 AND a3=1 THEN LET q
=5: GO TO 40
  815 IF a1=1 AND a3=1 THEN LET p
=10: LET q=10: GO TO 40
  820 IF a1=1 THEN LET p=10: GO T
O 40
  825 IF a2=1 THEN LET r=10: GO T
O 40
  830 IF a3=1 THEN LET q=10: GO T
O 40
  835 GO TO 40
1000 FOR n=7 TO 2 STEP -1: BORDE
R n: PAUSE 10: NEXT n: FOR n=-7
TO 7 STEP .5: BEEP .02,49-n*n: N
EXT n
1005 FOR n=0 TO 20: PRINT INK 2;
AT n,28;"O O": BEEP .0125,40: NE
XT n
1010 IF j(9,5)=1 THEN LET sc=sc+
200
1020 IF j(9,5)=2 THEN LET sc=sc+
150
1030 IF j(9,5)=3 THEN LET sc=sc+
120
1040 IF j(9,5)=4 THEN LET sc=sc+
100
1050 IF j(9,5)=5 THEN LET sc=sc+
50
1060 PRINT AT 9,20;"      ";AT 9,
20;sc: FOR n=0 TO 20: PRINT AT n
,28;"  ": NEXT n
1070 PRINT AT 15,22;"    "
1080 IF INT (RND*5)=3 THEN GO SU
B 2000
1090 RETURN
2000 FOR n=1 TO 10: BORDER RND*7
: PAUSE 10: NEXT n: BORDER 2: PR
INT FLASH 1; INK 2;AT 21,10;"JAC
KPOT": FOR o=1 TO 3: FOR w=20 TO
 30: BEEP .0125,w: NEXT w: FOR v
=30 TO 25 STEP -1: BEEP .0125,v:
 NEXT v: NEXT o: FOR n=0 TO 20:
PRINT INK 2;AT n,28;"ooo": BEEP
.0125,40: NEXT n: PAUSE 20: FOR
n=0 TO 20: PRINT AT n,26;"  ":
NEXT n: LET sc=sc+1000: PRINT AT
 9,20;"      ";AT 9,20;sc: PAUSE
 50: PRINT AT 21,10;"          ": R
ETURN
3000 DATA 255,255,255,127,127,63
,31,7,255,255,255,254,254,252,24
```

```
8,224,7,31,63,127,127,255,255,25
5,224,248,252,254,254,255,255,25
5,0,0,0,0,60,126,255,255
3010 DATA 31,63,63,63,63,31,31,7
,248,252,252,252,252,248,248,224
,1,1,1,3,3,7,31,31,128,128,128,1
92,192,224,240,248

3020 DATA 126,255,255,255,255,12
6,60,0,1,2,2,4,4,8,8,60,128,64,6
4,32,32,16,16,60

3030 DATA 9,31,9,1,3,1,0,0,32,24
0,32,0,128,0,0,0,1,1,73,255,73,7
3,255,73,0,0,36,254,36,36,254,36
```

Atari Split-screen

by Paul Lay

'Split-screen' is a clever utility for a 16k Atari 400/800.

The program allows you to divide the Atari's screen refresh routine between two different displays — one graphic, the other text. The net result is that you can (apparently) display text and graphics at the same time.

The program intercepts the deferred vertical blank interrupt signal, and instructs it to alternate between two totally independent displays. Thus each display is refreshed at 1/25th second intervals instead of 1/50th. Since the human eye has a perception rate of approximately 1/16th second, we are fooled into seeing the two alternating displays as one uninterrupted one.

The beauty of this method is that the text and graphics screens are genuinely independent, so you can have both text and graphics on the same line, scroll text without affecting the graphics, and so on.

The program has been set up with a GRAPHICS 0 text screen and a GRAPHICS 7 graphics screen, but these may be changed if desired.

To use the routine in your own programs, add your code to the listing below. To force graphics to the prepared screen, GOSUB GRAPH just before entering the graphics statements. Similarly with text, GOSUB TEXT and then print to the screen in the usual way. Note that the TEXT subroutine positions the text cursor at 0,0.

Split screen does have one major problem: screen flicker. Although the brain can't see the two displays as separate, it's being asked to cope with a continuously changing image and perceives this as a rapid flickering. In order to minimise the effects of this, the author recommends the following:-

(a) Use dark background colours and bright foreground ones.
(b) Don't change the background colour once set.
(c) Don't change graphics mode once set.

Page 6 locations 1536-1562 and 1636-1662 are used by the routine, so these memory locations must not be used by your program. Similarly, free memory above RAMTOP-8192 should be avoided if possible.

Note that you cannot change the text background colour or the value of COLOUR 3.

The screen flicker is irritating. Our referee suggests that it may even cause epileptic and migraine attacks in sufferers of either illness. If anyone can think of some way of eliminating or reducing the flicker, let me know.

```
100 GRAPHICS 16
110 TL=PEEK(560):TH=PEEK(561)
120 GRAPHICS 55
130 GL=PEEK(560):GH=PEEK(561)
140 RT=PEEK(106)*256
150 DL=GL+256*GH
160 GM=RT-8192
170 MH=INT(GM/256):ML=GM-MH*256
180 POKE DL+4,ML:POKE DL+5,MH
190 COM INIT$(11)
200 FOR A=1 TO 11:READ B
210 INIT$(A)=CHR$(B):NEXT A
220 DATA 160,0,162,6,169,7,32,92,228
230 DATA 104,96
240 DATA 160,255,140,48,2,160,255
250 DATA 140,49,2,169,0,141,198
260 DATA 2,160,100,162,6,169,7
270 DATA 32,92,228,76,98,228
280 FOR A=1536 TO 1562:READ B
290 POKE A,B:NEXT A
300 DATA 160,255,140,48,2,160,255
310 DATA 140,49,2,169,148,141,198
320 DATA 2,160,0,162,6,169,7,32,92
330 DATA 228,76,98,228
340 FOR A=1636 TO 1662:READ B
350 POKE A,B:NEXT A
360 POKE 1537,TL:POKE 1542,TH
370 POKE 1637,GL:POKE 1642,GH
380 A=USR(ADR(INIT$))
390 DL=GL+256*GH
400 GL=PEEK(DL+4):GH=PEEK(DL+5)
410 GRAPH=420:TEXT=440:GOTO 450
420 POKE 87,7:POKE 88,GL
430 POKE 89,GH:RETURN
```

```
440 ? :POSITION 0,0:RETURN
450 GOSUB TEXT:? "INITIALIZING ";
460 GOSUB GRAPH:COLOR 0
470 FOR A=0 TO 95
480 PLOT 0,A:DRAWTO 159,A:NEXT A
490 GOSUB TEXT:? ")";
500 REM Demonstration Program
510 GOSUB GRAPH:DEG
520 FOR COL=3 TO 1 STEP -1
530 COLOR COL
540 RX=COL*7
550 FOR T=0 TO 175 STEP 2
560 PLOT 80+RX*COS(T),30+20*SIN(T)
570 DRAWTO 80+RX*COS(T),30+20*SIN(-T)
580 NEXT T:NEXT COL
590 COLOR 2:PLOT 75,50
600 DRAWTO 75,55:PLOT 85,50
610 DRAWTO 85,55
620 COLOR 1:FOR A=56 TO 63
630 PLOT 74,A:DRAWTO 86,A:NEXT A
640 COLOR 2
650 FOR A=0 TO 50
660 X=INT(RND(1)*159)
670 Y=INT(RND(1)*95)
680 LOCATE X,Y,Z:IF Z<>0 THEN 660
690 PLOT X,Y:NEXT A
700 GOSUB TEXT
710 POSITION 2,7
720 ? "┌──────────────────┐"
730 ? "|Balloons In Space ||"
740 ? "└──────────────────┘"
750 FOR A=0 TO 1000:NEXT A:LIST
770 GOTO 770
```

TRS-80 Sound Synthesiser

by Andrew Wallis

'Sound synthesiser' is a program for TRS-80 owners with a sound box. It enables music to be composed in a similar fashion to the SOUND statement supported by some machines. If your cassette player has a monitor switch, directing output to the speaker while recording, you can use the program without a soundbox as follows:-

(a) Insert a scratch cassette into the player
(b) Plug in the cassette leads as for saving a program
(c) Switch on monitor
(d) Press RECORD

The program is menu driven. The only points to be made are that the pitch of a note is inversely proportional to the value entered, and that duration = value entered * pitch. Otherwise, the program is self-explanatory.

