ISSUE 13

FREE COMPETITION

Computer Age

DECEMBER 1980

60p

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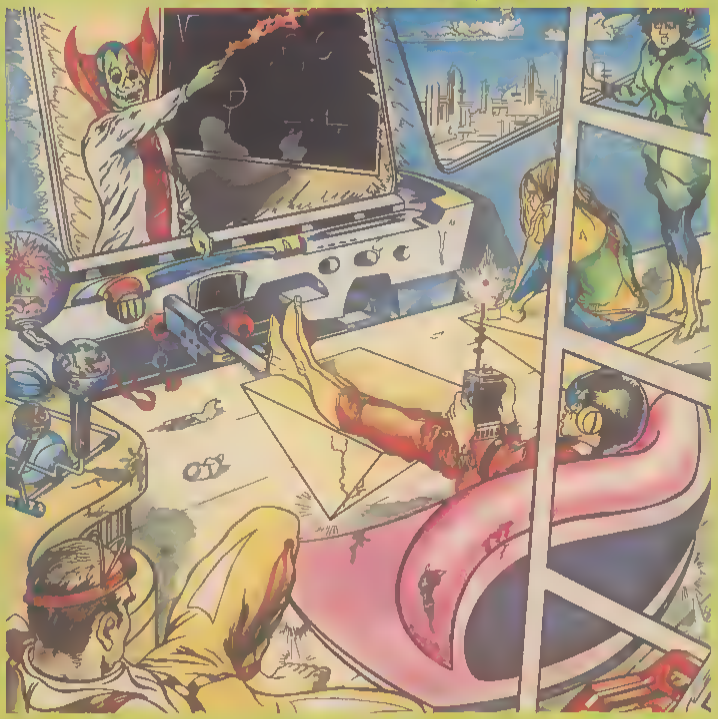

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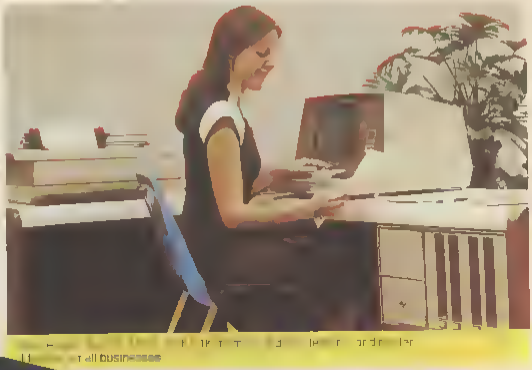

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by William Stok

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Martin Banks
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(Royal College of Art)

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Technical Victor Nicolls
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Advertisement Manager
Vanessa Blackburn [illegible] 01 928 8394

Advertisement Executive
Robert Greve 01 928 6394

Office Manager
Marian [illegible]

Secretary
Rebecca Foster

Publisher
John Fieshwater

Design Consultant
David G McFarlane

Typesetting
Input Typesetting Ltd

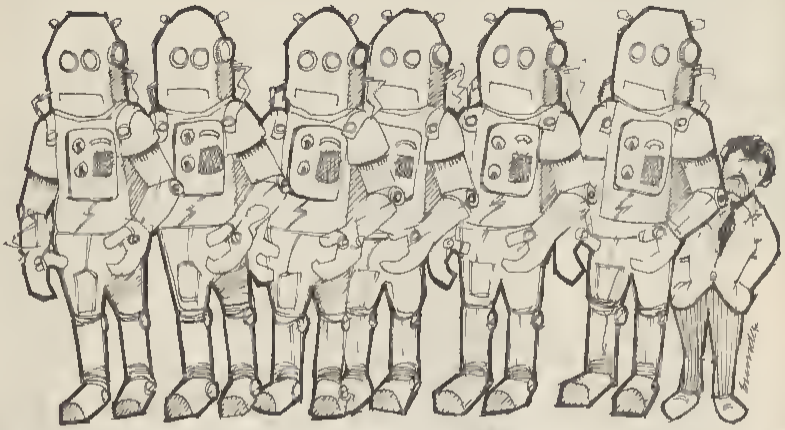
Artwork
G Tifen

Editorial Offices
4 Valentine Place London SE1
Telephone 01 928 6394

Computer Age is published monthly by Computer Age Limited 4 Valentine Place London SE1 [illegible] **Distribution by Moore Harness Limited** [illegible] Printed by [illegible] 12 [illegible] London W1V [illegible] £7.20 [illegible]

ISSN 0144-3674

IS MANKIND REDUNDANT?



It is a well hidden fact that many scientists technologists academics and professionals are believers It is not that the believer receives a bad press in specialist magazines but that he or she receives no press at all The author who is at the Department of Economics and Industrial Management University of Science and Technology, Kumasi Ghana here gives his point of view.

A constantly recurring theme in computer magazines these days is the reminder that the machine can be made more intelligent than a human being It can be programmed (or even programme itself) to respond intelligently faster more reliably and more thoroughly than a human Inevitably the conclusion is drawn that the human is therefore superseded by the intelligent machine The question then arises what place is left in the future for people when just about every task people perform including supposedly many mental ones can be done better by artefacts? Except of course for us chaps who write the programmes and wire up the hardware well that is until the self-programming and self assembling systems begin to appear!

The advent of intelligent machines has forced us to face up to one of the oldest questions ever asked Just who and what am I? And just what is the meaning of what I do? This question has now raised its head more stridently since we can no longer hide behind the fact that the older generation of machines did not think. Now machines have that potential and the capacity to perform mental operations is no longer uniquely human

For example when was it first realised that it is possible to programme a biological machine called a horse to make travel faster? The horse is better at running than I am However this is not too worrying since I am in control and I make the decisions If we build a robot controlled car, however I become a mere passenger Yet really the two cases are the same For modern control theory recognises two levels in decision making At one level there is the logical maximising of some objectively defined parameter – say route in the case of the horse or the robot chauffeur And at a deeper and much more important level there is the utility or significance of this parameter to the decision maker Thus the older textbooks on business theory will discuss the maximising of profit but the newer ones discuss the utility of this profit to the managers of the firm There are times when it does not pay to make too much profit! In other words both the horse and the robot chauffeur take their meaning from the utilities of the passenger In the case of the robot it may enter into the control process by carrying out the sensing and logical operations involved But the utilities attached to the various decision-outcomes the robot must choose from, must be human Machines even intelligent machines, can only take their values from us I worry about what I am doing and where I am travelling and the point of going anyplace anyway The computer does not. There is no question but that we can build artefacts which can outperform us in every conceivable specifiable way Yet we do the specifying – it is we who give meanings to the categories and the tasks built into these machines

The Turing test for intelligence says that if you exchange stimuli with some intelligent interface the responses you get for any given input from you will be indistinguishable between whether an intelligent machine is manning the other side of the interface or a human being Thus for all specifiable logical operations artificial devices may be equal to (or better than) a human

But all this really indicates is that humans have logical capacities the same as certain machines It is curious that we so readily jump to the conclusion that since we have machine-like capacities we are therefore *only* machines This is a somewhat irrational conclusion, to put it mildly Because a cat can catch a mouse it is therefore no more than a mousetrap? We do not have a one-to-one relationship with a machine We share certain sets of properties with them but not the capacity to assign meaning We must do this or the machines have no defined parameters to work with There is thus a human perspective built into any intelligent machine These machines must reflect the categorisations and hence the value judgements we make

The world is full of people who can perform the first level of the decision process – logical operations on defined categories But the task of categorisation and definition of relevant parameters is by far the most important and the most difficult. The world is full of intelligent fools but very short on people who can see the

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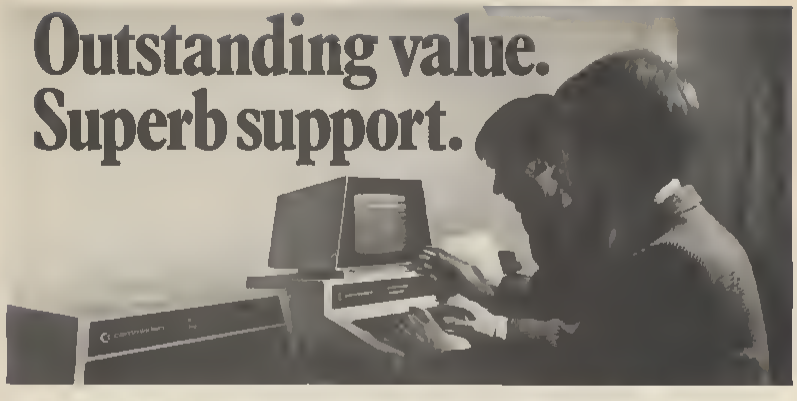

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significance of life but is going on with the manager. Heller did not find it difficult to find eleven men to run his experimental medical unit in which men were used as well dolls. Intelligent fools only operate at the first machine-like level of decision making.

Here we come to the real issue. Why is there a difference between the using of a man and a rat for experiment? Only in the significance we attach to a man as distinct from a rat. And on what grounds do we base our judgment of this? We base our judgements upon our cultural beliefs. It is our cultural beliefs which are causing us problems – and keeping us civilised – not computers.

Modern Western culture only recognises the scientific – i.e. that which can be consistently and repeatably demonstrated to be connected by cause and effect. The problems thrown up by modern physics – where such a tight relationship of cause and effect gets rather fuzzy – and dissolves into mere probabilities – have not yet entered into general thought patterns. It was the Greeks who gave us our modern belief that Creation is totally rational and connected – one-to-one cause to effect. It is one Great Machine. Pure reason *alone* sums up all of Creation. Given this premise – that everything is but part of a Great Closed System – then it is entirely logical to conclude that humans are also mere machines being but part of the Whole. We have therefore no significance relative to the rat or the lump of stone on my front doorstep.

Viewpoint

Now it is undeniable that Creation has a very large part of the machine about it. We ourselves have physical bodies working on the causal principles of levers, electrochemistry, cybernetics etc. But does it follow that that is *all* we are? Must the cat be *only* a mousetrap? Because we share certain characteristics with the apes does that necessarily mean we are but naked apes? We are having our noses rubbed in the fact that, unlike our intelligent artefacts, we do not know who we are – what our significance is. Why else are you reading this?

'Because a cat can catch a mouse, it is therefore no more than a mousetrap?'

Our Western materialist culture tells us that the question should not arise. But it does. I can't help it! I often wish the question would go away – but it won't. Could it be that the Greeks were not entirely right? Clearly they came a long way to the truth. Our enormous advances in scientific progress attest to the fact that Creation is rational. Yet could it be that thus [illegible] could it be that [illegible] as well as [illegible] ters? If the [illegible] not [illegible] terms of [illegible] programs [illegible] mind? I believe indeed I have [illegible] ing and that [illegible] is better than [illegible] it is [illegible] tell the [illegible] get lost, but I won't make the [illegible] ments or undertake. It is not possible [illegible] with pen. Western materialism [illegible] quite accept the idea that we have no worth relative to a chunk of hardware. Like many another theory it is not [illegible] ly that the Greek proposition needs to be put in a larger context. It is alright for limited circumstances – but it must ultimately be seen in terms of a longer frame work. In this sense, Western culture is indeed doomed. For it is intrinsically incapable of giving meaning to anything. And we cannot live without making value judgements. We must have some answer to the question of meaning. It is more than likely that Greek philosophy will be seen as a stepping stone to a fuller understanding. We have ignored the fact that by reducing everything to the mechanical we cannot by definition, recognise the human demand for significance. This demand will not go away.

Remember someone who taught 'Man shall not live by bread alone, but by every word that proceeds from the mouth of God'? Maybe he had something? ■

Retailing Reviewed

Although American retail shops have sold computers priced under $15 000 since 1975 the computer retail market still has a long way to go before it can be called 'well defined' Some major equipment vendors are in the midst of full speed ahead retailing operations others are quietly closing some stores and still others have no stores of their own at all. Yet another group of computer vendors takes a final approach let others do the selling

Prior to the advent of the microcomputer hardware vendors had only one way of selling their machines—they sent a neatly dressed, fast-talking salesman to a prospective customer's door When a machine weighs in at $1 million or so, this approach worked out But it is a costly way to sell computers and for mini- and microcomputers it just doesn t make economic sense

These days the American landscape is dotted with over 7 000 retail shops selling small computers. So, the idea of computer retailing seems to have caught on in a big way But the reality of the situation is a lot more complicated

To start with an American research group recently published its market study of retailing's impact on the U S small business computer marketplace Judging from reactions in the computer trade press and elsewhere the study conducted by Venture Development Corporation has shaken up the business Venture Development has its headquarters in Wellesley Massachusetts about 10 miles outside of Boston

Venture Development found that only 7 3 percent of present small business system users in the U S bought their machines from computer retailers Of the rest more than two-thirds acquired their machines directly from equipment manufacturers, while 13 5 percent bought from dealers and distributors and about 7 percent purchased from original equipment manufacturers (OEMs) and systems houses

Venture Development also surveyed potential small-business computer users and found that only 5 7 percent thought they would buy their machines from retailers About 50 percent of those interviewed said they would buy computers directly from manufacturers some 17 percent thought they would go to dealers and distributors for their systems while close to 13 percent favoured OEMs and systems houses as the source for their future business computers

The retailers problem, Venture Development concludes is that the attraction of low prices the main advantage of buying from a retail store, does not supplant the need for reliable service Apparently, most small business executives do not believe that they will get satisfactory equipment service and repairs from these retailers For that reason, they prefer to take their business elsewhere

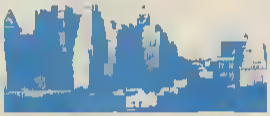
Venture Development s findings notwithstanding at least two major vendors, Control Data Corporation and Xerox Corporation are taking an aggressive approach to computer retailing

Xerox plans to open 15 stores in the U S as well as one in London by year's end Next year the company will add more it expects to open several hundred retail outlets within the next five years providing the stores are profitable

The first Xerox stores are selling computers made by Apple which cost between about $1 000 and $8 000 as well as those Xerox makes itself which cost between $12 500 and $13 800 The shops will also sell copiers and other office equipment

Meanwhile Control Data is preparing to open several hundred computer retail shops in the U S over the next year and a half Its own market research has given the company hope that the venture will be fruitful and it is obviously committed to the idea Control Data is realigning its corporate structure and is investing millions of dollars in order to carry out its retailing plans

Initially the Control Data stores will sell computers made by Ohio Scientific priced from $1 000 to $15 000 Control Data says it will also sell machines from other vendors, yet unspecified and will market its own application software as well as that of third parties In addition the stores will offer products and services formerly marketed by some of Control Data s numerous divisions, including the Commercial Credit Corporation and Education Services



Control Data claims its shops will be different than existing retail shops The pure hardware approach that other vendors take is wrong, a company spokesman says adding, small businesses need a lot of education and an understanding of how computers can help them We ll promote ease of use as well as a new understanding of old business problems

In contrast to these vendors retailing activities Digital Equipment Corporation (DEC) has closed two of its 27 computer retail stores one in New York s financial district and the other in Detroit Michigan where most of America s automobile industry is headquartered

DEC opened its first computer store in Manchester New Hampshire back in July 1978 Now, one and a half years and several stores later the company is assessing its retailing effort—and finding some problems

'With retailing we re outside our normal realm of marketing techniques,' says a company spokesman, 'so we re constantly rethinking our strategy There are many considerations like shop location and street presence, that we simply had not dealt with before

The DEC stores sell one machine—reconditioned PDP-8s—equipped with a raft of application programs

The world s biggest computer vendor IBM has a modest number of retail stores in the U S—50 The corporate behemoth calls its shops Business Computer Centers These locations carry only one product the IBM 5120 computer the company's cheapest machine priced between $9 340 and $23 990 The price range reflects various possible configurations Unofficial word is that neither the IBM stores nor the 5120 are doing especially well and that IBM may try an entirely new approach to retailing in the U S with an entirely new machine

Texas Instruments, America s number one manufacturer of semiconductors is taking a unique approach to computer retailing, albeit not too successfully Its 99/4 personal computer which costs about $1,000 is sold by independent computer retailers and by large department stores The machine's drowsy sales are attributed to the fact that it is aimed at an immature market home use and may simply be a good product that is ahead of its time

Radio Shack vendor of the successful and popular line of TRS-80 micros, sells its machines in its consumer electronics stores A lot of people are puzzled by the company's success—Radio Shack stores tend to be on the tawdry side, not really up to corporate taste

The country s numerous independent retailers are not to be discounted. These stores usually, carry a wide range of micros suitable for different types of customers In addition, they are able to help customers decide which machine will do the job at hand And according to Creative Strategies a San Jose California research organization no other distribution avenue supplies as broad an array of customers

But Creative Strategies points out that most small independent retailers generate less than $1 million per year in revenues They find it difficult to survive An examination of the stores products and service offerings versus their operating expenses reveals not only the difficulties they face but also their reasons for keeping services and staff below manufacturers 'expectations' Creative Strategies says

These stores may give those of the vendors a run for their money, this is already happening in some places In New York for example at least one independent retailer is doing a bustling business just a short walk from DEC's condemned shop The independent is selling Apple and Hewlett Packard micros to businesses in a neighbourhood that DEC at least for the present, has given up on. ■

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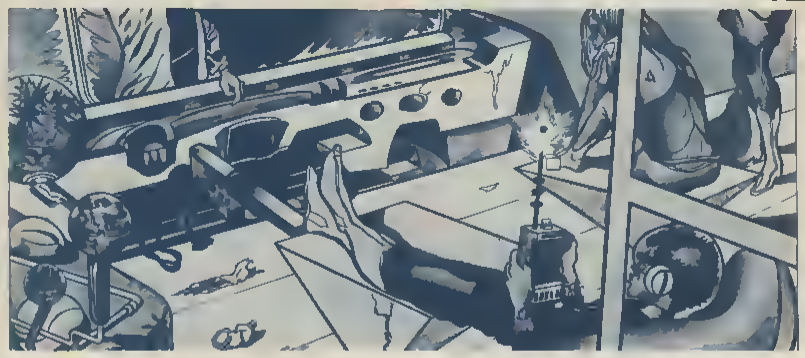

The Return of Mr Chips

When the electron rules in a brave new world old teachers will never die but only fade into view

He was late for school again "Oh blast! Oh heck " he puffed, whev faced white knuckles clenched in the cold as he ran breath streaming behind him in paintul gasps of toggy smoke, the cold air biting inside his chest Kevin was late for school again

It was never Kevin s fault of course Last Pursday , for instance, had been one of those cursing and swearing mornings as Kevin s father late for work himself railed at the implacable gods who frown on motoring activities In the end he had had to run for the bus and run from the bus stop hall a mile to the old Town School (rotten Geography) just as he was running again this morning Only today was Chewsday which meant it was one of his Dad's off days at the depot As he scalded some milk for his Kwikstart Oats Kevin could hear his Dad upstairs yelling at Mum He turned up the telly to shut out the noise, but he didn t know what it was on about They always put the cartoons on just when he had to leave for rotten school The rest of the time they were rabbiting on about politics and stuff

As he rounded the corner of St. Marks Road and began the venturesome journey crabwise along the great brick wall towards the yawning ravine of the school gates abseiling the South face in the thin air Kevin slamming on the brakes managed to miss Fatty Simpson by point three of a millimetre

Oi, watch out!" wheezed Fatty, whose father in dying had bequeathed him a certain spurious distinction among his peers

'Watch out yerself you overgrown orphan!" yelled Kevin, whose momentum had started him spinning in circles His flailing arms brought one thumb into painful proximity with a zebra striped pole in the pavement 'Danger – Children Crossing One night Mr Sawkins the Junior Master, reeling home late from New Year s revels, had hunsted Miss Sparks of Geography with a can of illicit whitewash purloined after love from the sack scented potting shed on tiptoe below the Headmaster s window hoisted her with much merriment stifled beneath the exciting shroud of her tweeds legs buckling each in turn up to the sign when excision ot the word 'Crossing had been as concise as it was clumsy So much for teacher pupil relations Fatty Simpson knew why both had left at the end ot Spring term And he d tell you, for a price

Spit!' said Kevin bravely He revolved to a halt sucking hard

"You re late again, said Fatty Simpson "What was it this time Dad pawned the car then?"

' So? You're late too Puff adder Been to a funeral, eh? '

Not today thumb-sucker I ve got a note My Mum can write Bet yours can't even watch television, they re so stupid!"

"P you're so finky clever garbage-guts how come you've got to go to school?"

Same reason you have said Fatty defensively Sociation They rounded the big brick gatepost together

Nah scos you re thick innit Scos you ain t got no Dad They said you was thick night?'