```
0 CLEAR 1000
1 REM ''' V.I.P (VERY IMPORTANT POINT)
2 REM *** ANSWER 'MEM SIZE' WITH '32700' ***
5 REM ***** MEMORY USED = 3221 *****
10 CLS
20 REM ***************
30 REM * SYNTHESIZER *
40 REM *     BY      *
50 REM *  A.WALLIS   *
60 REM ***************
70 REM ' DATA FOR M/L ROUTINE
80 DATA 62,2,211,255,221,33,188,127,221,78
90 DATA 0,22,10,121,183,202,58,127,221,126
100 DATA 1,183,194,22,127,221,54,1,30,30,2
110 DATA 195,24,127,30,1,221,70,1,123,211,255
120 DATA 16,254,221,70,1,62,2,211,255,16
130 DATA 254,21,194,24,127,22,10,13,194,24,127
140 DATA 221,35,221,35,195,252,126,62,2,211,255,201
150 REM ' READ M/L INTO MEMORY
160 FOR X=32500 TO 32500+74
170 REM ' START TO FINISH OF TABLE
180 READ D
190 POKE X,D
200 NEXT X
210 POKE 16527,126
220 POKE 16526,244
230 REM ' TELL TRS-80 WHERE M/L ROUTINE IS STORED
240 CLS
250 A$="S Y N T H E S I Z E R"
260 PRINT@540-LEN(A$)/2,A$
270 GOSUB 1000
280 GOSUB 1000
290 CLS
300 PRINT@0,"C H O I C E S :"
310 PRINT@64*2,"<1>.....ENTER DATA FOR MUSIC"
320 PRINT@64*4,"<2>.....PLAY MUSIC"
330 PRINT@64*6,"<3>.....TERMINATE PROGRAM"
340 PRINT
350 REM   DISPLAY OPTIONS
360 PRINT@64*10,"ENTER # ( 1 - 3 )":INPUT CHOICE
370 IF CHOICE<1ORCHOICE>3THEN PRINT@64*10,
    STRING$(64,192):GOTO 360
380 ON CHOICE GOTO 10000,20000,999
999 CLS:END
1000 FOR DELAY=500 TO 0 STEP -1
1010 NEXT DELAY
1020 RETURN
10000 CLS
10010 PRINT@0,"MUSIC GENERATION MODE"
10020 GOSUB 1000
10030 PRINT@64*2,"THIS PROGRAM USES
      TWO VARIABLES TO GENERATE"
10035 GOSUB 1000
10040 PRINT@64*4,"MUSIC.TONE (PITCH) AND DURATION (LENGTH)"
10050 GOSUB 1000
10060 PRINT@64*6,"THESE VARIABLES HAVE VALUES
      BETWEEN 1 & 255 INC."
10065 GOSUB 1000
10067 PRINT@64*8,"DURATION IS ENTERED
      FIRST,FOLLOWED BY PITCH.
10068 PRINT@64*9,"ENTERING 999 FOR ** DURATION ** ",
10069 PRINT"INDICATES THE END OF INPUT DATA"
10070 GOSUB 1000:GOSUB 1000:GOSUB 1000
10080 CLS
10090 X=32700
10100 PRINT@64*8,"DURATION ( 1-255 INC.)":INPUT L
10110 IF L=999 THEN POKE X,0 :GOTO 10180
10120 IF L<1ORL>255 THEN PRINT@64*8,STRING$(64,192)
      ELSE GOTO 10130
10125 GOTO 10100
10130 POKE X,L:X=X+1
10135 CLS
10150 PRINT@64*8,"TONE ( 1-255 INC.)":INPUT T
10160 IF T<1 OR T>255 THEN PRINT@64*8,
      STRING$(64,192)ELSE 10170
10165 GOTO 10150
10170 POKE X,T:X=X+1
10175 CLS
10177 GOTO 10100
10180 CLS
10190 PRINT@64*8,"A L L   D O N E ! !"
10200 PRINT@64*10,"PRESS 'P' TO HEAR MUSIC SO FAR ,";
```

```
10205 PRINT" 'R' TO RETURN TO MAIN MENU"
10210 I$=INKEY$:IF I$=""THEN 10210
10215 IF I$="R" THEN GOTO 290
10220 IF I$<>"P"THEN 10200
10230 GOTO 20000
10235 END
20000 Q=USR(0)
20010 CLS
20020 PRINT@128,"PRESS 'M' TO HEAR TUNE AGAIN ,";
20025 PRINT" 'R' TO RETURN TO MAIN MENU"
20030 PRINT@64*3,"AND 'A' TO ADD MORE DATA TO CURRENT TUNE"
20040 I$=INKEY$
20050 IF I$=""THEN 20040
20060 IF I$="M"THEN GOTO 20000
20070 IF I$="R" THEN GOTO 290
20080 IF I$="A" THEN GOTO 10100
20090 GOTO 20040
```

3-D 'Bee

by D Morrison

This program shows how simple it is to use the HIRES graphics of the MicroBee to give a good three dimensional image with just Basic commands.

The idea of the game is to proceed down the ski slope, dodging the poles in the direction that their flags are pointing. If you go too near to a pole it will be knocked over. If you go on the wrong side it will turn around.

The program is fairly self explanatory with the several remark statements and shouldn't be too hard to follow. It will run on any 16k or 32k MicroBee with or without a joystick.

```
00100 REM
00110 REM ******* SLALOME SKIING *******
00120 REM
00130 REM **** initialize values
00140 DIM H(20),Q(20,2),U(20):OUT 0,255
00150 CLS:CURS 26,3:UNDERLINE:PRINT"Slalome Skiing":NORMAL
00160 CURS 35,16:PRINT"By  David. Morrison. 1983.";
00170 CURS 1,7:IF Z<>0 THEN 210
00180 INPUT"Joystick control (YES or NO)? ";A1$
00190 S=2:IF A1$(;1,1)="Y" OR A1$(;1,1)="y" THEN LET S=1 ELSE
      PRINT"Use '<' and '>' repeatatively for left and right."
00200 INPUT"Number of players (1 - 5)? ";Z
00210 INPUT"Slope of mountain (0 steep - 100 flat)? ";E
00220 INPUT"Pickup speed (0 fast - 8 slow)? ";D1:D1=(9-D1)/10
00230 REM **** clear pole data
00240 FOR I=0 TO 20:FOR J=0 TO 2:Q(I,J)=0:NEXT J:NEXT I
00250 REM **** create positions for poles (alternating)
00260 P=0:F=-1:FOR Y=240 TO 32 STEP -INT(RND*15+35)
00270 IF F=-1 THEN LET X=300+INT(RND*70):F=1 ELSE LET
      X=INT(RND*70)+160:F=-1
00280 Q(P,0)=X:Q(P,1)=Y:Q(P,2)=F:P=P+1:NEXT Y:R=1
00290 REM **** set up screen for hillside
00300 HIRES:P=0:CURS 1,15:PRINT [A64 45];
00310 REM **** set error for disqualification
00320 ON ERROR GOTO 790
00330 REM **** draw in all poles
00340 GOSUB [Q(P,0),Q(P,1),Q(P,2)] 610:P=P+1
00350 IF Q(P,0)<>0 THEN 340
00360 REM **** wait for player to be ready
00370 CURS 1,16:PRINT"Player"R", press any key to start.";
00380 IF KEY$="" THEN 380
00390 REM **** initialize variables
00400 T=0:K=1:A=5:B1=-1:V=255:W=255:X=255:Y=255:P=0
00410 REM **** main game loop
00420 ON S GOSUB 510,550:V=X:W=Y:X=X-A*INT(B1):Y=Y+INT(B1)
00430 FOR I=0 TO E:NEXT I:T=T+1+E/50
00440 G=-USED:CURS1,16:PRINT"Player"R":      ";
00450 CURS 15,16:G=-USED:PRINT"Time "T"      ";
```

```
00460 CURS 28,16:PRINT"Time Limit "G+128"      ";
00470 IF K=-1 THEN CURS 50,16:PRINT"Disqualified!";
00480 IF Y<Q(P,1) THEN GOSUB [Q(P,0),Q(P,1),Q(P,2)] 680:P=P+1
00490 PLOT V,W TO X,Y:GOTO 420
00500 REM **** input from joystick
00510 L=IN(0):L=12-(LAND12):IF L<>4 AND L<>8 THEN 560
00520 IF L=4 THEN LET A=A-1 ELSE LET A=A+1
00530 GOTO 580
00540 REM **** input from keyboard
00550 A1$=KEY$:IF A1$="," OR A1$="." THEN 570
00560 B1=B1-D1:RETURN
00570 IF A1$="," THEN LET A=A-1 ELSE LET A=A+1
00580 IF B1<-1 THEN LET B1=B1+D1
00590 RETURN
00600 REM **** draw in a pole
00610 VAR(M,N,G):O1=FLT(N+1)/80+1:PLOT M,N TO M,N+INT(40/O1)
      TO M+G*INT(20/O1),N+INT(36/O1) TO M,N+INT(32/O1):RETURN

00620 REM **** draw in a turned around pole
00630 O1=FLT(N+1)/80+1:PLOTR M,N+INT(40/O1) TO M+G*INT(20/O1),
      N+INT(36/O1) TO M,N+INT(32/O1):PLOT M,N+INT(40/O1) TO
      M-G*INT(20/O1),N+INT(36/O1)TOM,N+INT(32/O1):RETURN
00640 REM **** draw in a knocked over pole
00650 O1=FLT(N+1)/80+1:PLOTR M,N TO M,N+INT(40/O1) TO
      M+G*INT(20/O1),N+INT(36/O1) TO M,N+INT(32/O1)
00660 PLOT M,N TO M+INT(80/O1)*G,N TO M+INT(72/O1)*G,
      N-INT(8/O1) TO M+INT(64/O1)*G,N:RETURN
00670 REM **** check position as we go past pole
00680 VAR(M,N,G)
00690 IF G=-1 THEN 750
00700 REM **** right facing pole
00710 IF X>M THEN 730
00720 K=-1:IF X>M-20 THEN GOSUB 650 ELSE GOSUB 630
00730 RETURN
00740 REM **** left facing pole
00750 IF X<M THEN 770
00760 K=-1:IF X<M+20 THEN GOSUB 650 ELSE GOSUB 630
00770 RETURN
00780 REM **** check whether end or off screen
00790 IF X<1 OR X>510 OR Y>33 THEN CURS 1009:PRINT"Disqualified"
      ;:K=-1
00800 H(R)=T*K:R=R+1:FOR I=0 TO 1500:NEXT I:A1$=KEY$:IF R<=Z
      THEN 300
00810 REM **** add up scores
00820 FOR I=1 TO Z:IF H(I)>0 THEN LET U(I)=U(I)+10000/H(I)
00830 NEXT I
00840 REM **** display scores
00850 CLS:CURS 28,2:UNDERLINE:PRINT"Scores":NORMAL:PRINT
00860 FOR I=1 TO Z:PRINT TAB(15)"Player";I[A20 46]U(I):NEXTI
00870 REM **** input for another go
00880 CURS 1,16
00890 PRINT"Press any key to continue, <RETURN> to restart";
00900 A1$=KEY$:IF A1$="" THEN 900
00910 IF A1$=CHR$(13) THEN 150 ELSE 240
```

Sprite Designer

by N Palmer

Not many machines have hardware sprites, and those that do generally need to use POKEs to get the sprites up and moving. N Palmer solves this problem with this sprite designer program for the Commodore 64.

The program allows the sprite to be designed on a grid. As the sprite is being made up, four sprites can be seen building up. They are in the form of non-expanded, x-expanded, y-expanded and x,y-expanded. Full operating instructions are included within the program and they can be viewed at any time without disturbing the sprite currently being designed,

After the sprite is finished it can be saved to tape. It can later be retrieved from tape for alterations if necesssary.