"No I am t!" yelled Fatty 'It s cos I ve got a Sociation problem like the Social geezer said 'e said 'Ome School was bad for me

'Thicky! Thicky!'" screamed Kevin racing away up the broad, white steps, his satchel leaping behind his back Way above him past walls and boards and venerable oaken joists, through empty classrooms in which the pale sun spilled across the galaxies of Brownian motion, toning hollowly beneath the carved lids of oaken desks and booming unheard in dusty atlas cupboards stirring faintly the ancient suit of chalk in the interstices of blackboards the school clock's muffled chime wheezed nine fifteen

• • • •

"You ll find it's another century at St Mark s,' said Harrowby to the New Applicant Teacher, bright and nervous across the plain of the boardroom table ' No Home School, no Play Programmes, no VDUs, no Information Stores Just straightforward, hard bloody classwork. You'll actually have to meet the pupil face to face in a one on-one teaching situation Think you can cope with that? '

We did a certain amount on the simulator in College said the New Applicant. He glanced up, and was disconcerted to find Harrowby staring straight at his face It wasn't done these days He looked down again and rearranged his hands

Look at me when you re speaking to me please, Mr Neumann " Harrowby had on his glasscutter's voice "Unless it actually embarrasses you to maintain eye contact over any realtime period Outreach, Mr Neumann Remember your Outreach! 'Prolonged ocular contact is

Short Story

pleasurably established on my own personal mind pattern something like that isn't it" He [illegible] elbow suggestively at [illegible] who cleared his throat [illegible] inclined to oblige

"These kids aren't like the rest, Harrowby explained "They're expertly assessed as being most at risk from non physical learning situations Outreach and association are two vital elements in their psychosocial framework Our society can't afford any significant inbuild of such variables at the present time

Consequently Neumann knew he would be told it remained necessary to maintain the Old School system Every Community Council was responsible for one and any old redbrick reassuring building would do Many had been res

cued from local authority structure plans back in the eighties just for that purpose Neumann realised Harrowby was still talking

"But they're an ever decreasing minority EdMin however does not as a matter of policy see that as a reason to rundown the programme yet, as this group still provides a valuable control in experimentation on Home School programmes A sort of link with the past. That is why I must warn you Neumann not to try to improve on Core curriculum Every lesson is monitored and variation especially of the political kind, will not be tolerated Is that understood?

Quite understood Sir You forget that my own training has been rigorously monitored at every stage "

"Yes I don't forget But neither should you forget that your final selection was based not on teaching ability alone but on complex psychological factors such as your Empathy stability of social awareness patterns and so on – in short what the old school used to call your Background! It hasn't just been the cost of producing you, Neumann, that weighs heavily on the budgetary mind of EdMin No it's the cost of the ones we throw away too that makes it all the more important you should come through your five years of work experience in good mental order It won't be easy You'll find for instance that people tend to look upon the Old School experience as somehow inferior There's a widespread feeling among pupils parent figures and educationists alike that the Home School Surrogate is someone who has failed to master the elementary tools on which our new society is built an intellectual cross between a Montevideo fishwife and a stuffed Paratha But we know this not to be so, do we not Mr Neumann? Neumann met Harrowby's unbending gaze and winced

"Yes Mr Harrowby

Fine Harrowby softened "In that case I anticipate few problem situations The job's yours Any questions you have?"

Just one Sir How is that you've managed to stay on in the work experience when everyone not on a three-day week has to retire after five years?"

Good question Neumann " Harrowby leaned forward confidentially And since we're now colleagues in this wonderful experiment in human relations it's one I'd like to answer

The inspector reached inside his jacket and removed a wafer thin panel from the inside pocket "Control unit Neumann And see this?" Harrowby shot his cuff expertly Six inches of Simulskin wrist, each nail, each hair growing naturally from a carbon polymer soup beneath the artificial epidermis, terminated in the formal grey of Britannic Plastics lovingly injection moulded from recycled acrylics Harrowby was a rather expensive robot

"Bloody computers!" said his father, twice "I don't know however we're going to afford it. Forty quid a month! Bloody computers!"

"You're late again Kevin" said Neumann without turning round from the blackboard Somehow every term seemed to throw up its Kevins he reflected Hopelessly disoriented individuals who went through life in an agony of self-reproach because they never seemed able to take the most elementary precautions against organisational failure Why couldn't the boy simply get up ten minutes earlier every day? All that worrying all that rushing about the hours wasted on scrawling I must try not to be late for class in the lines book a hundred times the embarrassment in front of his peer group Try to remember that every one is unique thought Neumann Kevin couldn't be *programmed* which was why he was in Old School He can't relate to mechanical aids without it triggering his latent psychoses, but he's not sufficiently antipathetic to warrant corrective training In other words he's *eccentric* and should therefore be expected to be late for class for no reason

"Why this time?" He turned on the unfortunate child, who stood red faced and dishevelled in the doorway at a loss

"Sorry Sir He looked at scuffed shoes grey socks slumped round his skinny ankles shorts more than a fraction long, the triangle of debatably white shirt hanging like a battered flag of truce from beneath the wrinkled blazer cap awry

"Sorry Sir Neumann repeated slowly, for the benefit of the tittering class "We can all see you're sorry, Kevin But you have to realise that if you were to participate and arrive on time occasionally there would be no need to be sorry Do you like feeling sorry? Is that it?

Neumann felt sorry too In his final term at St Marks he had suddenly begun to regret nearing the top of the hill the other side of which held out lessening hopes of greener grass Though the Kevins of this world seemed somehow to remind him of a sense of failure, and spurred in him the need to humiliate nevertheless he felt that deep down he really did care and he was sorry As if recognising a vicarious kinship he relented

"Well now, you might as well sit down, Kevin You know we're always glad to see you whenever you care to drop by It's Page 46 if that's okay with you

Quadratic equations Two boys filling a bath Boys were always filling baths in the old Math thought Neumann From the look of his pupils, it seemed an unlikely proposition He leaned back contentedly in the battered swivel chair arms folded and stared out of the window The hum of days was broken only by the furious little sounds of boys at work His view of the playing space was broken by the angled walls of the Science Lab, no longer in use His view of the immediate future remained unbroken Who says time travel is impossible?

"Please, Sir! came a wee voice Neumann's skin crawled

"Yes, Kevin what is it? He turned The voice had come from beside his left elbow He felt the furtive proximity of the boy smelt his body warmth, the toads-and-toffee smell of his nervous lubrications Controlling the nausea he still felt after nearly five years of sharing a room

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Neumann said again 'What do you want?'

"I've finished, Sir

'Nonsense

Have Sir It was easy!

'Yes, Kevin I know it's easy but then I know the answers Let's see if you've got it right

Dammit the boy had – and he'd taken the short cut too That wasn't at all what his test profile parameterised for him The little

'Kevin were you using a calculator? The boy reddened I thought so No don't start trying to deny it Hand it over and see me after class'

'But Sir I can't hand it over, cos I ain't got one I just could do it it was like an accident Sir

'Hand it over!'

Sir I can't Sir I ain't got one! The boy was close to tears

'Okay Kevin Go and get your book Sit up here at the desk where I can see you, and try problem number eight If you can manage that in two minutes, you might just not have to see the Headmaster after school'

Neumann was puzzled If the boy had a fault, apart from his execrable performances in History Geography English Art and Leisure Sciences, it was his honesty The only lies Neumann had caught him out in were those designed to protect other people, the sort of lies which Neumann secretly felt were always unjustly punished in kids The hand of the clock jumped The others were scribbling away faces disguised variously by concentration and anguish

'Done it Sir Kevin raised his hand sheepishly

'Well bring it here " Neumann's suspicions were growing but the boy had done it correctly, and again by the short route Okay Kevin, good lad you can go back to your desk

Neumann remained thoughtful for the rest of the lesson

• • • •

'But why can't I stay?' whined Kevin ' All my friends is here and Mr Neumann I don't want to go to lessons with a rotten old computer

I'm very sorry Kevin said Harrow by "But you have to understand this is a school for maladjusted children You were diagnosed, probably wrongly as someone who could not relate to Home School You messed up on Applied Software you came bottom in Earth Resources your vector analysis was abysmal, you had no real grasp of the League Tables, and you failed your Battlestar Galactica Parts 1 and 111 Your EdMin psychiatrist diagnosed chronic innumeracy, which I suppose you know could have meant prison when you grow up And now you suddenly display a remarkable aptitude for algebra That is why I'm afraid you have to be restreamed Kevin We can't have Mr Neumann wasting his time teaching you arcane subjects, it wouldn't be fair on the others I'm sorry I know you say you like Mr Neumann but EdMin are adamant They've given us little more to waste on Old Schools as it is

I'm sure you'll find Home School just as much fun when all of the teachers like you gets used to it Now we've explained to your parents and they've applied for a Local Authority grant to install the equipment so there's no need to worry whether they can afford to pay for your education Now your father's coming to see us so run along Come and see me when you get your degree and we'll have a good laugh about it eh!

Short Story

Kevin rode home morosely in his father's car Bloody computers' said his father twice I don't know however we're going to afford Forty quid a month! Bloody computers

And then a little later And where are we going to put the bloody thing that's what I'd like to know In the boolroom? Oh they say you just hook it into the mains but it's bound to interfere with your mother's television I'll probably have to DIY another bloody extension dig up me roses I shouldn't wonder Gordon Bennett! He swung the little car into a filling station to replace the battery powering the hydrolysis unit

And what good's education ever done me or your mother come to that? keened Kevin's father, piteously

Mr Neumann's promised to come and see us in a couple of weeks' time' Kevin told his mother "To see how I'm getting on He jumped to one side as the EdMin installation [illegible] hoisted through the hall with [illegible] packing case

That's nice Kevin [illegible] called Do shut the door dear I can't hear the telly think with all that banging and bashing Whatever next

Whatever happened to all that mumma lunsation we used to have? demanded Kevin's father through a mouthful of instant noodle Six crates I counted Bloody nonsense! Where are we going to put six crates I'd like to know? You used to get them pocket calculator thingies like a Social Security account card thin as that they were Couple of quid they cost didn't they Now it's six bleedin crates This country, I don't know I'll bet the bloody Japs don't have six crates I'll bet they can get a computer into a bloody wossname by now

ere when's 'e coming back to put it togevver? demanded Kevin's sister Jayne

You're only finky jealous cos you ain't got one! said Kevin

An you ain't got any yet, I seen it in the barfroom! giggled Jayne

"Shuttup scrawny bits!" shouted Kevin reddening Everyone knows girls is too stupid to need a education

"You mind your bleedin language, my son else you're for it!" shouted Kevin's father

The doorbell chimed *Colonel Bogey* It was the EdMin man back with the Home School Computer Sorry I'm late honest he said 'We had a union meeting I know I know bloody unions Any road how would you like to go on a two day week? Never get anyfink done then

Late? shrilled Kevin's Mum "Two bloody weeks and we calls it late!

Kevin watched as the EdMin man plugged the Home School into the mains When the teacher came into view he was not surprised to see Mr Neumann sitting there his eye lens elements glazed and liteless His friend Jim had a Neumann and so did Arfur Brainsby at number 15 Kevin's mother shuddered Gawd! she muttered I've heard of Rodger the Lodger! I ope it's not all there The white coat wrinkles cunningly worked into its everlastar fabric twitched

Gawd! It's alive! cried Jayne hiding behind her mother peeping out at Mr Neumann's seagreen face and deeply blue eyes She was fifteen and wondered if Mr Neumann had braces holding up the grey flannel trousers he would change into after class and wear down to breakfast every day The EdMin man rifled the last packing case and produced a small but complex keyboard Let's try Italian One he said and began fiddling with the keys My mother was Italian

And Mr Neumann opened his schoolmaster's mouth Lezzione primo Primo Lezzione he began flawlessly Home School was in class ■

• *Paul Ingrams is a freelance journalist and writer of fiction*

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Hyphen-Help alerts you when the last word on a line is too long to fit. You can choose between hyphenation or moving the whole word to the next line
Decimal Tab allows columns of numbers to be typed as easily as operating an adding machine. **WordStar** will line-up the decimals automatically
Paragraph Indent temporally sets the left margin to a tab stop so that documents with multiple indentations (like outlines) can be typed easily
Program Execution allows a program (such as an operating system utility) to be executed with automatic return to **WordStar**
MailMerge** (optional) is a powerful file merging tool. It can combine a file containing names and addresses with a file containing letter text inserting data where variables are specified even in mid paragraph. It enables personalised form letters to be created with a specified salutation and/or closing. The same data file can be used for both form letters and mailing labels
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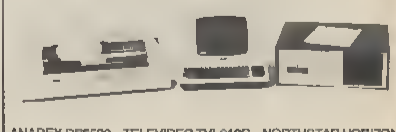
STOCK CONTROL



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3) Price lists by customer type
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6) Sales and Purchase remittance advice notes.
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10) Can print invoices order acknowledges copy invoices, credit notes, and packing lists
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12) Generates reminder letters first and second
13) Generates orders and order copies
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b Reset turnover count associated with each product.
c. Modify existing invoice quotation and purchase order numbers
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17) Transaction posting to client account. Facilities cash in/cash-out and other necessary transaction adjustments. Note ORDER and INVOICE produce their own specific transaction records. Transaction categories (e.g. invoice cash receipt etc.) are identified by transaction type
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Understanding Computer Systems

A Process-Oriented Approach

Harold W Lawson is at Linköping University, Sweden. He is currently head of its Computer Architecture Laboratory and Professor of Telecommunication and Computer Systems.

Have you ever tried to explain computer systems to someone (or to a group of people) who know nothing or very little about them? Where do you start? Do you first explain the binary number system, Boolean algebra and/or computer logic? Perhaps you begin by showing the classic CPU, memory, I/O block diagram and explain each of these constituents including stored programs, instruction sets, etc. Maybe you skip all of these low level details and explain flowcharting and/or some relatively simply high-level programming language like BASIC.

Regardless of where you begin, one soon recognizes that although you may be somewhat successful (after sufficient effort) the person or people being taught have no idea about computer systems and computing 'as a whole' and many questions remain about the 'miracle of the computer'. On the other hand, it seems on the surface, to be difficult to give a holistic picture of computer systems right from the beginning.

After several years of experience with a process oriented approach we can remove the doubt and say that it is indeed possible (and desirable) to introduce computer systems concepts and terminology right from the beginning in a holistic manner. This approach has resulted in the book 'Understanding Computer Systems'[1] and the purpose of this article is to present the main ideas of the approach. As with all endeavours of this nature success depends upon proper structuring of the presentation. The approach used is highly pictorial and terminology is introduced bit by bit in a logical fashion. Each chapter finishes with a summary, word list and problems. The entire vocabulary introduced is presented at the end in the form of a glossary. Enough about the structure of the book — let us consider the approach.

Introducing Processes and Systems

People learn best when new concepts are presented in terms of what they already know.

The process is used as the LCD (lowest common denominator) for explaining the constituents of computer systems. At the beginning, it is necessary to select widely known model processes that can be used as the basis for association with computer system related processes. To show the example used, we take, as a verbatim quotation, the introductory model process descriptions.

We begin this education process with a pictorial representation of a well-known real life *process* (*task*) faced by many of us.

A process

Note that the concept of *process* and *task* are synonymous and thus in all further references to process related concepts the word task may also be utilized.

Let us now consider this real life process of washing the dishes in the form of an abstraction which shows the major elements of this process as follows:

A process abstraction

Dirty dishes, detergent, water and dish cloth are *process inputs*. Clean dishes is a *process output*. The process which we have shown here can only be carried out *executed*' when we apply a *processor*.

A processor

Let us complement this single process by introducing a second process, thus creating a *system* of *cooperating processes*.

A second process

Note. Implicit in this description is the definition of a *system* as a collection of interrelated processes.

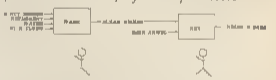
We can continue the general abstraction of this system of cooperating processes by introducing an abstraction for the second process, namely the drying process, in the following manner:

An abstraction of a system of cooperating processes

If the processes are to be carried out by a single processor *uni processor*, then this single processor must be assigned to *both* the WASH and the DRY process as indicated in the following picture:

A uni-processor

Note that if the dishrack becomes *full* during WASH execution then the single uni processor must be alternated between the execution of the processes WASH and DRY. Alternatively we could assign a processor to each process that is, the processes are executed *concurrently* (at the same time) by *multi-processors*.



Multi-processors

During execution of a process by a processor, let us say that the WASH process the processor could be *interrupted* by a *higher priority process* such as the following:

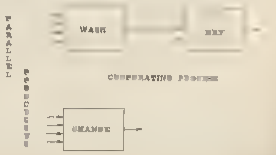
A high priority process

Consequently a new process is *created* which we can represent abstracdy as follows:

An abstraction of the new process

In the case of a single uni processor the processor temporarily *suspends* the process it is currently executing and *initiates*' execution of the CHANGE process. After *'termination'* of the CHANGE process, the processor returns to, *'resumes'* execution of the process that was suspended.

Alternatively in the case of multi processors the processor that acknowledges the interrupt (let us say the processor serving the WASH process) could *assign* another processor (the processor assigned to DRY or another available processor) to execute the CHANGE process in *parallel* with the ongoing WASH and/or DRY processes as follows:



(The above is an extract from the book)

[1] Understanding Computer Systems by Harold W Lawson Jr. Lawson Publishing Company Linköping Sweden ISBN 91 7372 333 4

At this point we have introduced several important non-trivial computer related concepts and terminology in terms that all can understand. The flavour of this example should now be remembered as we browse through in a highlight fashion, the further presentation of concepts and terminology. While the remaining descriptions of the approach will be terse you can certainly use your imagination to guess at the details of the approach which are presented in the book.

Data Flow and Control Aspects of Processes and Systems

Having introduced the basic process and system concepts it is trivial to build on the example to include data and control aspects. Data can be made analogous to *objects* processed by the processes of our example leading to the following view where the alphabet of *objects* is concretely declared

Enumeration of process related objects (data)

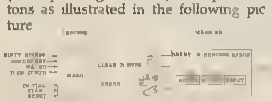
The flow of objects within a process is explained in terms of classical data processing steps namely *input* (take object from counter) *process* (wash object) and *output* (place object in dishrack). The transmission of objects between processes (over channels) including storage processes, is indicated by the following illustration from which for example the explanation of terms such as simplex half-duplex and full duplex are easily motivated and developed

Transmission of objects (data) over channels

In explaining control, we consider signals to processes and related control mechanisms. For example, the following illustrates the producer-consumer relationship of asynchronous control where the dishrack provides a perfect example of a buffer. The concept of synchronous control is then explained and compared to asynchronous control

Asynchronous control of multi processors

In finalizing the control notions an important analogy is made by presenting the process as a 'machine' with lights (corresponding to *states*) and pushbuttons as illustrated in the following picture

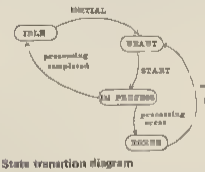


A process as a machine controlled by push-buttons

Concepts/Techniques

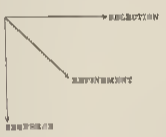
Introduction of Programming Concepts

After considering the WASH process as a 'pushbutton' machine, it is a simple matter to present the logic of a process as the following state transition diagram.



State transition diagram

To introduce the basics of programming a modified form of dimensional flowcharting as described by Witty is utilized. This flowcharting format is accomplished by using three drawing directions for indicating **sequences** of actions **selection** of alternative actions and **refinement** of larger actions into a sequence of actions. These rules are easily remembered from this picture



Flowchart conventions

These concepts are motivated step by step but we can see, as the final example the use of the rules for program like representation of the WASH process with declarations and procedures appear as follows

Flowchart of process logic

Your intuition should help in understanding this representation with the knowledge that the ground symbol (⏚) is used to show a sequence termination and the asterisk (*) is used to show the end of a repetitive sequence controlled by a condition at the beginning of the sequence.