To include the sprites in your own program just use the display data routine and copy the data statements into your program. These data statements can be read and POKEd into the appropriate registers for use. The program takes up about 13k of memory when run, so there should be no problems in fitting it into a 64k machine (even though there is not exactly 64k available).

```
10 REM **********************************
20 REM **        NITIN J. PARMAR       **
30 REM **        SPRITE DESIGNER       **
40 REM **             1983             **
50 REM **********************************
60 :
70 POKE53280,6:POKE53281,6:POKE646,5:V=53248:POKEV+21,0:POKEV+24,23
72 FOR X=0 TO 7:POKE2040+X,13:NEXT
75 PRINTCHR$(8)
80 DIMXY(24,21),SD(62)
90 PRINT CHR$(147)
95 PRINT"■■/. \. ARMAR ";CHR$(34);"●¬_\|‾ ‾‾●.|/‾_";CHR$(34);" (-) 1983"
100 PRINT"■■■■■■■■■■■■■■■■■■■■■■                  "
110 PRINT"■■■■■■■■■■■■■■ ●¬_\|‾ ‾‾●.|/‾_ "
120 PRINT"■■■■■■■■■■■■■■                  "
130 PRINT"■■■■■■■■■■■■■■■■■■■■DO YOU REQUIRE INSTRUCTIONS ?"
140 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■■■(Y/N)"
150 GET A$:IF A$="Y" THEN 10070
160 IF A$="N" THEN 200
170 GOTO 150
200 PRINT CHR$(147):POKE646,12:POKEV+21,0:POKEV+33,6:POKEV+32,6
210 PRINT"■■■■■■■■■■■■■■■■■■■■               "
220 PRINT"■■■■■■■■■■■■■■■■■■■■ ┌¬|.┌/● \"
230 PRINT"■■■■■■■■■■■■■■■■■■■■               "
240 PRINT TAB(9)"■■■■F1 TO CREATE SPRITE"
250 PRINT TAB(9)"■F2 TO WRITE DATA ONTO TAPE"
260 PRINT TAB(9)"■F3 TO READ DATA FROM TAPE"
270 PRINT TAB(9)"■F4 TO ALTER SPRITE"
280 PRINT TAB(9)"■F5 TO DISPLAY SPRITE"
290 PRINT TAB(9)"■F6 TO DISPLAY DATA"
295 PRINT TAB(9)"■F7 TO DISPLAY INSTUCTIONS"
296 PRINT TAB(9)"■F8 TO EXIT FROM PROGRAM"
300 GET A$:IF A$="" THEN 300
310 A=ASC(A$):IF A<133 OR A>140 THEN 300
320 A=A-132
330 ON A GOTO 379,1620,1710,10070,1330,9000,6000,10780
379 AL=0
380 POKEV+33,11:PRINT CHR$(147);"■■■";:POKEV+21,0:POKE646,12
390 FOR X=65 TO 88:PRINTCHR$(X+128);:NEXT X
400 PRINT CHR$(19),"■"
410 FOR X=1 TO 21:IF X<=9 THEN PRINT"0";RIGHT$(STR$(X),1):GOTO 430
420 PRINT RIGHT$(STR$(X),2)
430 NEXT:PRINT"■■■■";
440 FOR T=0 TO 2
450 FOR X=8 TO 1 STEP -1
460 PRINT MID$(STR$(X),2,1);:NEXT:NEXT
470 PRINT CHR$(19);"■"
480 FOR X=65 TO 85
490 PRINT TAB(28) CHR$(X+128)
500 NEXT:IF AL=1 THEN 9100
510 PRINT CHR$(19);"■"
520 FOR X=1 TO 21:PRINT"■■■";
530 FOR Y=1 TO 24
540 PRINT".";
550 NEXT:PRINT:NEXT:Q=0
560 CLR:DIMXY(24,21),SD(62):V=53248:FORX=0TO62:POKE832+X,0
565 SD(X)=0:NEXT
570 PRINT CHR$(19);"■■■■■.";:X%=1:Y%=1
571 GOSUB 5000:AL=0
580 GET A$
581 IF XY(X%,Y%)=0 THEN PRINT"■■.";
```

```
582 IF XY(X%,Y%)=1 THEN PRINT"▮▧ ";
590 IF A$="▮" THEN GOSUB 730
600 IF A$="▮" THEN GOSUB 790
610 IF A$="▧" THEN GOSUB 850
620 IF A$="⌉" THEN GOSUB 900
630 IF A$="E" THEN 200
640 IF A$=" " THEN GOSUB 960
650 IF A$=CHR$(20) THEN GOSUB 1050
655 IF A$="▧" THEN PRINT"▧▧▧▮▮▮▮";:X%=1:Y%=1
656 IF A$="⌉" THEN PRINT"▬":GOTO 380
660 IF XY(X%,Y%)=0 THEN PRINT"▮▧.";
670 IF XY(X%,Y%)=1 THEN PRINT"▮▬ ";
690 GOTO 580
730 IF X%=24 AND Y%=21 THEN PRINT"▧▧▧▮▮▮▮";:X%=1:Y%=1:RETURN
740 IF X%=24 THEN X%=1:Y%=Y%+1:PRINT"▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▧▮";:RETURN
750 X%=X%+1:PRINT"▮";:RETURN
790 IF X%=1 AND Y%=1 THEN 792
791 GOTO 800
792 PRINT"▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮";:X%=24:Y%=21:RETURN
800 IF X%=1 THEN X%=24:Y%=Y%-1:PRINT"▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮⌉▮";:RETURN
810 X%=X%-1:PRINT"▮";:RETURN
850 IF Y%=21 AND X%=24 THEN PRINT"▧▧▧▮▮▮▮";:X%=1:Y%=1:RETURN
855 IF Y%=21 THEN PRINT"TTTTTTTTTTTTTTTTTTTTT▮";:X%=X%+1:Y%=1:RETURN
860 Y%=Y%+1:PRINT"▧";:RETURN
900 IF Y%=1 AND X%=1 THEN 902
901 GOTO 903
902 PRINT"▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮";:X%=24:Y%=21:RETURN
903 IF Y%=1 THEN PRINT "▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▮";:X%=X%-1:Y%=21:RETURN
904 PRINT "⌉";:Y%=Y%-1:RETURN
910 Y%=Y%-1:PRINT"⌉";:RETURN
960 GOSUB1125:XY(X%,Y%)=1:PRINT"▮▧ ▮";:X%=X%+1
970 IF X%=25 AND Y%=21 THEN GOTO 1010
1000 IF X%=25 THEN X%=1:Y%=Y%+1:PRINT"▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▧▮";
1005 RETURN
1010 PRINT"TTTTTTTTTTTTTTTTTTTTT▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮";:X%=1:Y%=1
1015 RETURN
1050 IFX%=1 AND Y%=1 THEN 1052
1051 GOTO 1053
1052 PRINT"▬▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮.";:X%=24:Y%=21:GOTO1055
1053 IF X%=1 THEN PRINT"▬▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮⌉.";:Y%=Y%-1:X%=24:GOTO1055
1054 PRINT"▬▮▮.";:X%=X%-1
1055 GOSUB 1240:RETURN
1060 IF X%=0 THEN X%=24:Y%=Y%-1:PRINT"▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮⌉";
1070 IF Y%=0 THEN 1090
1080 RETURN
1090 Y%=21:X%=24:PRINT"▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧▧";:RETURN
1125 IF XY(X%,Y%)=1 THEN RETURN
1130 IF (X%/8)=INT(X%/8) THEN DX=X%/8-1:GOTO 1150
1140 DX=INT(X%/8)
1150 DD=((DX+1)+Y%*3)-4
1160 A=PEEK(832+DD)
1170 DB=(((X%-1)/8-INT((X%-1)/8))*8)
1180 BD=INT(2↑(7-DB)+.5)
1185 IF A$=CHR$(20) THEN 1260
1190 A=A+BD:POKE832+DD,A:SD(DD)=SD(DD)+BD
1200 RETURN
1240 IF XY(X%,Y%)=0 THEN RETURN
1250 XY(X%,Y%)=0:GOTO 1130
1260 A=A-BD:POKE832+DD,A:SD(DD)=SD(DD)-BD
1270 RETURN
1330 PRINTCHR$(147):POKEV+21,0
1331 PRINT"▮▮▮▮▮▮▮▮▮▮▮▮▮▧                    "
1332 PRINT"▮▮▮▮▮▮▮▮▮▮▮▮▮▧ ○─↘|↖↙|  ─♠|♠ "
1333 PRINT"▮▮▮▮▮▮▮▮▮▮▮▮▮▧                    "
1340 POKEV+33,9:POKEV+32,12:POKE646,8
1350 FOR X=0 TO 62:IF SD(X)<>0 THEN X=62:NEXT:GOTO 1400
1360 NEXT:GOSUB1370:GOTO200
1370 PRINT"▧▧▧▧▮ORRY THERE ARE NO SPRITES IN REGISTERS":GOSUB 10710
1380 FOR DL=0 TO 2000:NEXT
1390 POKEV+32,6:POKEV+33,6:RETURN
1400 PRINT"▧▮▮▮▮▮▮▮▮▮▮ORITING ─ATA |O |APE"
1410 INPUT"▧▧▧▮▮PRITE NAME    ▧▮▮▮";SN$
1420 IF LEN(SN$)>16 THEN PRINT"▧▧▮╱AME TOO LONG (16 CHRS MAX)":GOTO 1410
1425 IF LEFT$(SN$,1)="▧" THEN SN$=""
1445 IF A$="▬" THEN RETURN
1450 PRINT"▧▧▮▮▮▮▮▮▮";:OPEN1,1,1,SN$
1460 PRINT CHR$(147):FOR X=0 TO 62
1470 PRINT#1,SD(X):NEXT:CLOSE1
1490 PRINT"▧▧▧▮▮OULD YOU LIKE TO VERIFY DATA (|/╱)"
1500 GETYN$:IF YN$="N" THEN 200
1510 IF YN$="Y" THEN 1530
1520 GOTO 1500
1530 PRINT CHR$(147):"▧▧▧▧▧▧▧▧▮▮▮▬EWIND TAPE THEN PRESS ";CHR$(34);"X";CHR$(34)
```

Business is making money work

- Excalibur 64 is the low cost business computer
- Up to 2000 Kilobytes of stored information using space saving low cost diskette storage
- CPM 2.2 Disk software for all business applications
- Professional presentation colour and graphics
- Word processing in 80 x 24 format
- Direct output to typewriter quality printers
- Professional typist keyboard
- Designed for the Australian businessman

Computers: indispensible to education

- 64 K RAM on board
- Low cost cassette interface for educational programs
- Forth, Pascal, Fortram available in ROM and tape
- Essay writer: tape and ROM word processor
- Fast 4.0 MHZ action
- R.G.B., video and R.F. standard monitor and TV connection
- Standard RS232 and centronics parallel interface
- Z 80 A CPU
- Advanced on board colour basic
- Designed for the Australian student

a day in the life of the

'I chose value, quality and flexibility in a computer for my business. The Australian designed and manufactured Excalibur 64 at under $1000 fulfills my business needs.'

'I didn't like to study before I had a computer. My Excalibur 64 has made study easier and fun.'

Everyone gets tired of work and wants to play

- Games
- Graphics (126 programmable graphics and 126 preprogrammed)
- 26 colours
- High speed
- Low priced entertainment programs
- 640 x 288 High Resolution
- 320 x 288 Low Resolution
- Joy stick controller available for all games
- 4 channel sound – music synthesiser
- Real time clock
- Voice synthesiser
- Designed for the Australian home

Excalibur 64

'Until our Excalibur 64 came home, I was afraid of computers. I'm not now. I can watch my family growing into the future.'

Ask your local computer retailer for the Excalibur 64

He can demonstrate any:

- Business
- Educational
- Games Package Programs

Let your sense of value make the decision for you and your family. The Excalibur 64 is designed, developed and manufactured by Australians.

Something this good has to be Australian.

BGR

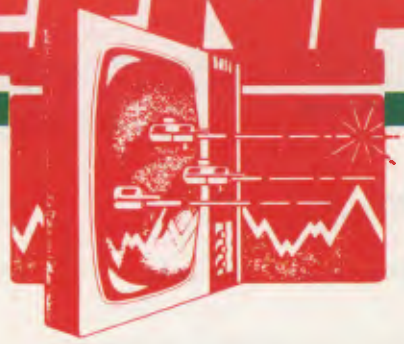
Dealer enquiries:
BGR Computers PTY LTD
GPO Box 5302 BB
Melbourne 3001
(03) 383 4200

Factory: 10 Breese Street, Brunswick, Melbourne.