At this point, enough has been presented indirectly about computing concepts in the context of the model processes so that the 'student' has achieved a basic understanding and confidence. The scope of the material described thus far has permitted the following vocabulary of non trivial concepts and terms to be understood (presented here in groupings of individual chapters)

process (task)
process outputs
processor
cooperating processes
concurrent processes
interrupt
process creation
process initiation
process resumption
parallel processes
process inputs
process execution
system
uni-processor
multi processors
process priority
process suspension
process termination
processor assignment

data
information processing system
alphabet
port
output port
transmission
simplex
half-duplex
information
data processing system
storage
input port
storage process
channels
duplex

control
speed (time) independent
speed (time) dependent
error conditions
system constraints
consuming process
monitor process
clock signal
process (machine) state
asynchronous control
synchronous control
signals
buffer
producing process
resource
resource ownership
process initialization

state transitions
finite state machine
state indicators
sequence
refinement
flowcharts (flowdiagrams)
declarations
state transition diagram
local storage
state variables
selection
program (algorithm)
repetitive sequence
procedures

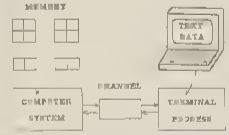
How many of us mastered so many concepts in so short a period of time when we began? In classical approaches to education (including self-education) in this area many of these concepts are learned only after many hours, days

[1] *Dimensional Flowcharting Robert W. Witty Software Practice and Experience Vol 7 553-584 (1977)*

weeks months (dare we say years) of suffocating in detail It is not uncommon that the details that have been learned in them s detriment is gaining a clear picture of these more basic general concepts

Introducing the Real Thing

We now proceed to consider, more concretely the data processed by computer systems by introducing the terminal (user s process) and the computer system in the following now familiar framework



Terminal connection to a computer system

It is easy to convince the student that by pushing buttons data is transmitted across the channel and placed in a memory where it is processed and results are sent back for display on the terminal screen At this point we still treat the computer as a black box process The terminal process is used to transmit data back and forth

In making data a more concrete concept the nature of numbers of base 2 and 10 are presented including an easy to comprehend algorithm for the process of converting a binary number to a decimal number as indicated in the following process description

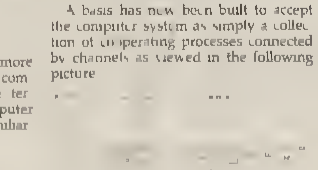
After having mastered the WASH process from the earlier example this process does not in any way seem strange and can be followed (simulated by hand) by following the dimensional flowchart and indicating resulting changes of state of the process state variables given inside of the process

Further details of electronic representation of signals precision of arithmetic data and the ASCII character set are easily introduced Word processing systems and the representation of programs as text are then motivated followed by the presentation of basic data structure concepts including arrays

Concepts/Techniques

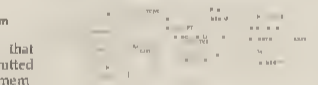
Now the More Conventional View

A basis has now been built to accept the computer system as simply a collection of cooperating processes connected by channels as viewed in the following picture



The cooperating processes of a computer system

These constituent parts and their general properties are now easy to motivate and introduce In fact, the CPU viewed as a *process* is eventually portrayed as follows

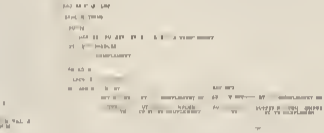


The central processing unit

A CPU state transition diagram and CPU process dimensional flowchart provide an easy guide to understanding CPU operation A simple instruction repertoire independent of any brand name and an assembly program presentation then make the point about concrete programs and their execution

Memories and Peripheral Devices

Memories of the core and semiconductor type are presented as well as a treatment of the structure of a flip/flop element as you got it – a process with its related process dimensional flowchart as follows

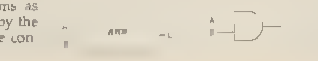


A Flip/Flop process description

Note we can now be convinced that the *process concept* can be used as a common denominator to explain both hardware and software concepts Storage and peripheral devices (tapes discs A/D and D/A converters printers etc) are then described in a rather conventional manner

Digital Processes and Hardware Construction

Even the smallest of computer elements (gates) are presented as *processes* with related process logic as indicated in the following example

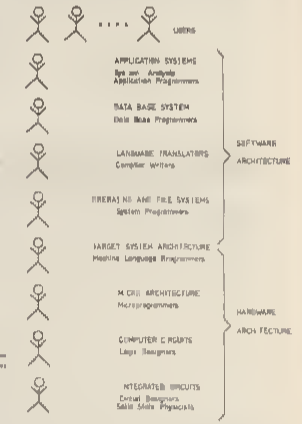


The principles of computer arithmetic are considered including the view of a binary adder in once again process form The notions of combinational and sequential circuits are conveniently introduced along with a basic explanation of clock signals and timing

These digital building blocks and their eventual encapsulation into integrated circuits, printed circuit boards and chassis are easily described against this background

Putting It All Together

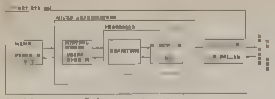
The process concept has enabled us to present basic computer system concepts the notion of programming and the composition of computer hardwares Putting this all together we then build up the notion of architecture starting with a basic delineation between hardware and software architecture as follows



A further key concept namely that of processor memory pairs as illustrated in the following provides the keystone to describing the various architectural levels

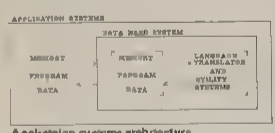
The basis for constructing programmed processes

The architecture of the target system (programmer s machine language machine) can then be described abstractly as nested pairs of processors and memories as indicated in the following



Architecture of the target system

The nesting is built upon to further describe the placement and role of operating and file systems language translators and utility systems, data bases and culminates in the following view of the application system relationship to lower level systems of cooperating processes



Application systems architecture

Note the dotted lines around the memory simply denote that it is not a separate physical memory but is a program and data *representation* in a common physical memory

Further architectural concepts such as multi port memories, DMA channels and common busses (highways) can be introduced in a natural manner as architectural alternatives Finally, the concepts of network architectures and related terminology round off this brief (but comprehensive) introduction to the core concepts and terminology of computer systems

Concepts/Techniques

Experience with the Approach

The approach described here has been tested and proved to be successful for a variety of audiences For those seeking a starting point in learning about computer systems (amateurs and professionals to be) the approach permits an examination of the nature of the forest before examining the details of the trees As an appreciation (computer literacy) vehicle the approach has worked successfully for journalists politicians and administrative and technical people A truly big success has been achieved in removing the fear of secretaries who are learning to use word processing systems 'Terminalists' of all varieties would certainly benefit from the understanding provided here They get an idea of where they fit into the picture of the system that they are using and some idea of what is happening in that 'black box

The demystification of the computer is a must if we hope to achieve any degree of harmony between technology and the citizenry of the world This approach which has been or is in the process of being translated into a variety of languages, provides a step in the right direction

Some Final Comments

Approximately 300 terms are presented in the book They are repeated in a glossary with reference back to the chapter in which they were introduced and described Attention has been given to presenting both the American and British words where different words are used for the same concept or term as well as to providing well known synonyms These basic concepts and corresponding vocabulary while far from being complete in any sense, provide a solid basic understanding of a cross-section of the entire technology

It is important to note that the approach is described in a completely product independent manner No manufacturer's products are pushed, therefore, the approach can be used to complement the real details of any manufacturer's concrete product. Teaching assistance materials including visual aids are available and are quite useful for presenting the approach to small as well as large groups The approach is well suited to being supported by animation and plans are being made to provide an animated video tape and animation via software for commonly available microcomputers ■

Editor's note Professor Lawson's Understanding Computer Systems is undoubtedly the best introductory book on the subject It is an amazing work A limited number of copies are offered to Computer Age *readers One hopes that this classic will be taken by distributors so that it becomes available throughout Britain and the Continent*

LEARNING WITH COMMODORE

Many manufacturers now offer courses to familiarise new users with their equipment and teach them how to use it most effectively. This is a review of courses given by one such company – Commodore, manufacturers of the ever-popular PET.

Recently at Commodore's invitation I attended two microcomputer training courses – 'BASIC for Beginners' and 'Advanced Programming in BASIC' – held at a hotel in London. Both courses were of three days' duration and, as their titles suggest, were intended to impart basic programming skills to PET users with minimal previous experience.

Commodore has been holding such courses regularly since October last year on a two- or three-day residential basis at hotels in London. Other titles currently include 'Disk Utilisation' (2 days), 'Service and Maintenance 3000 series' (3 days), and a projected PET assembler course.

In addition, one-day courses 'Word Processing' and '8000 Series Maintenance' are available, as are one-day seminars 'Microprocessors and the Businessman' and 'Microprocessors for Control and Monitoring'.

The courses I attended are described by Commodore as 'very intensive'. A glance at the timetable confirms this – 9.00 a.m. to 9.30 p.m. with one long dinner break from 5.00 p.m. to 8.00 p.m. on the first two days, 9.00 a.m. to 5.00 p.m. on the last. A games open session frequently extending into the small hours follows the 9.30 p.m. shutdowns.

'BASIC for Beginners' was attended by some twenty students from a reasonably predictable variety of backgrounds – Managers, Accountants, Teachers (including a Head of Maths) and Engineers and Salesmen (including Commodore dealers). Rather more unusually, and reflecting the inroads made by computing into his profession, a Doctor of Medicine was present.

The course was substantially 'hands-on', the intricacies of program design and testing being left for the advanced course. Students were grouped 'arbitrarily' into pairs, and each pair allocated one PET with dual floppy disk drive to work on.

Mike Gross-Nicklaus, the course tutor, commented that working in pairs 'helped reinforce the learning process' and that a one student/one-machine ratio had been rejected solely for this reason.

Whilst I have to admit that 2–1 is a far better ratio than is found in most schools and colleges, I am inclined to think that the reinforcement can be both positive and negative, depending on the personalities and backgrounds of the partners, and would personally have preferred to work alone (software production may be a highly managed and cooperative business, but learning remains an individual one).

In any case, Mike made it clear that partners could be changed if incompatibilities became evident.

The majority of the students were more or less complete beginners, though some had worked in other languages, such as FORTRAN or COBOL, and others were acquainted with the hardware.

The content of 'BASIC for Beginners' could very roughly be divided into three sections: 'Concepts', 'BASIC' and 'Procedures'. 'Concepts' provided by way of a preamble in the morning and afternoon sessions a perspective and theoretical framework from which to comprehend the main statements and facilities of BASIC. The emphasis throughout was on writing useful programs and 'Procedures' tried to encourage sensible practices such as flowcharting, observing line numbering conventions and employing titles, intelligible screen prompts and clear information presentation.

Concepts outlined in a gentle and introductory way the workings of a digital computer in particular of course the PET and its operating system. This proceeded without reference to bits, bytes,

Course Review

binary arithmetic, accumulators, or any other potential source of confusion, to schematically regard a computer as being built up of an arithmetic and logic unit memory store for data and programs and input/output devices The description of PET's operating system included the clock associated keyboard scans and a memory map

Illustration was provided by a machine code program 'VIEW' an extension to the interrupt handling routine, held in the bottom 1K of store (2 nd cassette buffer) which produced a rapidly changing display of characters on the screen (the memory scratch pad) tracing the clock, keyboard scans, stop key processing etc

A couple of exercises were given to make use of the clock These included the traditional 'digital clock program' and a program to time BASIC execution times Also touched on was internal representation using ASCII codes

The main body of the course, though, was concerned with writing simple programs in PET's interpretive BASIC

A systematic treatment of BASIC variable types, statements and data structures, up to and including random numbers string handling, arrays and subroutines, was interpersed with exercises such as a "dollar to pound conversion table (essentially just a times table) a simple (eg guessing) game and an elementary stock control/accounts advanced course

Use was encouraged of the PET's elaborate cursor control and graphics features to facilitate formatting of data tabular presentation of results and the use of striking screen prompts

Most of the students seemed able to cope with the materials – there were none of the "visible signs of distress" that Mr Gross-Nicklaus made it his business to detect The full syllabus was covered on this occasion, sometimes the pace is slowed depending on the class

"Advanced Programming in BASIC" was, on this occasion attended by rather fewer students than the first course – only six in fact – though I was assured that this was anomalous

Students were from a similar variety of professional backgrounds to the first class though had rather more programming experience in fact the equivalent of the first course plus three month's programming experience was regarded as a prerequisite for entry Some students had considerably more experience than this and most had particular applications or projects in hand that necessitated attendance some indeed, were to be disappointed that their specific problems would not be examined in class time (machine code routines are an example)

The reduced class size permitted students to work alone if they so wished, though most opted to work in pairs as Mike advised

Commodore word processing course

The course was structured around a model job – a general purpose utility program called 'Simple List Handler' From the outset the modular approach to programming was encouraged, coding was to play a definite second fiddle to job specification, flowcharting, and design of testing and test data – a very different approach from the "chimpanzee with a typewriter' one of the elementary course emphasised by the course title, which is not to be confused with the self-contradictory 'Advanced BASIC

'Simple List Handler' was intended to hold and manipulate a list of quantities and their attributes, such as e g a list of schoolchildren the subjects they were studying and the marks they obtained in an examination Each student or pair was asked to specify their own problem (i e list) and program

Once the program was specified it was possible to proceed to flowcharting it and thence to the production of a dummy program utilising line numbering conventions null subroutines and liberal sprinkling of comment (REM) lines

From this point on, practical exercises consisted of flowcharting writing and testing modules/sub-routines as the appropriate theory was introduced Each module was concerned with a different aspect of advanced" programming and by the end of the course menu selection techniques, entering, amending, deleting and listing the contents of an array, reading and writing to and from disk via IEEE bus and indexed sorting (bubble and Quicksort) and printing had all been covered as had, for the sake of general interest PEEK and POKE statements

Particular attention was paid to the user interface, making PET await valid keypresses for example and preventing the program being EXITed if the user unwittingly presses RETURN Several points of style were also noted with regard to screen messages and uncluttered screen displays

As with the earlier course, most students managed to complete the exercises

Mike Gross-Nicklaus adds these comments

In our future marketing of residential training courses we shall be making the point that these fees include the residential costs with VAT and Service The actual tuition fees are around £50 00 + VAT per day If you look around other commercial training schools I believe that you will find these fees in the low end of the scale (Please let me know if I'm wrong) We can't compete with the low fees charged by academic establishments which are presumably partially subsidised We are trying out on a pilot basis the running of non residential versions of these courses in the various regions of the UK visiting each region once every two months We are also investigating the encapsulation of the training material in work books supported by disk or cassette (While there is nothing to compare with hands on shoulder tuition I don't see why those who can't afford the fees or the time should be left out in the cold)

I ran a pilot Assembly language course at the beginning of August with ten students reasonably well versed in BASIC but without any experience of ASSEMBLER. I don't know if I had exceptional students or whether the nature of the course attracts those who learn easily but within an hour of starting all students were writing Assembler routines that worked. The appraisal form scores and comments were the most encouraging of any I've had in twenty years of course design A follow up at the beginning of September showed that 100% of the students involved were continuing with their Assembler studies and producing useful machine code routines I have added the course to the Commodore repertoire and we shall run it in the same manner as the other courses lots of hands on – progressive exercises – practical skills

The service and maintenance course is intended for dealer engineers but is open to members of the public The fee includes £175 00 for engineering diagnostic hardware and beginning routines

by the end of the three days and in any case a full sample listing was provided for study after completion of the course

Documentation was in fact, provided for both courses and was of a very high standard the 'BASIC for Beginners" manual contained a fairly full exposition of Microsoft BASIC with exercises and typical solutions, "Advanced Programming in BASIC documentation consisted of sample specification and flowcharts for 'Simple List Handler along with listing and sample output My only criticism is that in neither case were the pages numbered or an index provided

Both courses were concluded with some thoughts on where do we go from here? Gross Nicklaus made in my view some very sensible recommendations such as • use the opportunity of returning from a course to bring about some changes in behaviour e g insist on having an hour a day, or half a day a week free from interruption to further newly acquired computing skills, • do not fall into the trap of accepting a large scale imposed computing task that your employer now expects you to be able to perform as your first project, you will almost certainly fail at the expense of your own self-confidence and other peoples confidence in you • read and write simple useful programs to start with

Games were particularly recommended for the latter purpose and whilst generally I rather disapprove of games in computing, regarding them as a trivialisation of something at least fairly serious I have to agree with Mr Gross Nicklaus that they can offer the student some clever idiomatic BASIC without bogging him down in technicalities as an application program of any complexity would

Course Review

BASIC for Beginners is I feel in conclusion, as good a way as any to introduce the novice to computing, though at £275 plus VAT, travelling expenses and three full days off perhaps not the cheapest However the advantage of giving a formal introduction instead of leaving the student with a PET, a manual and the instruction 'Go on learn BASIC, it's easy is that the initial fear of the unknown, and especially of computers, that many people have can be dispelled before it becomes paranoiac Further it must be remembered that a residential course offers a unique opportunity to immerse oneself in the subject matter in a way that cannot be accomplished on any other sort of course and the quality of the hotels chosen by Commodore ensures that one is immersed in as comfortable and as well-fed way as possible

For the trainee professional programmer "Advanced Programming in BASIC' provides the ideal follow up a few months later, as it does for other professionals requiring serious computer competence It also costs £275

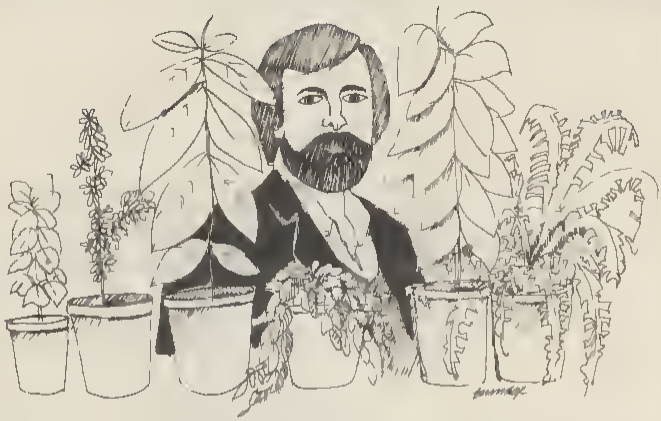
Whereas ' Advanced Programming in BASIC is concerned only with sequential file handling, 'Disk Utilisation which costs £175, also covers Direct Access Files, as well as disk commands and DOS support

Of Commodore's other courses, the forthcoming assembler course will assist those using the PET in time-critical applications such as control and monitoring scientific experimentation and engineering, where connection to the regular sampling from such equipment as digital voltmeters is required The Service and Maintenance course at £450 is the most expensive and is not in fact generally available to the public as it is primarily intended for PET dealer engineers

The one day courses offer particularly good value The Word Processing' course for example which costs £35 provides each student with his or her own PET with floppy disk drive and printer, configured with word processing software, for the day plus full documentation and refreshments

Before departing, delegates are invited to complete an appraisal questionnaire grading various aspects of the course/seminar tuition, documentation, usefulness etc – and making any further comments they consider relevant This has enabled Mr Gross-Nicklaus and his team to develop the courses in line with demand to the point that they now feel that they can offer something very worthwhile indeed ■

• *Anthony Esgate is Deputy Editor of* Computer Age



Six Large Green Plants

or, Human interactions with Computers

Well here we are. It's four in the morning and I'm sitting up in bed writing this on thin lined paper using the last-but-one issue of Computer Age for a support. Mind a little smashed on Polish vodka and Canadian whisky.

The book I meant to review – *Human Interaction with Computers*. Academic Press. London 1980 – is on the floor over there by the upturned briefcase I bought it from Boots in Regent Street in 1973 to go to America with for the first time ever (the briefcase I mean – the book came weeks ago or two of them in fact one to me at the Royal College the other care of Computer Age). (That's why I feel so guilty about this gonzo review.)

What do you think about the people who write words in magazines? Are they real? And the ones who edit, print, distribute and sell them? I don't feel very real. Here I am in Notting Hill computer less, lacking the means to program to plot to paint or even to cuddle anyone.

I wanted to tell you some things about my trip to Canada, seeing various artists who are using computers, about that book and some things at the Royal College of Art. Listen. I've been talking about computers and art all night, honest. Came to no firm conclusion. Had a bit to drink, and exchanged a few ideas. Mostly of running away.

Why are they all so worrying? Computer people talking about well *stuff*! How we won't live to be sixty, how one should live in another place (Paris or Poland or Venezuela). How small businesses can't survive. (Oh come to think of it that was all me.)

There sit these machines and art, politics change and stuff, and what it all comes down to this very windy night in West Eleven is reviewing a black book consisting of papers by a number of authors. About programming, computer aided design, relating to the technology interacting with the micro processor. One guy needing thumping, insisting on seeing people as components of systems.

If I don't write something nice about the book, or at least *sage*, they won't send me any more to review. Certainly not two at a time. In padded, yellow envelopes. At least I use them. Many reviewers sell them – but then they probably get hundreds each week.

I must recommend you to buy this book. It is a big and black and authoritative looking, and it's only six pounds forty! Now that's something. I mean that book I reviewed two issues ago was from the same publishers, about the same size, and yet cost £21. Need I say more? This book, here reviewed, mentioned above, is *less than a third of the cost*! True, it's not so pretty inside, but it does have a quite pleasing jacket. It is edited by two people named H. T. Smith and T. Green.

I asked some people – a random selection of experts – what they thought of it. A Miss Susan Ford of London said 'I don't know.' A man who had been cleaning a window said 'Yes it looks nice.' And from a librarian: 'If it was free it would save me buying one, if I wanted one. What's it about?' You will see that there was no negative reaction here, and there often is in book reviews, so that can't be bad, can it?

Hey we got our new digitising pad to work last night. I really don't understand much about interfaces. I mean, to get the position of the pen into the computer, to actually accept the xxxx yyyy flag, flag, flag carriage return line feed, that would enable you to draw on a graphics screen by moving the pen over the special tablet, is appallingly difficult.

Have to make the computer think that the port is in fact the keyboard (thus disabling the keyboard, tremendous, er, fun when you want to stop the program but Control C is ignored). Then you use a Line Input statement to grab the whole lot and put it in A$ or something, then switch the keyboard back.

You can then draw it all out on the screen in glowing colour, and when it looks right, plot it on the Calcomp 81 plotter also new, also just (barely) got going.

But the screen can't draw circles or arcs or italics, while the plotter can. And the plotter can't draw coloured blocks automatically, though the screen can. So there is much high academic software activity to be unleashed, like raiding personal computer magazine articles.

A terrible night. I dreamed I was in

Belgium with blood oozing out of my back The doctor said I must keep counting to ten, to take my mind off it In the morning, hungover as a bat I see two of my students in Hyde Park with brooms They appear to be sweeping it

Entering the computer studio I find that an incredibly heavy screen has fallen to the floor taking a white board and an overhead projector with it I wonder if there is anyone squashed underneath but cannot bear to look Someone wants to take my desk away there is fag ash all over the disk drive and it is clear that the forces of entropy are gathering ready and magenta for the end of time

Over coffee I explain my twin aims of changing the world and becoming rich and famous to a person who has the effrontery to call me confused The person doesn t understand the modest nature of my proposals

All I need is a small grant from one of the lesser known Research Councils conditional upon my helping to Make the Revolution Now

Perhaps one could go busking in the streets and subways, offering snippets of wisdom or readings from interim reports on minor research projects in exchange for the unambiguous clink of silver coinage

Goodness they *do* want to take my desk away You see there is or are a lot of politics in this place and I don t mean the Margaret Thatcher kind (I never mean the Margaret Thatcher kind) No I mean the irksome internal, major mutterings that go on about money space and fame

You see *I think* we ve only got this nice big computer studio looking out over the park with basements running under the grass – probably to plague pits – because the Department wanted the room, and couldn t think what to do with it Now they want to hold seminars in here to impress people

Ah ha! This must be the reason they suggested I buy – with their *real money funds* – six large green plants, to stick round my desk so no-one could see me

You do tend to dominate the room a bit, don t you you re the first thing people see when they come in

Discourse

'Goodness they do want to take my desk away'

What? Not the little conceptual notice that says look we know this is a College appointment but it s mostly the Department s computing equipment and even the 380Z is his and not the College s so we don t know why you and he keep talking about College Computing – it's *Departmental* Computing even if we don t pay his salary

(I ve just been appointed Royal College of Art Tutor in Computing in Art and Design so there)

The head of the Department comes in just when I m throwing a paper aeroplane It loops the loop, and he catches it bemusedly I show him the latest triumph A stylus drawn across the digitising pad leaves a thin red line on the screen

Can you rotate it?' he asks What do these people *want*?

In near conclusion I must ask you to buy the book that I have, uh hum reviewed here because If I don't, they won t send me any more and anyway it really does look quite nice, with lots of symbols on the cover

Hey – maybe if I send the jacket in (no the *book* jacket) with this piece, Computer Age can reproduce it, and it will look good, and and

A letter from Poland arrives Some of your things were very interesting but some were not '

I know I know

Earlier this morning, I lay in bed reading poems of Leonard Cohen I remembered I was 34 That's nearly 40

'Forty?' I snorted *'Forty??'*

I programmed the computer just now It generates random ages 'You are 26' 'You are 24

Well – more stochastic than random Limited by a narrow band of possibilities upon which

I have insisted ■

*The author is at the Royal College of Art Kensington Gore London

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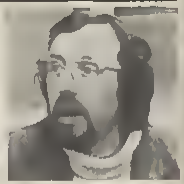

A company whose marketing nimbleness and flair belie its size prepares to enter the computer age

For those with long memories my case, I think, rests. For those with shorter memories however, I will remind you. Back in July I put into words a point of view about software for microcomputers that I still feel is correct though I wouldn't complain at all if I was proved wrong. Now, someone is to dabble at putting the point to the test.

Confused? Well, let me explain. W H Smith, that well known High Street retail chain that sells newspapers, confectionery, office supplies, records, calculators and God knows what else, is adding another product line to its inventory. This one is cassettes, even though it already sells cassettes. These new additions are not audio in nature however, (or at least not intentionally audio), they are program packages for microcomputer systems.

Smiths has produced an enviable track record in the High Street rat race of merchandising, that success being the one sure touchstone of having learned the arts and crafts of merchandising well. In its field it is a company that has a not unreasonable amount to be smug about.

So will it be the company that over the coming years becomes the one to be smug about the merchandising of computer programs, that theoretical Utopia of the software marketeer where the customer comes into a shop and says the magic words, twenty kingsize *Daily Mirror*, and a payroll suite for up to ten employees please'?

To be fair to Smiths they are only dabbling with the products at present having signed a contract for the supply of programs with ACT Petsoft and with plans to sell them in only a handful of outlets. That is the story so far, though if there is any hint of potential success with such products it can be safely assumed that the company will be in there like a rocket, firing on all merchandising cylinders.

It is perhaps pertinent therefore to consider what its chances of success might be, and have a look at the factors that may influence the final outcome.

And so we go back to the beginning of this piece, and the words I wrote for the July issue of Computer Age. In that particular article the subject was merchandising, and in particular the entry of Currys into the High Street retailing scene. As part of that discussion I put forward the idea that merchandising is only successful when the purchaser requires only limited pre-sales support effectively zero post-sales support, where the product could be delivered (or better still walked out with) and basically forgotten by the retailer, and where there were strictly defined and universally accepted product standards where they were appropriate.

The most analagous example I could come up with was the software used with hi-fi systems – records and tapes. Here, any record should play on any hardware regardless of manufacturer or technology employed. Within reason, the same can be said for cassettes. If they don't play there is something wrong with the record, cassette or hardware. Because little skill is required to obtain the desired end result with the purchased product, little end user support is required, and because of strict standardisation deviations from that desired result can be easily spotted and faults isolated and remedied.

What I said in July was that this is certainly not the case with microcomputer software packages and that (and I quote), 'One day it will happen. Then will be the time to merchandise.'

The big question therefore, certainly as far as Smiths is concerned, is how close we are to that day. Indeed has it actually arrived? To date there seems to be little evidence that it has, despite the generally frightening pace at which new developments occur in the microcomputer arena.

Once again, I would like to refer back to the article I wrote in July. Take, for example, the subject of software standardisation. Now, this can be looked at in two different ways, and in either case microcomputer software would currently seem to fail the test of merchandising criteria.

For the first view there is standardisation in terms of the actual products. Though BASIC is without doubt the most widely used high-level language on personal and small business micros, I can't think of one system that uses the original standard Dartmouth BASIC. They all use derivations of that original, each offering different enhancements and modifications, and all of them somehow different from the rest.

Then there is the operating system problem. Most of the systems manufacturers offer their own, no doubt wonderful, operating systems so there is little scope for standardisation here. Most of them also now offer the de facto standard operating system CP/M, from Digital Research. Fine – a standard item and to a large degree that is what it genuinely is. There are however oft-reported quirks about even CP/M's actual degree of standardisation, so even here all may not be as standard as it seems.

Here, then, standardisation requirements for successful merchandising are not met. It becomes difficult to mass market a range of products that require an intermediary system (i.e. the hardware) to be of any value whatsoever, if they are also required to meet a wide range of special standards. Software for micros is still very much in the era of 'made to measure'. The choice on whether this is in the form of Savile Row (expensive but usually effective) or jumble sale (cheap and pray a lot) is entirely up to the user. To date, the all-purpose elastic sided one-sized-unisex-outer-raiment has not been produced. Current packaged software has a tendency to fit the application in the same way as an off-the-peg suit where it touches.

Mention of applications leads on to the second view of software standardisation for here lies the biggest problem for the merchandiser. Unlike the purchaser of a record or cassette intended for playing through a hi-fi system, the purchaser of a packaged program invariably seems to have a different end-result in mind from all other purchasers of that program. It may only be a slight difference, but bet your sweet bippy that it exists. This is like someone buying a record of Tchaikovsky's Symphony No. 6 in B minor and deciding that they would really like it in E_b minor.

Now it can be argued that if that is what is wanted the purchaser can easily shop round till it is found in the form required, and the same can be said of packaged program purchasers. But what if it cannot be found? (In that case the computer person comes out ahead, it would cost a fortune to get someone to transpose Tchaikovsky and then get an orchestra to record it. It still however costs a lot to get hand tailored applications software.) What is found is certainly not a merchandised product.

If perhaps it was possible to produce both hand-tailoring and mass marketability in a packaged program then the ultimate goal of low cost, efficient, client specific merchandisable software packages would be achieved. At present that

is not really a starter and that obviously goes against the chances of Smiths as a software retailer The inherent complexities of actually making software meet the customer's requirements coupled with the skills needed to sell the packages into that arena by the company's sales staff seem to be prejudicial to its chances

But there is however, light at the end of the tunnel, or at least the possibility of light Its eventual existence depends greatly on technical developments now coming along, and market forces that as yet can only really be guessed at The following scenario – and it is just that for now could lead to Smiths ending up highly satisfied with its software sales if it takes to the market slowly, and doesn't get frightened by its first half yearly figures For it is certainly true that with the numbers of microcomputer systems already in the field in the UK and the numbers that are currently being sold there *just has to be* a market for high volume sales of packaged programs out there somewhere once the formula for hitting it is right

This scenario is maybe a possible formula The developments in the application of semiconductor technology especially in the form of read only memories means that ever more complex devices are being produced With memories this means more bits per chip Already manufacturers are developing 128K bit ROMs (that is 16k bytes of program store) Memories with double that capacity are coming That sort of capacity offers

Viewpoint

considerable leeway for the development of firmware modules ROMs that contain specific non alterable programs Such modules would have several potential advantages and one major disadvantage

To deal with the latter first, the problem resides with the nature of the component Once a program is committed to silicon it stays very committed If a bug is found afterwards that's bad news because the memories already produced are scrap and the whole job has to be started over There is really no way round this except ensuring that the programming is right and well constructed

Given that disadvantage however the scope of the advantages increases as the technology of the devices expands their capabilities Imagine a well-defined and well written program for some common application sales ledger for example In the future a very large ROM could hold such an application program, and it could be one that was complex enough to be sufficiently flexible to cope with most of the common variations sought by users It could also be provided with software hooks within it to which additional program modules either more specialised sub-routines or program modifiers – could be attached

The theoretical advantage of such an approach is that, though the software itself would be expensive to develop the *medium* that carried it would be cheap producible by the barrow load, and in some form of robust packaging, *easily merchandised* It would also be intrinsically reliable both through the protection afforded by the packaging and by the fact that semiconductor devices usually work well if they manage to pass the manufacturer's final test (This last part is for firmware theoretical It still in the end will depend on getting the program right)

But that is one possible future method for achieving an easily merchandised range of software products to market There could be considerable pressure from the semiconductor manufacturers themselves towards it as it will be, for them a good way to sell a lot of silicon

There is of course the problem of hardware and operating system standardisation to overcome though as I pointed out in the October issue the semiconductor companies have designs on those problems as well

Whether Smiths succeed in the short term is very much open to question, but, in the long term who knows? By dabbling now the company will certainly gain valuable experience if it is serious about the future And whichever formula is found to eventually crack the market for packaged programs, someone should be ready to tackle the veritable gold mine that will certainly exist ■

• *Martin Banks is editor of* Microcomputer Analysis *a Macintosh publication*

Part II

Conditional Structures

This series on FORTH assembler should be read in conjunction with the author's tutorial series on FORTH in previous issues of our magazine

We continue the discussion of assembly-language programming in general and the FORTH assembler in particular, with a couple of examples using *conditional structures*

First just a word about the mechanics of the process The assembly language programme is typed on the keyboard in the **Editor** mode and then 'flushed' onto disc or saved on tape The actual assembly of the relevant code will take place when this is subsequently loaded into dictionary In the majority of assemblers you are therefore required to state the memory location and to label, with a word of maybe six letters, the locations to which various jumps and branches will be made All this results in what is called a **symbol table** giving the addresses assigned to the various labels

In FORTH this is not necessary The programme is assembled into the first available location in the dictionary and jumps and branches are automatically assigned by means of the BEGIN —— UNTIL, IF —— ELSE ——ENDIF structures (the comma is obligatory in the assembly form of these commands)

When a programme has been loaded you can, if you're curious *disassemble* it to see what it looks like in my case with the APPLE resident disassembler contained in the *monitor* programme You find where the programme starts by

```
NAME
```

which reads tick name dot and this then returns the start address of the programme whose name is NAME You then enter the monitor and disassemble twenty instructions by *NNNNL where NNNN is the start address We do this in the programmes which follow

Example A programme to test if the contents of a memory location are positive or negative A number is considered positive if it lies between #0 and #127 and negative if between #128 and #255 Zero you notice is considered positive.

```
65005 CONSTANT COUT
10 CONSTANT ADDRESS

CODE TRY ADDRESS LDA,
  0<    IF, 20B # LDA,
        ELSE, 20E # LDA,
        ENDIF, COUT JSR,
NEXT JMP, END-CODE
```

FIGURE 1

Explanation

65005 (which is alternatively – 531 or FDED'HEX) is named COUT which is the name given to it in the Apple monitor and stands for character out

The address 10 has been named ADDRESS

The assembly-language programme starts with the word CODE as do they all This sets up the assembler TRY is the name of the programme which when assembled by loading into dictionary will cause the programme to run when invoked The instruction which follows thus picks up the byte which is contained in ADDRESS

0< is the FORTH assembler way of querying whether the number in the accumulator is less than zero (i e has the negative flag been set?) If it is then the number #206 is put in the accumulator whereas if it isn't the number #208 is chosen instead and then in either case a jump is made to COUT where a programme resides for putting out to the screen either N (#206) or P (#208) NEXT JMP, gets back to FORTH

Example of Use

```
1 ADDRESS !  (Store the number 1 in
ADDRESS)
  TRY P OK (the number is positive)
255 ADDRESS !
  TRY N OK  (The number is negative )
```

On invoking TRY you get a P or an N Here is the disassembler listing of the programme See Figure 2

```
7EF8-  A5 0A      LDA   $0A
7EFA-  10 05      BPL   $7EFF
7EFC-  A9 CE      LDA   #$CE
7EFE-  4C 01 7F   JMP   $7F01
7EFF-  A9 D0      LDA   #$D0
7F01-  20 ED FD   JSR   $FDED
7F04-  4C D0 03   JMP   $03D0
7F07-  00         BRK
```

FIGURE 2

Reading the two right-hand columns which contain the 6502 mnemonics and the data and addresses they operate on, the points to notice are

1 BPL $7EFF is interpreted in machine code as 10 (BPL) 05 (5 bytes on from $7EFA i e $7EFF) ELSE, causes this jump BPL is an example of relative addressing

2 JMP $7F01 is an absolute jump to an address decided by the word ENDIF, after the number for N is picked up, skipping over the command to pick up the number for P

3 Finally in either case a subroutine jump to $FDED occurs for interpretation of the ASCII code returning to FORTH by JMP $03D0 (So 03D0 is NEXT) Effectively the same programme could be written as in Figures 3 and 4

```
65005 CONSTANT COUT
10 CONSTANT ADDRESS

CODE TRY ADDRESS LDA,
  0< NOT IF, 20D # LDA,
        ELSE, 20E # LDA,
        END-IF, COUT JSR,
NEXT JMP, END-CODE
```

FIGURE 4

```
7EF8-  A5 0A      LDA   $0A
7EFA-  30 05      BMI   $7EFF
7EFC-  A9 D0      LDA   #$D0
7EFE-  4C 01 7F   JMP   $7F01
7EFF-  A9 CE      LDA   #$CE
7F01-  20 ED FD   JSR   $FDED
7F04-  4C D0 03   JMP   $03D0
7F07-  00         BRK
```

FIGURE 3

The difference is the use of 0< NOT and the swap over of the N and P instruc-

tions The disassembler shows BMI (branch on minus value) That is the programme does not jump if the value is less than zero

We extend the scope of this kind of programme by introducing *loop* structures and *subroutines* and write a programme called CASES which will put the computer into a mode in which it can put out upper or lower case letters whilst behaving normally on all other keys

We want a proper shift-lock facility That is if we are in lower case we want to *stay* there *until* we wish to jump to upper case

Here is the programme (Figure 5)

```
( USE LOWER CASE
  KEYPAD CREATED T KEYBOARD
  1   ND CONSTANT STROBE
  #8003 CONSTANT COUT
  #FB   CONSTANT CRDATA
  141   CONSTANT RETURN
CODE CURSOR 8 C, 8 C, LDA, COUT JSR , 136 #
LDA, COUT   #2 BTS, END-CODE
CODE DOIT LOOP   DEA, STROBE LDA ,
   CURSOR   #7F # BTS,  END-CODE
CODE CASES  RETURN # LDA, COUT JSR,
   CURSOR !
      CRDATA KEYBOARD LDA
143    # CMP, 0=  NOT IF,
141    # CMP, 0<  NOT IF,
RETURN # CMP, 0=  NOT IF,
ESCAPE # CMP, 0=      IF,  ' CURSOR JSR
STRODE LDA, #EGIN , KEYBOARD LDA
CODE#E  # CMP, 0=  NOT IF,
128     # CMP, 0<  NOT IF,
RETURN # CMP,  0=  NOT IF,
#97     # CMP, 0<  NOT IF,
219     # CMP, 0<      IF,    -96 LOOP

( #DS LOWER CASE )
( THIS CHORIES ON DIRECTLY FROM #E2 )
                              ;
        $ 32 #OR
```

```
                ENDIF,
              ENDIF
    DOIT
ELSE, NIL    T0 # LDA, CR T JSR  TL
' DOIT JSR,
              ENDIF,
              ENDIF,
              ENDIF
ESCAPE # CMP,        0=  UNTIL
                STROBE LDA,
ELSE, ' DOIT  0=
              ENDIF,
ELSE, PHA, 16# # LDA, COUT JSR  PL
' DOIT JSR,
              ENDIF
              ENDIF,
              ENDIF, 147 # CMP,
  0  UNTIL  STROBE LDA
NEXT JMP, END -CODE  FORGET CASE
```

FIGURE 5

Explanation

Lower case is obtained by adding #32 to the ASCII code for the capital or upper case letter If you look at the programme which starts CODE CASES you see that first of all you do a carriage return and then set up a cursor (more of that later) Then a loop is started by means of BEGIN and the keyboard is read from a monitor location $C0000 which is 16384

If a key has been pressed (tested by 128 0< NOT) and if that key was not the return key nor yet ESC (which is ASCII 143) but was in fact the ESCAPE key the programme falls into the inner loop started by the second BEGIN and eventually gets to the point where #32 will be added to future key codes if they fall between #193 and #218 — i.e. they represent letters

If you hit ESCAPE again you will go back to the outer loop and be in upper case

CURSOR is a subroutine which prints a dash for a cursor and then emits a backspace so that it will be overwritten by the next character

RETURN has to emit a space to rub out the cursor at the end of the line

If you are in uppercase then O will get you out of the CASES programme Unfortunately the programme will not work unless you have fitted the lower case converter to the Apple keyboard This is obtainable from Personal Computers Limited Notice that the subroutines are first defined and must contain an RTS at the end The subroutines are called in the programme by

NAME JSR

I conclude with a example of the programme in action (Figure 6)

```
AHHKE! For Herring in the heart of Night
Has flung the stone that puts the
                        stars to flight
And lo! The Hunter of the East has
                                caught
The Sultan's turret in a noose of
                                light
```

FIGURE 6

• *Gil Fitbey is a lecturer in Physics at the South Bank Polytechnic London*

RATIONAL FORTRAN

Whatever language you prefer getting an idea of other languages is a positive help in using your own

Ratfor (Rational Fortran) is an improved version of Fortran, devised by Kernighan – Plauger and described in their book (1). The main improvements are a completely new set of control statements and a DEFINE statement

How is it implemented?

Ratfor was designed to be implemented as a pre-processor that is instead of being compiled directly, your program is *first* translated into ordinary Fortran and *then* compiled using a Fortran compiler

Advantages of a pre-processor it's relatively easy to write and most of the work has been done already in (1) Therefore it's readily available and cheap – you could even write it yourself though it's not an overnight job

Disadvantages of a pre processor

- 1 You'll need a Fortran compiler (if you don't already have one)
- 2 Obviously the pre-processing takes time, which must be added to the Fortran compilation time How much time depends on details of implementation – the original design is rather inefficient and can be improved (2) My current implementation, based largely on the original design, takes about the same time for pre-processing as for Fortran compilation (on a program of non trivial size)
- 3 The pre-processor can detect some errors in Ratfor syntax However, most compile time errors will only be detected by the Fortran compiler, whose messages will necessarily refer to the Fortran version of the program

How does it compare with Fortran?