```
1535 GETW$:IFW$<>"V" THEN 1535
1540 OPEN1,1,0,SN$
1550 FOR X=0 TO 62:INPUT#1,S:IF S<>SD(X) THEN X=62:NEXT:CLOSE1:GOTO 1570
1560 NEXT:PRINTCHR$(147);"■■■■■■VERIFY ▢✓":FORDL=0TO2000:NEXT:CLOSE1:GOTO200
1570 PRINT"■■■■■■■VERIFY ERROR■"
1580 PRINT"■■■WOULD YOU LIKE TO RE-SAVE (Y/N)"
1590 GETYN$:IF YN$="N" THEN 200
1600 IF YN$="Y" THEN 1450
1610 GOTO 1590
1620 POKE V+32,6:POKEV+33,2:POKE 646,5
1625 PRINT CHR$(147)
1626 PRINT SPC(12)"■                  "
1630 PRINT SPC(12)"■ ▁▔♠▔⸝╱▏ ▔♠▏♠ "
1635 PRINT SPC(12)"■                  "
1640 GOSUB 1410
1650 OPEN1,1,0,SN$
1660 FOR X=0 TO 62
1670 INPUT#1,SD(X)
1680 NEXT
1690 CLOSE1:GOSUB 10750:GOSUB 10000
1700 FOR X=0 TO 62:POKE832+X,SD(X):NEXT
1710 POKEV+21,0:POKEV+33,9:POKEV+32,9:POKEV+16,0:POKE646,4
1720 GOTO 1760
1730 POKEV,70:POKEV+4,255:POKEV+8,70:POKEV+6,255:POKEV+23,12:POKEV+29,24
1740 POKEV+1,111:POKEV+5,90:POKEV+7,159:POKEV+9,180
1750 POKEV+21,255:GOTO 1850
1760 PRINTCHR$(147)
1770 PRINT"■■■■■■■■■■■■■                "
1780 PRINT"■■■■■■■■■■■■■ ●▔⸝▏▔ ▔⸝●▔♠▏ "
1790 PRINT"■■■■■■■■■■■■■                "
1800 FOR X=0 TO 62:IF SD(X)<>0 THEN 1730
1810 NEXT X
1820 PRINT "■■■■SORRY THERE ARE NO SPRITES IN REGISTERS":GOSUB 10710
1830 FOR DL=0 TO 2000:NEXT DL
1840 GOTO200
1850 POKE646,14:PRINT"■■■■■■■■■■■■■■■■NON-EXPANDED";SPC(10);"Y-EXPANDED"
1860 PRINT"■■■■■■■■■■■■■■X-EXPANDED";SPC(9);"XY-EXPANDED":POKE646,4
1870 PRINT"■■■■■■■■■■■■ ▔⸝▔●● ●▔♠▔▔ ▏♠▁ ▏▔ ▔▔╱⸝╱▔ ■"
1880 IF PEEK(203)<>60 THEN 1880
1890 GOTO 200
4999 GOTO4999
5000 POKEV+21,0
5010 POKEV+16,255
5020 FOR X=0 TO 8 STEP 2
5030 POKEV+X,20:NEXT
5040 POKEV+23,12:POKEV+29,24
5050 POKEV+1,60:POKEV+9,97:POKEV+5,137:POKEV+7,195
5060 POKEV+21,29:RETURN
6000 GOTO 7020
6008 FD=-1:FOR X=A TO A+2
6009 FOR IN=0 TO 78:PRINTCHR$(148);:NEXT
6010 PRINT MID$(STR$(X),2);" DATA ";
6020 FOR XX=1 TO 17:FD=FD+1
6030 PRINT MID$(STR$(SD(FD)),2);
6035 IF XX<>17 THEN PRINT",";
6040 NEXT XX:PRINT:NEXTX
6050 FOR IN=0 TO 78:PRINTCHR$(148);:NEXT
6060 PRINT MID$(STR$(X),2);" DATA ";
6070 FOR XX=51 TO 62
6080 PRINT MID$(STR$(SD(XX)),2);
6090 IF XX<>62 THEN PRINT",";
7010 NEXT XX:PRINT:GOSUB10630:GOTO200
7020 PRINT CHR$(147):POKEV+32,2:POKEV+33,12:POKE646,6
7030 PRINT"■■"
7040 PRINT"■■■■■■■■■■■■■▔ ▔ ▔ ▔ ▔ ▔ ▔ ▔ ▔■"
7050 PRINT"■■■■■■■■■■■■■      ▔♠▏♠ L⸝╱▔●     ▏"
7060 PRINT"■■■■■■■■■■■■■▁ ▁ ▁ ▁ ▁ ▁ ▁ ▁ ▁■"
7070 PRINT:PRINT:PRINT:GOTO8010
7080 INPUT "FROM WHAT LINE WOULD YOU LIKE TO START■■■■■■■    ■■■■";A
7090 IF A<0 OR A>63995 THEN PRINT"■ OUT OF RANGE !!(0 TO 63995)■■":GOTO7080
8000 PRINT"■":GOTO 6008
8010 FOR X=0 TO 62:IF SD(X)<>0 THEN 7080
8020 NEXT X
8030 PRINT"■■SORRY THERE ARE NO SPRITES IN REGISTERS":GOSUB 10710
8040 FOR DL=0 TO 2000:NEXT DL:GOTO 200
9000 AL=1:POKEV+21,0:POKEV+32,6:POKEV+33,6:POKE646,5
9010 PRINT CHR$(147)
9020 PRINT"■■■■■■■■■■■■■■■              "
9030 PRINT"■■■■■■■■■■■■■■■ ♠L▏▔⸝╱ ●▔⸝▏▔ "
9040 PRINT"■■■■■■■■■■■■■■■              "
9050 B=0:FOR X=0 TO 62:POKE832+X,SD(X):B=B+SD(X)
9060 NEXT X:IF B<>0 THEN AL=1:GOTO 380
9070 PRINT"■■■■SORRY THERE ARE NO SPRITES IN REGISTERS":GOSUB 10710
```

```
9080 FOR DL=0 TO 2000:NEXT DL
9090 GOTO 200
9100 PRINT"█████";
9110 FOR Y1=1 TO 21
9120 FOR X1=1 TO 24
9130 IF XY(X1,Y1)=0 THEN PRINT "█.";:GOTO 9150
9140 PRINT "█ █";
9150 NEXT X1
9160 PRINT:PRINT"███";
9170 NEXT Y1
9180 X%=1:Y%=1:PRINT"███████";:GOTO 571
10000 X1=0:X2=-1:FOR Y=1 TO 21
10010 FOR X=1 TO 17 STEP 8:X2=X2+1
10020 FOR XX= 7 TO 0 STEP -1:X1=X1+1
10030 IF (SD(X2) AND 2↑XX)=(2↑XX) THEN XY(X1,Y)=1:GOTO 10050
10040 XY(X1,Y)=0
10050 NEXT XX:NEXT X:X1=0:NEXT Y
10060 RETURN
10070 PRINT CHR$(147):POKEV+21,0:POKEV+32,12:POKEV+33,12:POKE646,11
10080 PRINT SPC(2)"╲NSTRUCTIONS FOR F1  -  ♦PRITE ╲AKER"
10085 PRINT SPC(2)"────────────────────────────────":POKE646,2
10090 PRINT:PRINT
10100 PRINT SPC(1)"|HE CURSOR KEYS MOVES THE CURSOR AROUNDTHE GRID.█"
10110 PRINT SPC(1)"|HE ";CHR$(34);"─┴─";CHR$(34);" KEY CLEARS THE GRID AND";
10120 PRINT SPC(6)"CLEARS THE SPRITE REGISTERS.█"
10130 PRINT SPC(1)"|HE ";CHR$(34);" |⌐╲⌐";CHR$(34);" KEY PLACES THE CURSOR";
10140 PRINT SPC(1)"THE   HOME POSITION.█"
10150 PRINT SPC(1)"|HE ";CHR$(34);"⌐⌐L";CHR$(34);" KEY DELETES THE CHARACTER";
10160 PRINT SPC(4)"BEHIND THE CURSOR AND REPLACES IT WITH A";CHR$(34);".";
10170 PRINT CHR$(34):PRINT
10180 PRINTSPC(1)"|HE "CHR$(34);"⌐";CHR$(34);" KEY EXITS FROM THE SPRITE MAKER"
10190 GOSUB 10630
10200 PRINT CHR$(147):POKE646,11
10210 PRINT SPC(0)"╲NSTRUCTIONS FOR F2-ORITING ⌐ATA ┌N |APE";
10220 PRINT SPC(0)"──────────────────────────────────────":PRINT:POKE646,2
10230 PRINT SPC(1)"╲F THERE ARE NO SPRITES IN REGISTERS   THEN A MESSAGE WILL";
10240 PRINT SPC(1)"APPEAR TO REMIND    YOU.█"
10250 PRINT SPC(1)"|HE NAME YOU PUT IN MUST BE A MAXIMUM  OF 16 CHARACTERS.█"
10260 PRINT SPC(1)"|HE FILE NUMBER MUST BE BETWEEN 1 AND  255.█"
10270 PRINT SPC(1)" |OU CAN ALSO VERIFY THE DATA STORED ON TAPE."
10280 GOSUB 10630
10300 PRINT CHR$(147):POKE646,11
10310 PRINT SPC(1)"╲NSTUCTIONS FOR F3-_EADING ⌐ATA (|APE)"
10320 PRINT SPC(1)"────────────────────────────────────":PRINT:PRINT
10325 POKE646,2
10330 PRINT SPC(1)"|HE NAME YOU PUT IN MUST BE A MAXIMUM  OF 16 CHARACTERS.█"
10340 PRINT SPC(1)"|HE FILE NUMBER MUST BE BETWEEN 1 AND  255.█"
10350 PRINT SPC(1)"⌐LACE THE TAPE IN THE CASSETTE DECK    BEFORE YOU PRESS ";
10360 PRINT CHR$(34);"─| ⁄─⁄";CHR$(34);" ON THE FILE   NUMBER INPUT.█"
10370 PRINT SPC(1)"⌐RESS ";CHR$(34);"♦|⌐⌐";CHR$(34);" ON THE TAPE DECK";
10380 PRINT SPC(1)"WHEN YOU ARE ASKED TO DO SO.█"
10390 PRINT SPC(1)"|HE SPRITES WILL AUTOMATICALLY BE DIS- PLAYED AFTER";
10400 PRINT SPC(1)"LOADING DATA FROM CASSETTE."
10410 GOSUB 10630
10430 PRINT CHR$(147):POKE646,11
10440 PRINT SPC(1)"╲NSTUCTIONS FOR F4  -  ♠LTERING ♦PRITE"
10450 PRINT SPC(1)"──────────────────────────────────":PRINT:PRINT
10455 POKE646,2
10460 PRINT SPC(1)"╲F THERE ARE NO SPRITES IN REGISTERS   THEN A MESSAGE WILL";
10470 PRINT SPC(1)"APPEAR TO REMIND    YOU.█"
10480 PRINT SPC(1)"|HE INSTUCTIONS TO THE SPRITE MAKER    (F1) WILL APPLY."
10490 GOSUB 10630
10500 PRINT CHR$(147):POKE646,11
10510 PRINT SPC(0)"╲NSTUCTIONS FOR F5  -  ⌐ISPLAYING ♦PRITE";
10520 PRINT"────────────────────────────────────":PRINT:POKE646,2
10530 PRINT SPC(1)"╲F THERE ARE NO SPRITES IN REGISTERS   THEN A MESSAGE WILL";
10540 PRINT SPC(1)"APPEAR TO REMIND    YOU.█"
10545 PRINT SPC(1)"♠LL EXPANDED SPRITES WILL BE SHOWN."
10550 GOSUB 10630
10560 PRINT CHR$(147):POKE646,11
10570 PRINT SPC(1)"╲NSTRUCTIONS FOR F6  -  ⌐ISPLAYING ⌐ATA";
10580 PRINT SPC(1)"────────────────────────────────────":PRINT:POKE646,2
10590 PRINT SPC(1)"╲F THERE ARE NO SPRITES IN REGISTERS   THEN A MESSAGE WILL";
10600 PRINT SPC(1)"APPEAR TO REMIND    YOU.█"
10610 PRINT SPC(1)"♠ LINE NUMBER BETWEEN 0 AND 63995 MUST BE CHOSEN.█"
10611 PRINT SPC(1)"⌐ITHER LOAD MAIN PROGRAM AND ENTER DATALINES OR";
10612 PRINT SPC(1)"NEW PROGRAM, ENTER DATA LINES  AND MAKE THE MAIN PROGRAM";
10613 PRINT SPC(1)"AROUND THE    DATA LINES."
10620 GOSUB 10630:GOTO 200
10630 PRINT CHR$(19):POKE646,11
10640 PRINT SPC(5)"███████████████████████⌐L⌐♦♦ <♦⌐♠─⌐ |♠─> |⌐ ⌐⌐/|╲/⌐";
10660 FOR DL=0 TO 200:GETA$:IF A$=" " THEN RETURN
10665 NEXT DL
10670 PRINT "⌐
10690 FOR DL=0 TO 100:GETA$:IFA$=" " THEN RETURN
10695 NEXT DL
10700 GOTO 10630
10710 POKE54296,0:POKE54276,0:POKE54277,0:POKE54296,15:POKE54277,10
10720 POKE54278,200:POKE54274,10:POKE54275,200AND15:POKE54276,65:POKE54272,10
10730 POKE54273,10:FOR DL=0 TO 300:NEXT:POKE54296,0:RETURN
10750 PRINT CHR$(147);SPC(3)"███████⌐L⌐♦♦⌐ ⌐L⌐♦♦ ♦|⌐⌐ ⌐⁄ | |⌐ |♠⌐ ⌐⌐─⁄"
10760 PRINT SPC(2)"███♦ORRY TO KEEP YOU WAITNG,╲ WON'T TAKE  MUCH LONGER."
10770 RETURN
10780 PRINTCHR$(147);"|YE":END
```

SCREENPLAY



Ian Davies has a look at games for Dick Smith's VZ-200.