It's a significant improvement over Fortran, well worth the increase in compilation time – except probably for very small programs Ratfor programs are much easier to write, read and modify They may be structured readably GO TO statements are no longer needed, lower-case may be used, and the DEFINE statement may be used to provide symbolic constants, long variable names single identifiers to replace repeated common block declarations and more

How does it compare with BASIC?

This comparison is more interesting It must be said straight away that BASIC has some advantages string handling and input/output are more convenient in a good BASIC, and an interpreter provides a better environment for program *development* than Ratfor's multi-stage compilation.

Of course, it's necessary to use a compiler to obtain fast-running programs and the Microsoft approach (they produce a BASIC compiler and interpreter which are largely compatible) provides the best of both worlds for BASIC programmers

However BASIC has serious disadvantages as a language. Its control statements and its subroutine and function facilities are extremely primitive, making it tedious to write and difficult to read and modify

These problems are largely solved in Ratfor, and in principle it's possible to use Ratfor's subroutines and functions to remedy its defects in string-handling and input/output. Indeed subroutine libraries such as THE STRING BIT and STRING/80 are now on the market, claiming to provide a ready made solution

The possibility of a Ratbes pre-processor to improve BASIC (by introducing Ratfor like statements and also better subroutine and possibly function facilities) is intriguing but it would be a somewhat more difficult task than the Ratfor pre processor and the immediacy of an interpreter would be lost

How does it compare with Algol/Pascal?

Both Algol and Pascal are inherently better designed than BASIC or Fortran, and so, all things being equal you might well expect to prefer either of them to Ratfor

However in practice it seems to happen that those languages which are best in principle tend to suffer from limitations imposed in particular implementations for instance RML Algol doesn't produce fully compiled code (it produces intermediate code and interprets it at about half the speed of compiled Fortran), Pascal/MT doesn't implement string constants or standard Pascal disk read/write statements (it uses low-level CP/M based routines) and both languages fail to provide double precision floating-point variables (essential in complex calculations where rounding errors may accumulate)

Furthermore there may be substantial problems in transferring programs written in these languages to different machines, whereas Fortran is sufficiently standardised to be moved between most computers with little trouble (it took me only a couple of days to convert my implementation of the Ratfor pre processor from Microsoft to Burroughs Fortran, to run on the Burroughs 6700)

What are the facilities?

Algol and Pascal programmers will be familiar with the concept of the compound statement, whereby any single statement may be replaced by a series of statements enclosed between the words BEGIN and END

This facility is provided in Ratfor, which uses braces ('{' and '}') in place of BEGIN and END

So instead of

```
      IF (LSTTOK NE 9) GOTO 731
      CPOS = CPOS + 8
      CALL TSTEND
      GOTO 740

731   IF (LSTTOK NE 13) GOTO 740
      LINECT = LINECT + 1
740   CPOS = 1
      CONTINUE
```

we may have

```
if (lasttoken == TAB) {
      cursorpos = cursorpos + 8
      call testend
      }
else if (lasttoken == CR) {
      linecount = linecount + 1
      cursorpus = 1
      }
```

or alternatively

```
if (lasttok = TAB)      { cpos = cpos + 8 - mod(cpos-1,8) }
else if (lasttok = CR)  { linecount = linecount + 1; cpos = 1 }
```

Clearly, the compound statement makes it easier to see what's going on in the program, it lets the programmer dis-

[illegible] with [illegible] GOTO statements

Notice that Ratfor also permits the use of the semi colon to separate statements on the same line, although this facility should be used sparingly lest it interfere with program readability

The various other Ratfor facilities may be described as follows (Colons in the text below are merely punctuation marks Editor)

- 1 IF (condition) compound statement ELSE compound statement

If condition is true, *perform* first compound statement *otherwise* perform second compound statement The ELSE clause is optional Because a compound statement may include any Ratfor or Fortran statement Ratfor statements may be nested indefinitely

- 2 WHILE (condition) compound statement

If condition is true, perform compound statement then continue to perform it until condition is no longer true

- 3 REPEAT compound statement UNTIL (condition)

Perform compound statement then continue to perform it until condition is true This is the same as a 'WHILE statement except that the test is at the end instead of at the beginning (and works in the opposite way) The UNTIL clause is optional

- 4 DO ivar = i1 ,i2 ,i3 compound statement

Thus is quite simply a Fortran 'DO statement without a label All the normal Fortran rules apply

- 5 FOR (statement 1 condition, statement 2) compound statement

Perform statement 1 then if condition is true perform compound statement followed by statement 2, then continue to perform compound statement followed by statement 2 as long as condition remains true

This is a much more general looping statement than DO because statement 1 and statement 2 may be each be any single Fortran statement (not a Ratfor or compound statement) and the condition may be any Fortran logical expression

- 6 BREAK

Exit from the current WHILE REPEAT DO, or FOR loop

- 7 NEXT

Jump to the next iteration of the current 'WHILE, REPEAT DO or FOR loop

- 8 # comment

A # anywhere on a line declares the rest of that line to be a comment which will be skipped by the pre processor Such a comment may follow on the same line as some program text The Fortran C comment convention doesn't work in Ratfor

- 9 DEFINE identifier\program text\

The exact form and effect of the DEFINE statement isn't standardised in Ratfor, it should allow you to define an identifier to represent any section of program text (a number another identifier a series of statements) Some implementations may permit the use of parameters with this statement

- 10 Ratfor permits the (optional) use of signs in place of the normal logical operators as follows

GT	>
GE	>=
LT	<
LE	<=
EQ	==
NE	!=
NOT	!
AND	&
OR	|

Some of these signs may vary according to the implementation The use of '=' for NOT, adopted from the C language (which Ratfor resembles in some respects) isn't immediately obvious to non C programmers personally I prefer '?' which is more self-explanatory (emphasis is after all the opposite of negation!) and less likely to be confused with the OR sign

- 11 The end of a line normally indicates the end of a statement as in Fortran However a line ending in a comma, or an obviously incomplete Ratfor statement, will be assumed to continue on the next line Alternatively an un[illegible]

Ratfor

[illegible]

An [illegible] statement may be used in Ratfor unless otherwise specified GOTO [illegible] may be used if desired Labels [illegible] in any position on the line as long as they precede the statement to be labelled

The Fortran arithmetic if statement may not normally be used in Ratfor In my own implementation Ratfor keywords are only recognised if they're in lower case consequently, arithmetic if statements may be accepted if the word IF is in upper case However this isn't a standard feature

Who should consider using Ratfor?

Consider using Ratfor if

- 1 You're writing programs more than 1 page long
- 2 You're writing programs for which fast execution time is more important than fast compilation time
- 3 You don't have access to a compiler for a good structured language or it doesn't have the facilities you require or you're used to Fortran and don't want to learn a completely new language
- 4 You're not completely new to programming and can cope with compiler error messages which refer to the *Fortran* translation of your Ratfor program ■

References

1 Software Tools by **Brian W Kernighan & P J Plauger** (Addison Wesley Publishing Company, 1976)

2 'MOUSE4 an improved implementation of the Ratfor pre-processor by **Douglas Comer** (in Software Practice & Experience Jan Feb 1978)

● *Jonathan Pelfrey is at the Computer Unit The University of Warwick Coventry*

Transferring Files Between Two CP/M Machines

Dr J. D. Lee is at the Department of Chemistry The University of Technology Loughborough

For a variety of purposes it is often desirable or even necessary to transfer files from one micro-computer to another. In an office these might be files of text for Word-processing, in a laboratory the files might contain readings from experiments in an accounting system or data base, the files might be numeric data or alphanumeric text.

If both micro computers have the same sort of disk storage it is only necessary to transfer the floppy disk containing the files to the second computer which can then read the data.

Conversely if the two machines have different types of disk storage (e.g. • 8 inch disk and 5 inch disks • or hard sectored disks and soft sectored disks • or double density disks and single density disks • or double sided disks and single sided disks) then it is not possible to transfer files by this means. The remainder of this article describes a method of copying from any CP/M™ compatible computer to another regardless of the type of format of disks used on each machine. Whilst this method is extremely useful for copying certain types of file it must **NOT be used for copying proprietary software** such as interpreters compilers assemblers etc. since such copying would be in violation of Copyright agreements.

The Copying Procedure

If the two computers have incompatible disks then any copying procedure involves both machines the first to read disks in its particular format and the second to write a new disk in its particular format. Furthermore, both machines must be *linked* in some way so that one can talk to the other. There are four ways of linking two computers.

- Connect an RS232 serial port from one computer to an RS232 serial port on the other
- Connect a parallel port from one computer to the other
- Join the buses of the two computers,
- Connect via a telephone modem

The simplest way of linking two microcomputers is to connect an RS232 serial port on one computer to an RS232 serial port on the other. When this is done, one computer transmits the data along the line and the second computer listens and stores whatever comes down the line.

Since it is still necessary to talk to both of the computers via a terminal or VDU, it is generally necessary to have *two* RS232 ports on each computer (if the computer has an integral video board plus a keyboard then only one RS232 will suffice).

Under CP/M the most direct way of establishing such an RS232 connection is to use the RS232 designated as the LIST device (usually used for a printer) on the transmitting computer and connect this to the RS232 designated as the paper tape READER on the receiving device. One computer is thus transmitting data to its LIST device whilst the other is receiving data from its READER.

Data can then be read from a disk file and transmitted from the port designated as the LIST device of the first machine by typing

PIP LST = filename ext *followed by pressing*

Carriage Return (where filename ext is the name of the file to transmit)

The data can be received by the port designated as the paper tape READER and stored on disk by the second computer by typing:

PIP filename ext=RDR: *followed by pressing Carriage Return* (where filename ext is the name under which to save the data)

This procedure works satisfactorily under the following circumstances

- 1 A crossed RS232 lead is connected from the transmitting computer's LIST device to the receiving computer's READER device (At its simplest this need only consist of two wires!)
- 2 The baud rates of the two RS232 interfaces must be set equal to the same speed
- 3 The receiving computer is started before the transmitting computer
- 4 The data transmitted occupies less than 16K since the receiving computer will store the data on disk when 16K has been received During the time taken to store on disk, some characters that are being transmitted down the line will be lost
- 5 The top bit (parity bit) of each data byte must not be important as this may well be reset by CP/M on the transmitting computer This means that, in general, ASCII files and other texts files will be copied correctly It is worth noting that FORTRAN and COBOL source files are stored as ASCII characters but BASIC programs may or may not be stored in ASCII form, depending on the particular interpreter used

File Transfer

It should be noted that thus procedure will not work for copying machine code programs, for two reasons Firstly the top bit of each data byte may be corrupted in the transfer, and secondly the receiving computer may recognise an end-of-file-marker (Control Z) before the end of the transmission thus prematurely terminating the transfer

The latter cannot happen with ASCII files as Control Z is not a printing ASCII character but can legitimately occur in machine code where Control Z corresponds to the Zilog instruction LD A,(DE) It is possible under PIP to suppress checking for Control Z as the end of file marker This creates a new problem since the receiving computer does not know when the transmission is complete This does not overcome problems concerning the top bit or the 16K limit on file size

An alternative method is to convert each byte of the machine code program into its hexadecimal equivalent and transmit the corresponding ASCII characters Thus the instruction LD A,(DE) corresponds to 1A hex and is transmitted as the character '1' followed by the character 'A' The receiving computer must then translate each pair of ASCII characters back into machine code The only valid characters to be transmitted are then the digits 0 to 9 and the upper-case letters A to F Any other character can then be used as an end-of-file-marker

At first sight it would appear that the user of such a system would have to write two programs one to transmit and the other to receive data However a program called DUMP COM is provided as a CP/M utility which takes a file and prints the contents in hexadecimal form on the console This is so near to the requirement for the transmitting program above that there seems little point in writing a transmission program as DUMP will suffice and a receiving program has been written which is compatible with DUMP To transmit a file to the LIST device (and hence to the other computer) one types

DUMP filename Cont^ P *followed by Carriage Return* (^P represents Control P rather than two characters)

The program to receive data in a form compatible with DUMP is given (page 34) and is called UNDUMP To use it one types UNDUMP on the receiving computer and then one starts the transmitting computer UNDUMP receives pairs of ASCII characters as data interprets them as hexadecimal converts this into the binary equivalent and stores the binary equivalent of the data received in memory starting at 100 hex (ie the normal position of a CP/M transient program)

UNDUMP does not save the data on disk This is accomplished by means of a SAVE command typed in immediately after the transfer has been completed The advantage of this is that since the data are not stored automatically on disk the 16K limitation encountered in the previous method is avoided At the end of a dump DUMP returns to the operating system and CP/M issues a prompt of A> (or B> if B is the logged in drive) UNDUMP detects the > symbol as the end of transmission marker and instructs the user how to SAVE the data in memory onto disk. Cromemco users should note that CDOS uses a different prompt and one byte of UNDUMP must be changed for the program to work correctly

Comments on UNDUMP

1) The program is written in Intel 8080 code so that it will assemble using the CP/M assembler, ASM
2) UNDUMP places the program being received in memory starting at location 100 hex and working upwards UNDUMP itself also occupies some memory as does the operating system CP/M CP/M is located at the top end of the available memory The higher UNDUMP is located in memory the more space is available to store the program being received However UNDUMP must not overwrite CP/M! Thus UNDUMP should be located as high in memory as is possible and in the listing provided this is assumed to be at 32K (8000 hex) UNDUMP will attempt to overwrite itself if a file that is too large is transmitted!
3) UNDUMP obtains characters from the RS232 link by accessing the CP/M READER. If the READER has not been implemented in the CP/M being used then a suitable input driver must be added to the UNDUMP program to replace the CP/M READER
4) UNDUMP checks the characters received from the line to ensure validity UNDUMP gives an error message if a hex character is not 0 to 9 or A to F, or if characters are dropped during the transmission UNDUMP will therefore detect seven eighths of all possible corruptions and all dropped characters that may occur during transmission
5) The time taken to transmit a file depends on the size of the file and the baud rate used At 1200 baud approximately 2K of useful data are transmitted each minute
6) Transmission of large files takes an appreciable amount of time at low baud rates The UNDUMP program echoes characters received from the line to the console so that the transfer is seen to be functioning A side effect of this is that the console of the receiving computer must run at a faster baud rate than the transmitting line

How to build a crossed RS232 connector

Unfortunately the vital link between the two computers requires a non-standard lead The connections necessary to build such a lead are given below

RS232 to RS232	Connection made
pin 7 to pin 7	Ground to Ground
pin 2 to pin 3	Transmit to Receive
pin 3 to pin 2	Receive to Transmit

Strictly only one of the last two connections need be made, but by connecting both the lead becomes symmetrical and either plug can go in either computer One further complication may arise if the printer RS232 of the transmitting computer is wired for printer busy This is one wire in the RS232 by which the printer is able to tell the computer when to send characters If this is implemented then the crossed lead must tell the computer to transmit characters This is usually accomplished by joining pins 7 and 20 in the RS232 plug for the transmitting computer or in both plugs to keep the lead symmetric ■

■ Readers are reminded that it is highly inadvisable to copy proprietary software

Data Base Principles and Techniques

Part III: Data Description and Manipulation Languages

Professor Holsapple is on the Business Administration faculty of the university of Illinois at Urbana His major research interests are in the areas of data base management and decision support systems His published research work appears in such journals as Decision Sciences International Journal of Information Systems The Computer Journal *and* Policy Sciences *He is co-author of the research treatise* Foundations of Decision Support Systems *(Academic Press) Dr Holsapple is vice president of Micro Data Base Systems Inc*

Introduction

Earlier articles (in Issues 11 and 12) described the nature of data base schemas They examined the building blocks available for use in constructing a data base schema the varieties of schemas that can be constructed, and a simple 7-step procedure for schema design. In particular data structuring for the Micro Data Base System (MDBS) was examined MDBS is the first sophisticated data base system implemented in machine languages for use on microcomputers (e g Z80 8080/8085 8086)

Interestingly the MDBS data structuring facilities include not only CODASYL record types and sets, but also N M sets recursive sets and multiple owner sets These latter features are not even available on mainframe data base systems It is important to epmhasize at this point that data base management (in the strict sense) *differs substantially* from ordinary file management even though many vendors loosely refer to file management software as a "data base system"

In this article we examine the language components of a data base system its Data Description Language (DDL) and its Data Manipulation Language (DML) DDL and DML syntaxes differ from one data base system to another The MDBS DDL and DML are used here for illustrative purposes Concluding the article is a brief discussion of add-ons to the basic data base system, a query system a recovery and transaction logging system, and a dynamic restructuring system

Data Description Language (DDL)

Suppose that we have constructed a schema using the 7 step procedure (subject to any desired adjustments or refinements) This schema information is then *formally described* in terms of the Data Description Language The process of converting a schema picture into a DDL specification is straightforward However there is some additional information, not shown in a schema picture that must also be captured in a DDL specification

A which record types are *entry points* into the data base
B *the order* in which member occurrences in a set occurrence are to be accessed and whether or not member records of a set are automatically added to a set occurrence when they are created
C for an N M set *the order* in which owners of a given member occurrence are to be accessed, as well as the member order
D the *access levels* of data item types record types and sets
E data base *users* their passwords and access levels

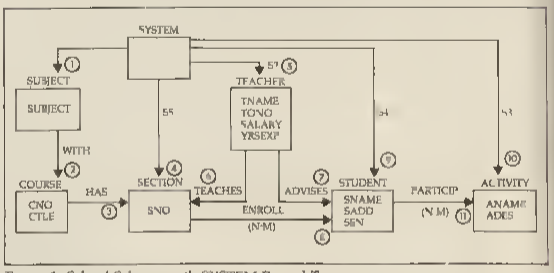

Figure 1 School Schema with SYSTEM Record Type

A The SYSTEM record type

The MDBS automatically creates a special record type SYSTEM This record type has only one occurrence (which is also created and maintained by MDBS) and it contains no data The occurrences of any record type that is the member of a SYSTEM-owned set are entry points into a data base processing of occurrences always begins at the SYSTEM occurrence

The schema produced with the 7-step procedure in the earlier article (Issue 12) must be amended by making SYSTEM the owning record type for at least one set We may declare as many additional sets with SYSTEM as owner as we like The following rule of thumb is recommended If a record type is not the member for any set then declare it to be the member of a set owned by SYSTEM If a record type is the owner or member of an N M set then declare it to be the member of a set owned by SYSTEM Thus the example schema from the earlier article is amended as shown in **Figure 1** by adding the SYSTEM-owned sets S1 S2 S3, S4 S5

B Set Order and Automatic Membership

When defining a set with the DDL we can specify how the member record occurrences in any occurrence of that set are to be organized Consider the ADVISES set If we want to be able to easily obtain a *sorted* (on student name) list of information about all students *advised by a particular teacher*, then we declare the ADVISES set to be sorted on the basis of SNAME using the following DDL statements

See A

The data item type used as the sort key of a set occurrence must be from the set's member record type Here AUTO means that as each occurrence of STUDENT is created it is automatically added to a set occurrence of ADVISES The 1 N indicates that ADVISES is a conventional CODASYL set

to easily obtain [illegible] on the basis of [illegible] in other set but [illegible] DENT. Call [illegible] description for the [illegible]

See B

Here, MAN (Manual) means that as each occurrence of STUDENT is created it is *not* automatically added to a set occurrence of the ADVISES2 set but after it has been created we can add it manually by giving a certain command to the MDBS DMS.

To easily obtain an alphabetical list *of all students* in the data base regardless of advisors we can declare the SYSTEM owned set S4 to be sorted on student name. The DDL description for S4 is

See C

S4 has only one set occurrence and its members are sorted on the basis of SNAME.

Generally speaking, if we want member records for some owner to be maintained in k (e.g., 3) different orders then we declare k (e.g., 3) different sets between the two record types. Each set is sorted on the basis of a different data item type. Set orders other than SORTED can be declared (e.g., "IMMATerial LIFO FIFO etc.) It should be noted that all data item types of a record can be used, simultaneously, as a sort key for a set.

C. Owner and member order

When defining an N:M set with the MDBS DDL we can specify not only an order for member occurrences but also an order for the owner occurrences associated with each member occurrence. If we want to use SORTED order for owner occurrences then a data item type from the owner record type must be declared as the owner sort key. Thus an N:M set can have an owner sort key as well as a member sort key. To be able to easily obtain a sorted list of all students participating in a particular activity and a sorted list of all activities in which a given student participates, the DDL statements for defining PARTICIP are

See D

The first sort key (SNAME) is the owner sort key, the second (ANAME) is the member sort key.

D. Access levels for data security

When declaring each data item type in the DDL we can optionally specify two types of access levels for it. One is the read access level and the other is the write access level for that data item type. Similarly, read and write access levels are declared for each record type, set and N:M set. There are 255 levels of read and write access for each item type, record type and set type. These access levels are used by the data base system in connection with the passwords section (described next) for data security.

E. Passwords

In addition to formally specifying a schema, the DDL specifications will also include a PASSWORDS section. This section is used to specify permissible users of the data base, their passwords and their access levels. Each user is given a read access level and a write access level. A user can look at (read) occurrences of any data item type, record type, set or N:M set whose read access level is less than or equal to the user's read access level. A user can modify (write) data items, records, sets or N:M sets whose write access levels are less than or equal to the user's write access level.

The completed DDL specification is input to the MDBS DDL Analyzer/Editor which checks the consistency of the specifications and uses them to generate schema tables for the data base. The schema tables contain all information about the structure of the data base in an internal form for use by MDBS software. The complete DDL syntax is described in the MDBS User's Manual (see Panel feature).

Data Manipulation Language (DML)

Having submitted the DDL description of a schema to the DDL Analyzer and having saved the resultant schema tables in auxiliary memory, we are now ready to write application programs that load data into the data base. Aside from data base loading, other kinds of data manipulation include extracting data from the data base and modifying data values that are in the data base. All data manipulation is accomplished through the use of MDBS DMS DML commands. To execute a particular DML command, a subroutine function of the following generic* form is used:

EO = CALL (A, "Command name, command arguments")

where

A is the DMS entry point address.

command name is the name of the DML command to be executed.

command arguments is a list of one to three arguments (separated by commas) consisting of data item type, record type, set or N:M set names and/or data block names.

A data block is simply the name (up to 8 characters) of a list of one or more variables in an application program. Needed data blocks are defined in the application program. Data blocks are the mechanism whereby the data base system transfers data from the data base to program variables, and vice versa.

EO is a variable in the application program. The data base system sets the value of EO to indicate what has happened during the attempted execution of the DML command. If a value of zero is returned in EO then the command executed successfully.

**The actual calling procedure is different for different host languages. MDBS interfaces with the following host languages: BASIC (interpretive and compiled), FORTRAN, COBOL, PL/1, PASCAL and machine languages.*

SET ADVISES AUTO 1:N
SORTED SNAME
OWNER TEACHER
MEMBER STUDENT

A

SET ADVISES2 MAN 1:N
SORTED SSN
OWNER TEACHER
MEMBER STUDENT

B

SET S4 AUTO 1:N
SORTED SNAME
OWNER SYSTEM
MEMBER STUDENT

C

SET	PARTICIP	MAN	N:M		
	SORTED	SNAME		SORTED	ANAME
OWNER	STUDENT				
MEMBER	ACTIVITY				

D

A value from 01 to 254 indicates an error in the application program's logic. If 255 is returned then the owner (or member) occurrence that we were attempting to find for some set does not exist.

A. Data base keys

The data base itself (after loading) contains many record occurrences. As each of these occurrences is created in the data base, MDBS assigns it a *unique identifier*, its *data base key* (dbk). The dbk is *not* a data item type declared in the DDL. A record occurrence's dbk may be thought of as the *address* of where that *record occurrence* is located in the data base. We do not need to keep track of or even look at data base keys.

B. Currency indicators

Many DML commands make use of *currency indicators*. **In the discussion that follows, whatever is said about a set also holds for an N:M set.** There are four kinds of currency indicators in MDBS:

Current Owner (CO) of a set
Current Member (CM) of a set
Current Record Occurrence (CRO) of a record type
Current of Run Unit (CRU)

As we (i.e., our DML programs) rummage about in a data base, we cannot look at every record occurrence simultaneously.

We do not look at every owner occurrence (e.g., all teacher occurrences) of a set (e.g., of ADVISES) at the same time. We can, however, look at one of them and that owner occurrence is called the *current owner* (CO) of that set. If we then look at a different owner occurrence of the same set, then it becomes the new CO. For each set in a schema, MDBS allocates space in the schema tables to hold the data base key of that set's current owner. There are DML commands that allow us to control which owner occurrence of a set is the *current* owner. Since SYSTEM has only one occurrence, *SYSTEM is always the* current *owner of any set it owns.*

As we (i.e., our DML programs) browse through a data base, we do not look at every member occurrence (e.g., all student occurrences) of a set (e.g., ADVISES) simultaneously. We look at them one at a time. The member occurrence of a set that we are looking at at any given instant is called the *current member* (CM) of that set. There are DML commands that allow us to control which member of a set is the *current member*. For each set in your schema, DBMS allocates space in the schema tables to keep track of the dbk of that set's current member.

Forgetting about sets for the moment, we might want to browse through the occurrences of some record type, but we cannot look at all occurrences (e.g., all course occurrences) of a particular record type (e.g., of COURSE) simultaneously. We look at them one at a time. The occurrence of a record type that we are looking at, at any given instant, is called the *current record* occurrence (CRO) of that record type. (It does not have to be the current owner or current member of some set.) We can control which occurrence is the *current of its record type* with various DML commands. For each record type in your schema, MDBS allocates space in the schema tables to hold the dbk of that record type's current occurrence.

MDBS also allocates space in the schema tables to hold the dbk of the most recently accessed record occurrence. At any point in the execution of a DML program, the most recently accessed record is called the *current* record *of the run unit* (CRU).

If a schema has 12 sets and 7 record types, then MDBS automatically sets up 32 currency indicators:

- 12 current owner indicators
- 12 current member indicators, and
- 7 current record indicators
- 1 current of run unit

It is important to know about the existence of currency indicators because many DML commands use values of certain currency indicators as inputs. Some DML commands have the effect of changing the values (i.e., dbks) of currency indicators that is, they output new currency indicator values.

All CODASYL oriented systems use currency indicators for navigating through a network of data base records. However, they offer only one currency indicator per set, whereas MDBS furnishes two currency indicators (current owner and current member) per set. The value of this additional currency indicator furnished by MDBS should not be overlooked. It makes the DML programming logic considerably simpler. With MDBS there is no need for the programmer to save and restore data base keys nor to suppress currency indicator updates.

C. DML Commands

It is beyond our present scope to examine the individual MDBS DML commands. For specific details and examples see the MDBS User's Manual or the MDBS Data Base Primer. However, it is appropriate to indicate the types of data manipulation that can be performed with this DML.

The create command allows us to create an occurrence of any record type and to store the contents of some programmer designated host language variable(s) into the created occurrence. Another command allows us to add a record occurrence into a set occurrence in the event of a manual set.

There is a type of command that causes the data base system to find a desired record occurrence based upon a sort key value or upon that record's order in a set occurrence (e.g., find the first or next member record in a set occurrence). When a record is found it becomes the current member of a set, the current owner of a set, the current occurrence of its record type or the current of the run unit.

Once a desired record is found by the data base system, another type of command instructs the system to transfer data from that record to a desired host program variable. Conversely, the programmer can use a kind of command that stores data from a specified program variable(s) into a field(s) of the record that has been found. A found record can also be removed from a set occurrence or deleted from the data base.

In CODASYL data base systems, data can be extracted from a record or stored into a record only if that record is the current of the run unit. As a convenience to the programmer, this restriction has been eliminated in MDBS. Data extraction and storage can be performed with respect to any record that is the current owner of a set, the current member of a set, the current occurrence of its record type, or the current of the run unit.

Finally, the MDBS DML includes a group of commands that allows a programmer to navigate through a network of data base records. For instance, if the TEACHER record for John Doe is the current member of the set S2 then it can easily be made the current owner of the set ADVISES. A "find" command can then be used to find any or all students advised by John Doe. A "get" command can be used to retrieve information about any student that is found.

The data base facilities described above furnish powerful tools for the development and subsequent utilization of information systems. Optional enhancements to a basic data base system can be provided through add-on packages. One important enhancement is a query facility that allows a user to generate reports without writing a program. Another enhancement is an automatic data base backup facility. A third enhancement is a facility that allows a data base administrator to alter a data base's logical structure without dumping and reloading its data.

A. *Query System*

To illustrate the value of a query facility added onto a data base system, we shall briefly examine some of the features of MDBS QRS. This query package accepts English-like, nonprocedural queries about any MDBS data base and generates reports that answer those queries. The query syntax is

<COMMAND> <FIND CLAUSE> <PATH CLAUSE>

As an example, suppose that we want a report of teacher names and the name and address of every student advised by each of those teachers for those teachers with a salary of under 15000. The report could be produced by writing an appropriate DML application program. Alternatively, the report could be produced by the following QRS query:

LIST TNAM, SNAM, SADD FOR
SALARY < 15000 THRU S2 and ▶

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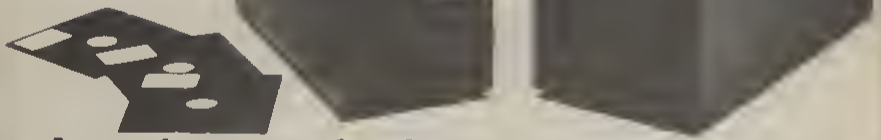

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ADVISES

In this query

LIST is the <COMMAND>
TNAM SNAM SADD is the <FIND CLAUSE>
FOR SALARY < 15000 is the <CONDITIONAL CLAUSE>
THRU S2 and ADVISES is the <PATH CLAUSE>

QRS supports many other commands besides LIST. There are commands for changing data values, for statistical analyses for various utilities (such as defining synonym, report titles, value-label associations) and for the interactive use of DML commands. The find clause consists of names of data item types (arithmetic expressions involving data item types are also permitted) whose values are to be extracted from a data base. These values are extracted subject to conditions specified in the conditional clause. Complex Boolean conditions are permitted. The path clause lists the sets that QRS should use in responding to a query.

Queries can be batched into a file and then executed via a READ command. Output reports can be routed to a console, printer and/or disk file. QRS can also be used as an add-on package for the Hierarchic Data Base System (HDBS). HDBS, a subset of MDBS, supports tree structures with multiple SYSTEM-owned sets.

B. *Recovery System*

A recovery system presupposes automatic transaction logging. In the MDBS Recovery and Transaction Logging (RTL) system, any transaction that changes the contents of a data base is logged to a separate transaction file. In the event of a system crash (e.g., power failure), the user merely executes the recovery program that is supplied with RTL. This recovery program applies transactions logged in the transactions file (since the last data base back up) to a back-up copy of the data base, producing an up-to-date data base.

C. *Restructuring System*

The MDBS Dynamic Restructuring System (DRS) consists of a collection of DML routines that can be used in an interactive mode or called from a host language. These routines give a data base administrator the ability to alter a schema, even though data has already been loaded into the data base. DRS automatically makes all needed changes to the schema tables and to the data base record occurrences themselves. Common alterations to a schema include the addition, deletion and renaming of data item types, record types and sets.

V. Conclusion

The advent of a genuine sophisticated data base system for microcomputers is a significant breakthrough in the software field. Developers of micro-computer application systems are relieved from the drudgery and inefficiencies of file management. It makes available data handling facilities that were heretofore accessible only on minis and mainframes. As explained earlier, MDBS surpasses these mini mainframe data base systems in several respects while costing one to two orders of magnitude less.

In effect, the Micro Data Base System can be used to transform nearly any of the major micro programming languages from a file handling system into a powerful flexible data base management system. Moreover, MDBS provides uniformity of data handling procedures across these many languages (e.g., several versions of BASIC, FORTRAN, COBOL, Pascal, PL/1). Data base design and definition are not affected by the programming language, nor is the DML logic affected. ■

● *Readers are reminded that a tutorial series on Data Base Management Systems by Dr. Darrel Ince at the Open University will appear in the new year.*

The UNIX Operating System

Unix is a very successful mini-computer operating system. As a result it is now being implemented in various forms on a variety of machines from micros to super minis. This paper discusses the Unix system as in use on many PDP11 mini-computers up and down this country (and others). A later paper will discuss the versions implemented on micros.

History

Unix started off in life when Ken Thompson a programmer at Bell Laboratories found himself frustrated by the inconvenience and unfriendliness of the computer systems he was using. So he designed and implemented a single-user system (hence the "UN" in the name) for a small machine. Some ideas were taken from the (big!) system MULTICS (MIT GE Honeywell), hence the rest of the name. The objectives of his system were that it should be simple, easy to use and particularly good at fast software development. It then became multi-user when it was found that this was practical even on small machines.

Marketing

Unix is now marketed by Bell Laboratories. It is expensive for commercial users ($30000), but is sold very reasonably ($300) to 'on-going degree giving" establishments for use purely in teaching and non-sponsored research. Intermediate rates are available for educational administration and bulk contracts. The licence fee covers all named CPUs for one organisation.

For obvious commercial reasons (and especially as it is a portable system) Bell are very concerned about security and make thorough checks before licences are awarded. Users are expected to be equally careful.

To give an immediate feel for the philosophy of Unix it is worth describing the distribution technique. Having signed contracts and paid your money you receive one magnetic tape, one manual and a page of system installation details. We (with a PDP11 having discs but no magnetic tape) first had to find a friend with a PDP11 which had disc drives compatible with ours, and a magnetic tape deck.

On mounting the tape and obeying the installation instructions the system calls for, and partly fills, three disc packs one after the other. The first disc then contains the complete binary system ready for booting and running. The second contains the source text of the whole system and commands, mostly written in the high level language C (reference C). The third contains the complete documentation. You can then run the system as supplied and (together with the word processing software provided) produce your own manuals. Alternatively because it is all available as text in a high level language, it is easy to alter the system and/or commands and add new commands or delete unwanted ones. It is then a simple matter to produce a new manual, omitting the details of any commands you don't want the users to know about (or aren't going to implement) inserting the documentation for new commands and amending existing ones as required. The software even produces the index and keyword summaries for you. Alternatively, if you have the disc space to spare it is possible to keep the documentation on-line and use the system's "help" facility to provide an on-line manual.

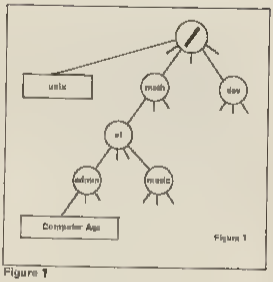


Figure 1

Being written in a high level language, Unix doesn't have bugs, so there are no updates.

Versions

Like all systems, Unix has been through a number of versions in development. The first version widely distributed (and currently in use at most sites) is Version 6. This runs on a PDP11 with a minimum 96 Kbytes of memory. A typical PDP11/34 can support up to a dozen terminals plus a few exotics such as computer links. The recently released Version 7 has lots of extra goodies, but as distributed is really aimed at bigger machines (PDP11/70 and VAX). It is in the process of being implemented at a few sites and will probably replace Version 6 everywhere as variants to run on small PDP11s are developed.

Other Bell varieties include 'mini-unix' (for small PDP11s of up to 56 Kbytes) and 'Programmers Work Bench' for program development on a PDP11 satellite to a larger mainframe. Versions also exist for LSI11s, Interdata machines, and decidedly different variants are now being written to run on various micros such as Z80s, Z8000s and M68000s.

FILE SYSTEM

Hierarchical Structure

The file store is hierarchical, so that directories are nested in tree fashion. The top of the tree is referred to as "/". Thus, given the structure (see Figure 1) where the round entries represent directories, and the rectangular ones represent terminal files, a file of information at the top level is referred to by the name /unix. The file at the lower level would be called in full "/math/ef/admin/computer age", from any user name (if permissions are set). A command to change directory, such as

chdir /math/ef

moves the current position in the tree to the directory /math/ef" and the same file can now be referred to as "admin/computer age". The command

chdir admin

would move us down another level, and the file can now be referred to simply as 'computer age'.

The files have traps restricting access by various users (see below), and directory files can only be written to by system commands.

All terminal files are of the same type, irrespective of whether they contain binary information, text, commands, etc. It is up to the program using a file to access it in serial or direct access mode as required. the program must know the file's format.

Demountable File Systems

A demountable volume contains a hierarchy of files as above, with one directory at the head, and, to access it, it must first be "mounted". To mount it, the command might be

mount floppy /math/ef/music

causing the contents of the floppy disc to appear in the file store as a sub-tree under the existing directory "/math/ef/music". Its files are then indistinguishable from the rest of the file store, and can be read, created and so on, using standard commands.

Input/output

Unix is unique in the way that input/output is indistinguishable from the file structure. A directory exists at the top

Unix

level called 'dev' and if one writes to the file '/dev/lp' for example the output goes to the line printer. That particular file of course looks as though it is read protected. Similar files exist in the same directory for each peripheral on the machine and the system is aware that any references to such 'special' files are actually peripheral operations. The user need not know the difference. Devices such as discs are not directly accessible to ordinary users (one cannot allow users to write over the disc as a whole!) and are usually implemented in two forms: block structured and serial.

To perform input/output from within a program in, say, the language C, a file (or input output device) is opened by

fd = open ('ef/admin/file', mode),

which opens the specified file in the given mode, and returns a 'file descriptor' integer. (This is negative if the file cannot be opened.) The file can then be read in serial fashion using the returned file descriptor value by a command such as

read (fd, buffer, nchars)

to read the given number of characters into the given buffer. To read in direct access fashion, the program must execute a positioning command in the correct place in the file, such as

seek (fd, position, mode)

where the mode specifies whether the given position is relative to the beginning of the file, the end of the file, or the current position. When the device is finished with, it is closed by

close(fd)

Linking files

A file is an area of disc, with a given owner and various other properties (see below). Its name as far as a particular user is concerned comes from the directory entry which refers to it. Several users can have directory entries pointing to the same file. The user who first creates the file becomes the owner, then other users can 'link' to it. A file remains in existence until all links have been removed. For example, if a news file is created with links and read and erase permission to a number of users, it will continue to exist until all of them have 'erased' it. Each 'erase' command merely removes the user's directory entry, when the number of links becomes zero, the file is deleted by the system.

File properties

Each file has:

- an owner
- the dates of the most recent read and write operations
- details of size
- the number of users who have links to it (the file will be deleted when this reaches zero)
- a link to the owner's directory
- access permissions in the form of {read, write, execute} for each of {the file's owner, members of his group (see below), and the general public}

Users

Each user in the system has an entry which specifies:

- his log in name
- his password (optional - if he hasn't one, our system won't let him log in on terminals in the computer room without a default one)
- his user identity number (the 'owner' of a file)
- his group number (he can only be in one group - we have separate groups for computing science staff, other staff, computing science students, other students etc.)
- his 'home' position in the file store (e.g. '/math/ef')
- the name of the program he will use for a command interpreter (default is the standard one described below, we use two others as well - one for editing only, and one for confidential examination work).

At Nottingham we have also implemented for each user a disc space ration (if his files exceed his ration for five successive logins during which he will receive increasingly strong warnings all his files vanish!) and a running priority.

Each user also has facilities such as a mail file, a file of commands which is executed each time he logs in, and so on.

Processes

To start a new process an existing running program must execute a call

procid = fork()

This causes a second identical copy of the program to be created, with the same set of open files and environment. The only distinction is that the process identifier 'procid' delivered is 0 in the new program, and the new (non-zero) process number for the original. From any running program the call

exec (progname, arg1, arg2)

causes it to be replaced by the named one (with the given arguments). A new and different program can thus be started off by first 'fork'ing and then 'exec'ing the new process, as in

```
procid=fork(), {fork to initiate second
                program}
if (procid==0) {== is equals, tests
                which program we are
                in}
then    exec{convert the new process
(       )       to the required program}
                {existing program
                continues}
```

To enable programs to talk to each other directly, the techniques are by interrupts ('signal' and 'wait' with the obvious meanings) or a direct two way input/output channel. The latter is called a "pipe", a Unix concept now becoming widely accepted. It is set up as in, for example

```
pipefd=pipe(), {set up a channel the
                'pipefd' is just like an
                other file descriptor}
procid=fork()   {now split into two
                programs}
if (procid==0)  {test to see which
                program we are in}
then            {parent      read from
                pipefd}
else            {child       write to
                pipefd}
```

The "pipe" must (of course!) be read by one process and written to by the other. If the pipe becomes too full the program writing to it is automatically suspended.

The Shell

The default command interpreter is known as the "shell" and a single command is called with arguments separated by spaces as in

comm a1 a2 a3

The name 'comm' is the name of a file containing either a binary program or a command text (macro) and the system searches for such a file first in the current directory, then in the user's main command directory, then in the system command directories. In Version 7 of Unix any search sequence can be specified. If it is a binary program, it is executed; if it is a command macro a copy of the shell is invoked to interpret it.

It should perhaps be emphasised that the terms 'command' and 'program' are equivalent: any program is called just by typing its name (i.e. the name of the file containing it).

The characters '*' and '?' in file names refer to any number of characters and any one character respectively. Thus a call such as

comm a?b*

passes to the command as parameters the names of all files with 'a' as their first letter and "b" as their third.