MATCH BOX

Game: Match Box
Supplier: Video Technology
Price: $12.50

Match box is a memory enhancement program designed to increase your power of recollection in a game format. It runs on a standard VZ-200 with no extra memory required.

The screen is divided into twenty-five squares, each identified by a single letter. Beneath each square is a hidden symbol. Two players are required for this game, and the computer will take it in turns asking each player to select a pair of squares. The symbols underneath these squares will be revealed briefly, and then hidden again.

The objective of the game is to match up as many identical pairs of symbols as possible, and so it is necessary to remember where various symbols have appeared. Once a pair of symbols have been involved in an identical match, they are thereafter out of play. Each match scores a player one point, and the player with the highest number of points wins the game.

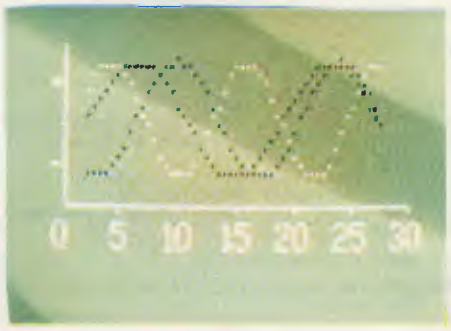
Match box is a series of three basic programs, which are automatically loaded into the VZ-200 one after the other. The first program displays the name of the game, the second provides instructions and the third actually plays the game. Because of this, Match Box is painfully slow to load and cannot repeat the instructions after a game without completely re-loading all three programs.

Additionally, the game runs very slowly and seems to crash regularly – requiring a complete re-load. On the plus side, Match Box will help to increase your retention and is non-violent – two rare characteristics in video games.

Use of graphics: ★★★
Use of sound: ★★
Addictive quality: ★★
Game speed: ★
Use of colour: ★★
Value for money: ★★

BIORYTHMS

Game: Biorythm/Pair Matching/ Calendar
Supplier: Video Technology
Price: $12.50



This tape consists of three programs all related to dates. The biorythm program (pictured) predicts your emotional, physical and intellectual highs and lows over a given period. It does this in a graphical format and provides text to (incorrectly) explain the meaning of the graph.

The pair matching program accepts the birthdates of *two* people and then tells you which week day they were born on. It then goes on to produce a percentage of compatability for emotional, physical and intellectual factors. It does this by comparing the two biorythms involved – a trivial process based on the number of days between the two dates.

The calendar program accepts two dates and tells you which day of the week those two dates were, and also how many days are between the two dates.

If you are thinking that these programs apply the same simple formula in three different ways, then you are probably correct. They all perform useful functions, but do not perform anything particularly clever.

Use of graphics:
Use of sound:
Addictive quality: ★
Game speed: ★
Use of colour:
Value for money: ★

CIRCUS

Game: Circus
Supplier: Video Technology
Price: $12.50

Under the Circus Big Top, acrobats perform death defying stunts on the catapult (see-saw). One acrobat jumps off a high platform onto the empty end of the catapult, thereby sending the other acrobat flying high into the air.

Your job is to move the catapult from left to right so that the acrobats continue to land on their respective ends and project the other into the air. A stream of balloons float high above the ring, and the acrobats must collect as many of these as possible for ten points per balloon. The game becomes progressively faster until it runs at an impressive speed, thereby sorting out the men from the boys.

Control of the catapult is really rather complex, as the game accurately models the actions of a real catapult. In other words, the second acrobat will be projected differently depending on how close to the pivot point the first one lands. This type of subtle control is very important, as the player inevitably finds himself in a position where the falling acrobat is going to land on top of the other acrobat. The only alternative is to move the catapult completely out of the way, in which case the airborne acrobat falls to his doom. With careful control, the dedicated player can learn to avoid this situation.

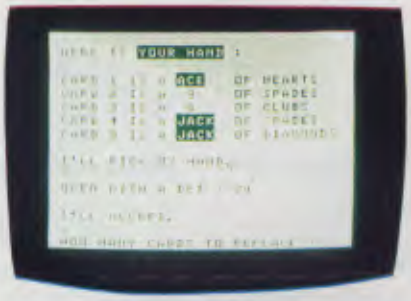
The game is over either when all the balloons have been collected, or when there have been five fatal falls.

Circus runs on an unexpanded VZ-200 and is played to the tune of "My Body Lies Over The Ocean". The game can make use of a joystick if one is installed. In general, Circus is a great deal of fun and rather addictive until one has master control of the catapult.

Use of graphics:	★★★★
Use of sound:	★★★
Addictive quality:	★★★★
Game speed:	★★★★★
Use of colour:	★★★
Value for money:	★★★★

POKER

Game: Poker
Supplier: Video Technology
Price: $12.50



VZ-200 Poker is a rather sad implementation of straight draw poker – you against the computer. It allows you to bet, raise, call, bluff and fold. So much for the good news.

Poker is written in Basic, and makes absolutely no use of colour, graphics or sound. These sins could easily be forgiven if it was a particularly good poker player, but alas, it is not. The program suffers badly from a fear of large bets, so a 100% reliable way to win is to place a bet of $100. It will immediately fold.

The program will happily replace –3 of your cards, and will even replace the same one three times. Any non-numeric input will result in the familiar "?REDO" message from Basic. The player can happily continue to spend more money than he owns.

Poker is the type of game that any novice could write in a single evening after a few weeks experience with Basic. That a game of this quality is available for purchase is disappointing.

Use of graphics:	
Use of sound:	
Addictive quality:	★
Game speed:	★
Use of colour:	
Value for money:	★

LAZING AROUND

by J J Clessa

Quickie

A 20kg monkey hangs from a rope which passes over a single pulley and is balanced by a 20kg weight hanging from the other end of the rope. The monkey begins to climb up the rope. *Will the 20kg weight go up, go down — or stay still?*

Prize puzzle

Three artists — Albert, Brian and Charles — each paint a picture on a square canvas. Brian's picture is seven square metres more than Albert's in area, and seven square metres less than Charles'. All sides have exact measurements. What are the dimensions of the pictures?

December prize puzzle

The puzzle would have presented very little problem for those of you with micros, although a little thought would have saved quite a bit of computer time — especially if you were to generate *all* 10-digit numbers rather than the smallest.

Since the required answer had to be divisible by the integers 1 to 12, it must be a multiple of 12 x 11 x 7 x 5 x 3 x 2 — that is 27720. Hence you could set up a simple loop with increments of 27720. Luckily, the solution is 1 234 759 680, which comes up relatively early in the loop.

You can cut down considerable time by tailoring the loop to skip whenever the second digit is equal to the first.

The winning entry came from M Young, Caringbah, NSW whose prize is on the way.

To those overseas entrants who were worried that their entries might arrive too late: I can't recall a case in which a late entry was from overseas.

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