The power of the shell comes from the way it allows commands to be combined and input and output to be redirected and modified. The syntax of commands is as follows:

Redirecting output - to redirect output from the screen to a given file, type

who > file

(where the 'who' command gives the names and locations of everyone currently logged in) or for the printer

who > dev/lp

Redirecting input - to cause input to be taken from a file instead of the keyboard, type

edit < script

Piping output/input - to initiate two or more programs (which will then be multi-programmed together) with the output of the first fed as input to the second ("piped") and so on, type

who | grep ef | {execute the 'who' command, and pass on only those lines containing the characters 'ef'}

Continued on page 59 ▶

BRAND NEWS

compiled by Micropsy with Anthony Esgate

13

This middle section may either be pulled out or photocopied then filed for reference. It will be comprehensive and range over the whole field of products, services, events and courses. **PU** stands for Personal User. **SB** stands for small base – that is small budget or small business. **MB** – medium base, medium budget or medium business. **BB** – big base, big budget or big business. **Addresses** are to be found at the end of **Brand News.**

Systems

ACESS DATA COMMUNICATIONS

ACCESS DATA COMMUNICATIONS ranges of mini and micro computers, launched at COMPEC, based on Apple II, Motorola and DEC PDP 11 CPUs and varying from £2000 to £20,000. Offering own range of software, operating packages as well as a bespoke program tailoring service and word processing package Word Access will follow. *SB, MB*

ACT

ACT Series 800 Concept, launched at Which? Computer Show, combining data processing and word processing in a distributed systems environment, based on ACT Series 800 microcomputer system. *SB*

AMDAHL

AMDAHL has announced enhancements to its 470 computer series and software products with new functions including HARDWARE: 32 channel extension, 4096 subchannels, 470 Extended Performance Accelerator. SOFTWARE: Multiple System Communications and Control (MSCC); MVS/Extended Channel Support (MVS/ECS); Universal Timesharing System (UTS); MVS/SE Assist Release 2.1; MVS/SE Support Release 1.0; Airlines Control Program (ACP) Support. *BB*

AUTOSENSE EQUIPMENT LTD

AUTOSENSE EQUIPMENT LTD range of microprocessor based testing systems for testing of domestic appliances. *Electrical Manufacturers*

BMG MICROSYSTEMS

BMG MICROSYSTEMS has announced enhancements to the MS6000 range of computer systems to make it extendable to true multi-user capability. Multi tasking operating system is MP/M in conjunction with memory bank switching giving a total of 208K of Random Access Memory. For word processing BMG now also offer daisy wheel printers and for high speed printing a Centronics 6000 Series line printer. *SB/MB*

BURROUGHS

BURROUGHS B5900 – smallest large system on the market. Utilises all company's existing and now well proven large system environmental system and application software. Object code compatible with all Burroughs large scale computers (B6800, B6500, B7500). Source code compatible with company's smaller systems (B1900, B2900, B7800). Utilises multi level Function Processor Architecture. From £160,000 for a system incorporating 1.5MB main memory, two operator displays, a peripheral sub system with five data link processors, a data communications subsystem with a line support processor and four line adapters and an independent Maintenance Function Processor. *BB*

The ACT Series 800 microcomputer system designed specifically for business use

CELDIS

CELDIS 16 32 bit multiple station development system known as EXORmacs. Developed by Motorola to support 16 bit M68000 and to anticipate the requirements of the next generation of 32 bit microcomputers. Basic system comprises microcomputer chassis with slots for up to 15 PCBs, an intelligent M6800 based CRT an EXORdisk (II 1MB dual floppy drive and a 132 column 180 cps printer. Five boards include M68000 processor module, debug module with bus arbiter and programmable timers, an M6801 based intelligent floppy disk controller board, a 128 KB dynamic RAM and 32 KB static RAM board. Software comprises VERSAdos multitasking operating system and comprehensive list of development software. *SYSTEMS DESIGNERS PROGRAMMERS*

COMPUCORP

COMPUCORP Model 675 Integrated Information System. Compatible with Compucorp OMEGA. Word Processing range and offers outstanding performance both in terms of speed and storage capacity. Users will be able to access 2.6 megabytes of storage by means of systems high speed 655,360 character 5.25 inch diskette with a standard 64K main memory. Double density 675's designated the Fast Track and four disk model the Fast Track 2+2. *SB, MB*

COMPUTER ANCILLARIES LTD

COMPUTER ANCILLARIES LTD BELLCOM 80 WORD PROCESSOR. Offers keyboard nearly identical to IBM Selectric, logically grouped special function keys, extra large screen display size, automatically proportioned text and the ability to hold up to 25 pages in memory. From £5900. *MB, BB*

DACOLL

DACOLL DEMOCRAT multi micro distribut

CALS BELLCOM 80 WORD PROCESSOR

ed processing system 64KB dynamic memory Winchester (20/40 MB) or floppy disk drives 20 MB Tape Cartridge remote (synchronous or asynchronous) and printer interfaces Supports up to 64 intelligent terminals Remote VDUs contain 48 KB dynamic memory each in addition to ROM and display memory Operating under sophisticated operating system programs is fetched loaded from CPU into remote terminal which runs under own VIDOS operating system Software includes COBOL Assembler Test Editing and standard utilities External communications protocols available for various mainframes From £8000 *MB*

DIGITAL EQUIPMENT CORPORATION

DIGITAL EQUIPMENT CORPORATION three new members of MINC family of laboratory computers systems-MINC 23 MINC/DECLAB 23RT and MINC/DECLAB 2dRSX Incorporate the new PDP 11/23 processor and offer greater flexibility and performance than the current MINC systems with which they are software compatible *SCIENTIFIC*

GENERAL AUTOMATION

GENERAL AUTOMATION BOSS computer range designed and manufactured in U K Comprise three entirely compatible systems – BOSS 1 2 and 3 BOSS 1 is a single screen floppy disc based micro featuring a 128KB memory and printer which costs from £8000 BOSS 2 is designed for the medium sized business and has 128KB minimum and 10MB disc drive (5MB fixed 5MB removable) It will support up to 16 screens BOSS 3 is a high performance system combining high speed microprogrammed architecture with 64KB and 128KB MOS memory modules It can address directly 128KB of main memory with GA Memory Management System Supported by CONTROL family of operating systems High level languages available 32 screen system about £150000 *MB BB*

IBM

IBM 4341 Model Group 2 Processor a powerful addition to the top end of the 4300 processor range Uses same chip technology as the other 4300 processors but its internal performance over 4341 1 has been increased up to 1 8 times *BB*

IMLAC INTERNATIONAL LTD

IMLAC INTERNATIONAL LTD Front End Text Processor enhancement for COMPOSER 1550 system Sub system comprises high speed data entry terminals (type 1550) and disk memory (type 80) linked to standard composer by programmed controller (type TCU) Additional equipment costs amounts to £ 25 in the Composer system price *PRINTERS*

LOGABAX

LOGABAX enhancements to Lx 500 Personal Computer Has been given more power and is now available with dual density disks that increase the capacity to 364 characters Memory on the system has been increased to 64K characters Standard LX 500 will remain available with 192K disk capacity and 32K memory Dual density LX 500 will sell at £3500 including keyboard 20col character VDU and matrix printer plus assembler and BASIC interpreter *MB*

MICROSENSE

MICROSENSE APPLE III computer 6502A major component of processor Hardware emulation of 48K Apple II or plus 1 4MHz

BRAND NEWs

ITT BOSS 3

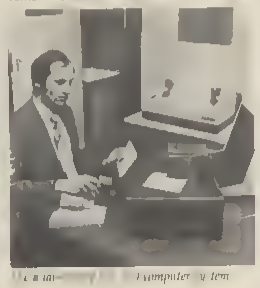
average clock speed 2MHz minimum dynamic RAM 64KB expandable to 6 Mbyte self test diagnostics built in floppy disk drive built in Winchester hard disk board full floating point hardware Three optional workstation modes are 80 column dual Black & white Three graphics modes are 560 by 192 16 colours 140 by 192 16 colours 560 by 192 Black & white plus Apple II modes RS 232C compatible serial interface Sophisticated Operating System (SOS) and Pascal system (Apple Business BASIC Pascal FORTRAN 1Q1 quarter) *PU SB APPLE*

NEWPORT INSTRUMENTS

NEWPORT INSTRUMENTS P 100 Protein Analyser Uses pulsed nuclear magnetic resonance spectrometer In combination with a special aqueous relaxation reagent Relaxation rates are measured in less than 20 seconds and correlated with protein content which is displayed directly on a large LED display Microprocessor control of calibration and all data reduction is built in providing direct read out of the protein content either as a concentration in solution or as a percentage in weight For hard copy a small thermal printer is included *SCIENTIFIC*

NIXDORF

NIXDORF 8890 Information Processing System a high capacity medium range mainframe with an IBM independent but fully compatible operating system Marketed by Nixdorf Computable Information Systems Division (CIS) in Munich



Computer system

Multiprogramming dual storage technology 8 bit processing and interactive operation With 1 4 megabyte and a wide range of peripherals the new system can be used in conjunction with different operating systems and software programs from the vast spectrum of applications *BB*

OLIVETTI

OLIVETTI has formed a new company within the UK Olivetti Computers (UK) Ltd to market the full range of IBM compatible processors and products made by Olivetti and IPL These include the OF 5300 range three processors covering the prime 4300 range the OH 5500 range three processors covering the 3000 range and the Olivetti H Each 5580 the largest commercial uniprocessor available in the world today with power rated at up to 9 MIPS and storage of up to 16 MB *BB*

P 100 Protein Analyser

PHILIPS BUSINESS SYSTEMS

PHILIPS BUSINESS SYSTEMS PMS Professional Control System comprising P350 mini Business computer with software package designed by SEF Computing the multi subsystem Designed to solve production planning problems in all types of batch manufacturing concern while the simple programming approach means that the personal requirements of users are not unreasonably taken into account £25 000 and aimed at firms employing between 5 and 50 persons *INDUSTRIAL*

PLESSEY PERIPHERAL SYSTEMS

PLESSEY PERIPHERAL SYSTEMS SYST

[illegible] using the MICRO 1-23 [illegible] 11 based microprocessor with choice of 10 or 27 megabyte disc cartridge sub-systems mounted in a desk height cabinet [illegible] for scientific industrial education and small business applications. In addition SYST 23VX series floppy disk controllers systems designed for special related applications in the small system environment. Comprises entry level single disc systems with either one or two dual density floppy drives in tabletop or rack mountable chassis. Also based on LSI 2s... *MB*

SINTROM

SINTROM DCS 80 tough new industrial/scientific computer. Multibus compatible modular construction. Twin 8" floppy disc drives with intelligent controller containing its own 8080 microprocessor that permits extensive error reporting. It also allows concurrent operation with the main CPU which is an enhanced version of the Intel iSBC 80/10." CP/M range of operating systems capabilities provided. Process Control BASIC Pascal FORTRAN 80 and Programming Language C run under CP/M. Other software aids include PL/M compatible compiler cross assemblers communications software and data exchange programs. *SB MB (SCIENTIFIC, INDUSTRIAL)*

SPERRY-UNIVAC

SPERRY UNIVAC has introduced two new medium performance unit processors with CACHE memory into the 1100/80 range designated 1100/60 E1 and E2. Brings total number of models in the family to ten six uniprocessors and four multiprocessors. Both new models have 2K words CACHE memory and offer considerable performance improvements over the basic C1 and C2 uniprocessors. *BB*

STAR

STAR AUDITOR 60 smaller version of Auditor 100 providing low cost entry into computing for the smaller group. Comprises VDU with electronic keyboard 64 Kbyte processor 10 Mbyte hard disc unit 120 cps printer and an acoustic coupler. An extra VDU may be connected for simultaneous processing of the same or a different application and a daisy wheel printer may be connected for word processing. Uses menu and screen prompting techniques. Standard packages include Order Processing Stock Control Sales Purchases and Nominal Ledger. Accountants Time Ledger Accounts Production from Incomplete Records Word Processing Book Keeping and Payroll. *MB*

TEI TECHEX

TEI TECHEX WPS80 Word Processing and Office System combines sophisticated word processing facilities with a colour alphanumeric graphics business computer. CP/M compatible with colour graphics video terminal dual 8" floppy disks. The printer and special software. Provides a complete system for formatting editing and printing both standard text and specialised applications. *MB*

BRAND NEWs

VECTOR COMPUTER SYSTEMS

VECTOR COMPUTER SYSTEMS market full range of vector Graphics computers. Currently offer System 28 now with 2 8" floppy disks and 2.4 Mbyte store and System 3030 with 8" Winchester hard disc system 32 MB store with two 5¼" floppy disk drives giving an additional 0.63 MB store. System 3030 handles up to 32 VDUs and an additional 4 CPUs may be added to give a total disk storage of 126 MB. Also available System B with 64K two 5¼" floppy disks giving 0.63 MB store. All Vector equipment compatible (eg add 3030 storage unit to System B) and can be interfaced to most mainframes. Programmable in BASIC FORTRAN Pascal ALGOL and assembler running under CP/M 1 or 2. *SB MB (VECTOR GRAPHICS)*

Applications

ABACUS SOFTWARE

ABACUS SOFTWARE TINY PASCAL for the PET and APPLE II. Complete package allows user to create compile and execute programs written in TINY PASCAL (subset of Pascal with structured programming features). Package has three main components Line Editor Compiler and Interpreter which executes the P-code by turning the computer into a pseudo 16 stack machine. Trace and single step modes are built into the interpreter. *PU SB(PET APPLE)*

APL*PLUS LTD

*APL*PLUS LTD* APL*PLUS VM for IBM and IBM like system users in the UK. Supports FORTRAN COBOL etc and makes no change to IBM's VM/370 System Control Language (SCP). Uses only standard interfaces. Special functions now provided with in VS APL that were previously only available as system commands or as key words that had to be copied into the active workspace prior to use. System variables which manage interaction between the APL processor and either the active workspace or the terminal have also been enhanced. *BB(IBM)*

BIS APPLIED SYSTEMS LTD

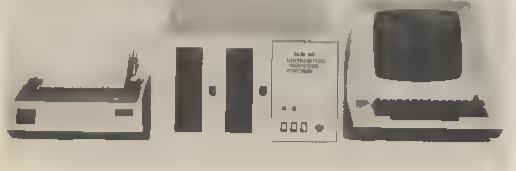
BIS APPLIED SYSTEMS LTD STRUCTURED BASIC PREPROCESSOR for users of DEC BASIC or MICROSOFT MBASIC. Programs are easier to understand run more quickly use less memory are simpler to maintain and are quicker to write and test. Implements logic constructs DOWHILE ENDDO IF ELSE ENDIF CASE CASENTRY CASEOTHER ENDCASE. All branching to subroutines is done using meaningful names. *SB MB(DEC MICRO SOFT)*

COMPSOFT

COMPSOFT DMS (Data Management System) now runs on Commodore PET 3000 Series. Records can be selected using up to 4 search criteria and displayed or printed. Can perform complex calculations whenever user stores numeric information. Available for Commodore Computhink and CP/M. *SB(PET)*

COMPUTERPLAN

COMPUTERPLAN DATAPLAN program generator. Produces structured Business BASIC programs from easy to use English Language sentences. Enables user to maintain files and produce reports to printer or VDU. Written in Business BASIC



DCS 80 Industrial/Scientific Multibus computer

BRAND NEWs

HONEYWELL

HONEYWELL ha[illegible] hardware[illegible] These include [illegible] execute [illegible] Basic [illegible] (FTN) and [illegible] function MOD 400 [illegible] with the new languages [illegible] Advanced FORTRAN, Advanced [illegible] and Advanced BASIC. Mod 400 mirror [illegible] and new communication [illegible] with the [illegible] 2780/3780 HASP and [illegible] support under MOD 400 [illegible] *MB*

HOSKYNS

HOSKYNS Modular Applications Systems for Planning Accountancy (M+S A) now provides powerful facilities for organisation of [illegible] and [illegible] and [illegible] based on Texas Instruments 990 computers costs from £10670 [illegible]

ICL DATASKIL

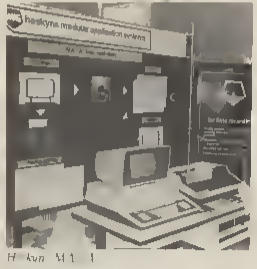
ICL DATASKIL DMF+VMM (virtual memory manager) Utilises free common memory to hold frequently used program segments. Transparent to user software. Provides increased performance in selected partitions reduced repetitive disk accessing increased overall system performance. *MB BB*

LP ENTERPRISES

LP ENTERPRISES CPIM 2.2 for North Star Horizon Computer Systems. Fully supports single sided double sided disks with 35 or 40 tracks. Gives total capacity of 380 KB per drive. £90 plus VAT. Dealer & OEM terms available. *MB JEM (NORTH STAR)*

MAI

MAI DATAwRITE word processing function for Basic Four computer systems. Allows data preparation and word processing to take place [illegible] currently on the system. Controlled by a [illegible] function VDU with its own [illegible] so that word processing can be [illegible] other terminals. Mono driven. From £900. *MB*



Hoskyns Mod[illegible]

MAP COMPUTER SYSTEMS LTD.

MAP COMPUTER SYSTEMS LTD. Incorporate Record Accounting system and Time Fee Ledger System for accountants. Also Sales Ledger Planning that looks after goods and non-sales returns basis. Available on Superbrain and any other computer operating [illegible] *BM PCL ACCOUNTANTS*

MICRO SCOPE

MICRO SCOPE MICR[illegible] financial system for [illegible] Provides full sales purch[illegible] ledger facilities runs on [illegible] ware easy to install and [illegible] range of managements [illegible] £15000 *BUILDERS*

MTC SOFTWARE

MTC SOFTWARE PILOT [illegible] adaptation of common PILOT [illegible] ed as a new machine [illegible] the Mark II PET. All features [illegible] PILOT are supported including [illegible] ing automatic editing of use[illegible] direct and file input and [illegible] and escape and goto options. Additional features are special PET graphics commands extended string handling and long arrays and PEEK and POKE [illegible] as in BASIC. All facilities of PET [illegible] can be used with MTC PILOT programs which can be entered edited and later fixed loaded and run just like BASIC programs. *PU SB(PET)*

Datawrite 7 a Basic for computer providing dual data processing word processing fun[illegible]

ALAN PEARMAN LTD

ALAN PEARMAN LTD Upgrade to Softronics APL for Rair Black Box Computer priced at £150. Most of the primitives are implemented including inner product monadic and dyadic format and the ability to run script arrays with arrays. Files are handled by the standard method of Shares Variables. A useful feature is the capability of accessing memory by system function. Vanguard APLV80 has also been improved with a more efficient keyboard checking routine giving an increase in speed of execution of some 30%. Additionally a new Auxiliary Processor is incorporated which increases the response of Port I/O for communications. £15. Also complete APL Superbrain with 64K of memory are available at the standard Superbrain price of £1995. For Superbrain owners a conversion kit can be obtained at £475 comprising APL tapes, PCB and TIS interpreter. APL applications software covering Word processing Financial Planning Communications Data base Report Formatting Statistics available from £12 £200. *SB MB(APL)*

PERKIN ELMER

PERKIN ELMER new Optimising Pascal Compiler for use on its family of 32 bit minicomputers including its Model 3220 and 3240. Up to 64 users can share access to this compiler for program development. Optimised code produced is sharable. Conforms to ANSI draft language standards. £3920 including complete documentation.

right-of copy fee £360. Also available is RELIANCE II a high throughput integrated transaction processing system. Runs on all 32 bit Perkin-Elmer Supermini's including 3200 range and is capable of controlling 128 transaction processing terminals and 64 development terminals concurrently. £8630. In addition Interactive Query System IQ/32 which provides simple user interface for ad hoc queries to database files £2070. *BB*

PRIME COMPUTER

PRIME COMPUTER Optimised Pascal for general purpose interactive Series 50 computer range. Meets ANSI draft standards and offers additional features. Optimises globally across entire program units using sophisticated flow analysis techniques. This produces highly efficient code reduces program space requirements and maximises program execution speed. Global optimisation can be turned off for max. compilation speed during program development. *BB(PASCAL)*

RTZ COMPUTER SERVICES LTD

RTZ COMPUTER SERVICES LTD has invested about £70000 in converting the McCormack and Dodge General Ledger System G L PLUS for use on ICL 1900 and 2900 DME/VME equipment. It is now available for those machines as well as the original IBM. *BB(IBM/ICL)*

SISCO

SISCO a new company. Small Information Systems Company offering packages specifically designed for the MDS Series 21 user. Packages all of which can be customised to suit customers requirements include order processing invoicing stock control sales ledger payroll purchase ledger nominal ledger and vehicle maintenance costing. Many of the packages are designed to be plugged together. Available on a purchase or rental basis. *MB(MDS)*

SYSTEMS RELIABILITY LTD

SYSTEMS RELIABILITY LTD HOTEL TAG can provide guests with a complete list of calls made from their route telephone to clear up disputes over phone bills. *HOTELS*

TEXAS INSTRUMENTS

TEXAS INSTRUMENTS WORD PROCESSING OPTION for DS990 Models 4 6 8 20 and 30 commercial computer systems designated TIPE 990. Features menu prompted operation which promotes easy use and reduces training requirements. *MB (TEXAS INSTRUMENTS)*

VENTEK

VENTEK new software offerings for 1500 series processors. BASICPLUS an interpreter for an enhanced version of BASIC and ML15TTY a teletype emulator that provides high-level language control over asynchronous peripheral devices such as badge readers card readers and printers. *MB*

Printers

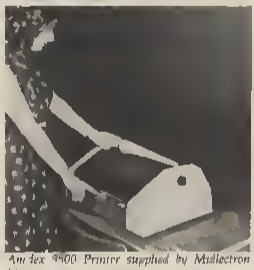
ANDERSON-JACOBSEN

ANDERSON JACOBSEN Dot Matrix Printer Terminal AJ830. Full ASCII character set RS 232/424 interface fully variable spacing and inbuilt diagnostics. *MB*

BRAND NEWs

ANADEX

ANADEX new 80 column dot matrix printer range DP9000. High density graphics capability plus alphanumerics featuring descenders underlining condensed type and double width printing. Adjustable tractor feed handles up to A4 stationery and three interfaces are provided as standard. Siemens also available. *MB*



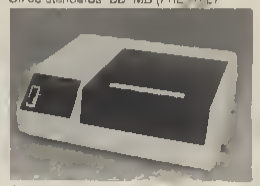
Anadex 9900 Printer supplied by Midlectron Ltd

BENSON

BENSON new interface to Prime computers allows connection between any Benson electrostatic printers plotters and the entire Prime range. Rasterisation may be performed in the computer or in Graphwere the Benson micro programmed vector to raster converter. Link is through the SDS 3009 interface supplied by Prime and software allows use of the Prime spooling system. *BB (PRIME)*

CENTRONICS

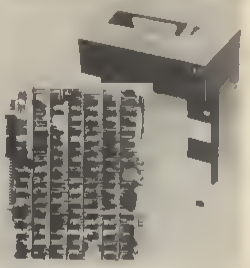
CENTRONICS SCREEN IMAGE PRINTER designed for connection to Viewdata Teletext or similar. Particularly important in Prestel where the user is paying for the length of time the image remains on the screen. Also if user purchases goods through system receipts etc will be necessary. Printer mechanism based on Centronics Microprinter which requires no ribbon or toner. Prints a standard Viewdata or Teletext page of 40 characters per line and 24 lines per page and can reproduce full graphics sets. Meets BS415 safety standard and video interface performs to Post Office standards. *SB MB (PRESTEL)*



CENTRONICS Screen Image Printer

COLOATA

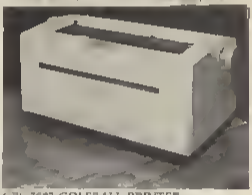
COLDATA BDS HPC 30 System of add on printing systems for Hewlett Packard 3000 Series II or III minicomputers with a choice of 300 to 1600 lines per minute. Complete system consists of controller interface card one of [illegible] available line printers employing band or drum technology and all cabling and documentation. *MB(HEWLETT PACKARD)*



COLDATA BDS HPC 30 PRINTING SYSTEM

CPS (DATA SYSTEMS) LTD

CPS (DATA SYSTEMS) LTD CPS 3982 GOLFBALL PRINTERS heavy duty machines well suited to word processing applications in conjunction with microcomputers. 130 print positions interchangeable type heads suit most languages with an 88 character set. Standard Booklace Academic type head and Stencil facility. First batch of machines have PET (IEEE) interface and self test facility. Centronics parallel interface extra (enables connections to be made for external interfaces [illegible] computers with RS232 input). *MB*



CPS 3982 GOLFBALL PRINTER

HAL COMPUTERS LTD

HAL COMPUTERS LTD MICROTEK MT80 alphanumeric dot matrix printer. Operates at 125 characters per second providing 70 lines per minute with bi directional throughput. Vertical format unit is provided as standard. Software selectable for 40 80 120 132 columns. Form width continuously adjustable 4–5 inches. Self diagnostic testing facility. Parallel or RS232 interface and character buffer storage up to 3K bytes. From £460. *SB MB*

[illegible]

IMPECTRON LTD
IMPECTRON LTD LRC M410 Printer Bidirectional 40 column dot matrix machine for printing onto single or multiply paper Up to 120 characters per second 9 lines per second Comprises solenoid printhead drive assembly line feed mechanism electronic control circuitry and ribbon cartridge Standard roll paper used up to 3 67" wide *SB MB*

THE LRC M410 PRINTER MECHANISM FROM IMPECTRON LIMITED

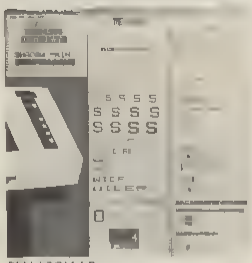
POWER EQUIPMENT CO LTD
POWER EQUIPMENT CO LTD range of acoustic silencers including new model designed to absorb noise produced by Anadex DP8000 printer known as Powrnoise Silencer Reduces sound by 7E 80% Easy to fit *SB MB (ANADEX)*

by the Anadex DP 8000 pr

RIVA TERMINALS
RIVA TERMINALS dealers for Lear Siegler Series 300 Ballistic Printer Highly dependable 150 cps serial dot matrix printer with built in microprocessor Patented ballistic head gives crisp clean printing with true underlining and lower case descenders *MB*

SOLITAIRE-KPG COMPUTER SYSTEMS LTD EPM Programmable Printing Machine Based on 300 line per minute matrix line printer will produce characters up to 2 8" high and 2" wide in various fonts 21 different bar codes supported OCRA and OCRB printing vertical printing capability and comprehensive line drawing facility *MB BB*

BRAND NEWs



PEM FROM KPC

Bureaux, Consultancies, Services, Shops

ANTON FILLER
ANTON FILLER Hybrid No Break Set une of the few no break sets suitable for being installed in a computer room No noise level down to 55dBA 94 5% efficiency produces very little load on computer air conditioning equipment Also 400Hz No-Break system with 63dBA at 1 metre and 85% efficiency *BB*

AUTOMATION FACILITIES
AUTOMATION FACILITIES CCP computer cleaning products include EXTERNAL FOAMCLENE antistatic foam cleaner aerosol ASTOPOL anti static polish aerosol SAFETISS lint free paper wipers SAFE CLOTHS spun bonded cleaning clothes VDU SCREEN CLEANING SAFECLENS anti static screen wipes TAPE DRIVE HEAD SAFECLENE tape drive cleaning fluid SAFEWIPES lint free cotton squares SAFEBUDS cotton bud sticks DISC PACK/CARTRIDGE/DRIVE DISCLENE disc cleaning fluid aerosol SAFEWANDS plastic cleaning spatulas SAFESLEEVES SAFE PADS and SPRAYDUSTER Also FLOPPICLENE floppy disk head cleaner *SB MS BB*

BUSINESS AIDS
BUSINESS AIDS SCIMITAR MICRODESTRUCTOR reduces microfilm to a line dust at rate of 940 inches per hour or 95 4

inches of film per minute 4 facet film feed attachment enables shredding destroy 16mm and 35mm film and unattended *MB BB (CRF ME*

CELDIS
CELDIS Model TC 150/ST comprehensive tool kit in attache case 23 tools including pliers wrenches cutters screwdrivers and nutdrivers *ENGINEERS*

COMPUSERVE
COMPUSERVE has announced three developments of its information service for owners of personal computers daytime access to the Compuserve Information Service commodity market information from Commodity News Service continually updated stock prices from major exchanges *PU SB*

COMPUTER TIME SHARING SERVICES LTD
COMPUTER TIME SHARING SERVICES LTD Services for Publishers a mailing list service and a computer program to handle reader service enquiries Former MAILR can accommodate subscription and circulation lists for up to 95000 names and addresses Latter BINGO matches reader s

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SUPERBRAIN from SUN

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Why the Sinclair ZX80 is Britain's best selling

Built: £99.95

Including VAT post and packing free course in computing free mains adaptor

Kit: £79.95

Including VAT post and packing free course in computing

This is the ZX80. A really powerful full-facility computer matching or surpassing other personal computers at several times the price. Personal Computer World gave it 5 stars for excellent value. Benchmark tests say it's faster than all previous personal computers.

Programmed in BASIC – the world's most popular language – the ZX80 is suitable for beginners and experts alike. And response from enthusiasts has been tremendous – over 20 000 ZX80s have been sold so far!

Powerful ROM and BASIC interpreter

The 4K BASIC ROM offers remarkable programming advantages:

* Unique one touch' key word entry the ZX80 eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST, etc.) have their own single key entry.
* Unique syntax check. A cursor identifies errors immediately.
* Excellent string-handling capability – takes up to 26 string variables of any length. All strings can undergo all relational tests (e.g. comparison).
* Up to 26 single dimension arrays.
* FOR/NEXT loops nested up to 26.
* Variable names of any length.
* BASIC language also handles full Boolean arithmetic, conditional expressions, etc.
* Randomise function useful for games and secret codes as well as more serious applications.
* Timer under program control.
* PEEK and POKE enable entry of machine code instructions.
* High-resolution graphics.
* Lines of unlimited length.

Unique RAM

The ZX80's 1K-BYTE RAM is the equivalent of up to 4K BYTES in a conventional computer – typically storing 100 lines of BASIC.

No other personal computer offers this unique combination of high capability and low price.

The ZX80 as a family learning aid. Children of 10 years and upwards are quick to understand the principles of computing – and enjoy their personal computer.

The Sinclair teach-yourself BASIC manual

If the specifications of the Sinclair ZX80 mean little to you – don't worry. They're all explained in the specially written 128-page book (free with every ZX80). The book makes learning easy, exciting and enjoyable, and represents a complete course in BASIC programming – from first principles to complex programs.

Kit or built – it's up to you

In kit form, the ZX80 is pleasantly easy to assemble, using a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9V DC nominal unregulated. If not, see the coupon.

Both kit and built versions come complete with all necessary leads to connect to your TV (colour or black and white) and cassette recorder. Plug in and you're ready to go. (Built versions come with mains adaptor.)

personal computer.

Now available for the ZX80... New 16K-BYTE RAM pack

Massive add-on memory Only £49 95

The new 16K BYTE RAM pack is a complete module designed to provide you – and your Sinclair ZX80 – with massive add on memory You can use it for those really long and complex programs – or as a personal database (Yet it can cost as little as half the price of competitive add-on memory for other computers)

For example you could write an interactive or conversational program to show people what your ZX80 can do With 16K BYTES of RAM they could be talking to your computer for hours!

Or you can store a mass of data – perhaps in a fairly simple program – such as a name and address list or a telephone directory

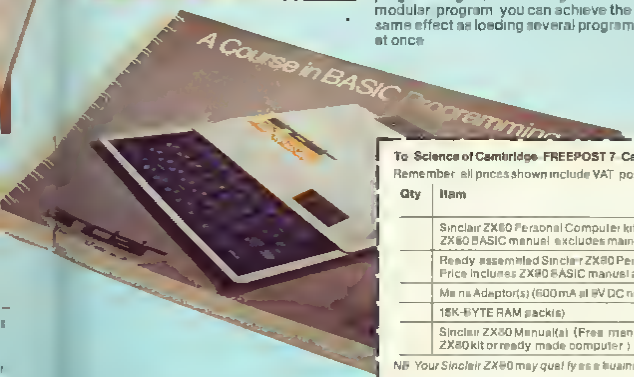
And by linking a number of separate programs together into one giant but modular program you can achieve the same effect as loading several programs at once

We're also confident that it won't be long before you can buy cassette based software using the full 16K BYTE RAM So keep an eye on the personal computer magazines – and brush up your chess perhaps!

The RAM pack simply plugs into the existing expansion port on the rear of the ZX80 No wires no soldering It's a matter of seconds and you don't need another power supply You can only add one RAM pack to your ZX80 – but with 16K BYTES who could want more!

How to order

Demand for the ZX80 exceeds all other personal computers put together! So use the coupon to order today for the earliest possible delivery All orders will be despatched in strict rotation We'll acknowledge each order by return and tell you exactly when your ZX80 will be delivered If you choose not to wait you can cancel your order immediately and your money will be refunded at once Again of course you may return your ZX80 as received within 14 days for a full refund We want you to be satisfied beyond all doubt – and we have no doubt that you will be



To Science of Cambridge FREEPOST 7 Cambridge CB2 1YY

Remember all prices shown include VAT postage and packing No hidden extras Please send me

Qty	Item	Code	Item price £	Total £
	Sinclair ZX80 Personal Computer kit(s) Price includes ZX80 BASIC manual excludes mains adaptor	02	79.95	
	Ready assembled Sinclair ZX80 Personal Computer(s) Price includes ZX80 BASIC manual and mains adaptor	01	99 95	
	Mains Adaptor(s) (600 mA at 9V DC nominal unregulated)	03	8 95	
	16K-BYTE RAM pack(s)	15	49 95	
	Sinclair ZX80 Manual(s) (Free manual with every ZX80 kit or ready made computer)	06	5 00	

NB Your Sinclair ZX80 may qualify as a business expense **TOTAL £**

I enclose a cheque/postal order payable to Science of Cambridge Ltd for £ _____

Please print

Name Mr/Mrs/Miss _____

Address _____

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sinclair ZX80

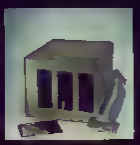
Science of Cambridge Ltd.

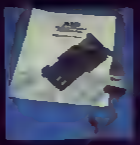
6 Kings Parade Cambridge Cambs CB2 1SN Tel 0223 311488

We are now entering our fourth financial year of dealing solely in the personal computer market – in fact, we started it! Over this period, Personal Computers Limited have formed a group of graduate specialists who will help you in the fields of word processing, financial planning, statistics, economic modelling, forecasting accounting systems, foreign exchange, banking and oil exploration.

We also do rather well with computer graphics and highly recommend the graphics tablets and our plotter for Apple

We can also offer two excellent items of software – Format 80 and Visicalc – at a combined price of ONLY £150, and the Sunrise Sound Generator for only £80! (excl. V.A.T.)





8" Disk Drive *(above left)*

Our 8" disks are still as popular as ever – 2.8 Mbytes give you 1.2MB each at the reliable security of Shugart Technology. Disks interface via Assemblers uses the same D.O.S.

A.I.O Serial and Parallel

Three hand-shake lines, RTC, CTS & and DTR. Incorporates two serial interfaces on board, optimised for parallel printer, providing 2 fully-buffered 8 bit parallel ports. Also 4 edge connectors and will have spacing 2mm.

Light Pen

A much sought after graphics activity we introduced to the U.K.

80 Character Card

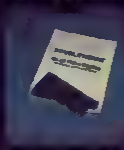
expose up the real commercial world for all Apple owners

Paper Tiger

132 characters per line, also graphics. It plus other sizes, including 240cps, multi-copy

Centronics 730

A considerable reduced version from a known manufacturer. A new plain functional appeal. 100 characters per second. Identical interface to the



Items unsure?

Shugart SA 455

Shugart Compact

Epson MX 80

Juno Boards

This is what we do..

and we do it rather well!

Personal Computers Limited

The Sinclair ZX80 is innovative and powerful. Now there's a magazine to help you get the most out of it.

Get in sync

SYNC magazine is different from other personal computing magazines. Not just different because it is about a unique computer, the Sinclair ZX80 (and kit version, the MicroAce). But different because of the creative and innovative philosophy of the editors.

A Fascinating Computer

The ZX80 doesn't have memory mapped video. Thus the screen goes blank when a key is pressed. To some reviewers this is a disadvantage. To our editors this is a challenge. One suggested that games could be written to take advantage of the screen blanking. For example, how about a game where characters and graphic symbols move around the screen while it is blanked? The object would be to crack the secret code governing the movements. Voila! A new game like Mastermind or Black Box uniquely for the ZX80.

We made some interesting discoveries soon after setting up the machine. For instance, the CHR$ function is not limited to a value between 0 and 255 but cycles repeatedly through the code. CHR$ (9) and CHR$ (265) will produce identical values. In other words, CHR$ operates in a MOD 256 fashion. We found that the = sign can be used several times on a single line, allowing the logical evaluation of variables. In the Sinclair LET X=Y=Z=W is a valid expression.

Or consider the TL$ function which strips a string of its initial character. At first we wondered what practical value it had. Then someone suggested it would be perfect for removing the dollar sign from numerical inputs.

Breakthroughs? Hardly. But indicative of the hints and kinds you'll find in every issue of **SYNC**. We intend to take the Sinclair to its limits and then push beyond, finding new tricks and tips, new applications, new ways to do what couldn't be done before. **SYNC** functions on many levels, with tutorials for the beginner and concepts that will keep the pros coming back for more. We'll show you how to duplicate commands available in other Basics. And perhaps how to do things that can't be done on other machines.

Many computer applications require that data be sorted. But did you realize there are over ten fundamentally different sorting algorithms? Many people settle for a simple bubble sort perhaps because it is described in so many programming manuals or because they've seen it in another program. However sort routines such as heapsort or Shell-Metzner are over 100 times as fast as a bubble sort and may actually use less memory. Sure, 1K of memory isn't a lot to work with, but it can be stretched much further by using innovative clever coding. You'll find this type of help in **SYNC**.

Lots of Games and Applications

Applications and software are the meat of **SYNC**. We recognize that along with useful pragmatic applications like financial analysis and graphing, you'll want games that are fun and challenging. In the charter issue of **SYNC** you'll find several games. Acey Ducey is a card game in which the dealer (the computer) deals two cards face up. You then have an option to bet depending upon whether you feel the next card dealt will have a value between the first two.

In Hurkle another game in the charter issue, you have to find a hapless little Hurkle who is hiding on a 10 X 10 grid. In response to your guesses, the Hurkle sends out a clue telling you in which direction to look next.

One of the most ancient forms of arithmetical puzzle is called a "boomerang". The oldest recorded example is that set down by Nicomachus in his *Arithmetica* around 100 A.D. You'll find a computer version of this puzzle in **SYNC**.

Hard-Hitting Objective Evaluations

By selecting the ZX80 or MicroAce as your personal computer you've shown that you are an astute buyer looking for good performance, an innovative design and economical price. However selecting software will not be easy. That's where **SYNC** comes in. **SYNC** evaluates software packages and other peripherals and doesn't just publish manufacturer descriptions. We put each package through its paces and give you an in-depth objective report of its strengths and weaknesses.

SYNC is a Creative Computing publication. **Creative Computing** is the number 1 magazine of software and applications with nearly 100,000 circulation. The two most popular computer games books in the world, *Basic Computer Games* and *More Basic Computer Games* (combined sales over 500,000) are published by Creative Computing. Creative Computing Software manufactures over 150 software packages for six different personal computers.

Creative Computing, founded in 1974 by David Ahl, is a well-established firm committed to the future of personal computing. We expect the Sinclair ZX80 to be a highly successful computer and correspondingly **SYNC** to be a respected and successful magazine.

Order SYNC Today

Right now we need all the help we can get. First of all, we'd like you to subscribe to **SYNC**. Subscriptions are posted by air directly from America and cost just £10 for one year (6 issues), £18 for two years (12 issues) or, if you really want to beat inflation, £25 for three years (18 issues). **SYNC** is available only by subscription. It is not on newsstands. We guarantee your satisfaction or we will refund the unfulfilled portion of your subscription.

Needless to say, we can't fill up all the pages without your help. So send in your programs, articles, hints and tips. Remember, illustrations and screen photos make a piece much more interesting. Send in your reviews of peripherals and software too—but be warned, reviews must be in-depth and objective. We want you to respect what you read on the pages of **SYNC** so be honest and forthright in the material you send us. Of course we pay for contributions—just don't expect to retire on it.

The exploration has begun. Join us.

SYNC

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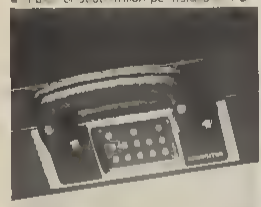
BRAND NEWs

name and addresses from [illegible] bingo cards to those [illegible] editorial mentions From £1 [illegible] month *PUBLISHERS*

CUSTOM

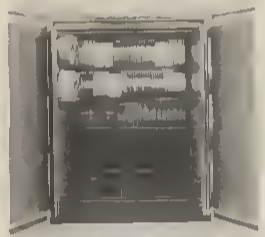
CUSTOM world's first computer locking attache case Works by push button electronic mechanism with memory device User selects own combination of up to 8 numbers plus a floating decimal point giving a choice of 100 million permutations PU



The push button electronic locking mechanism with built in memory locks from Custom Computex Case

DATA EFFICIENCY LTD

DATA EFFICIENCY LTD DATA SAFES manufactured by LAMPERTZ in Germany to exacting German standards Will withstand two hours exposure to fire or dropping from over 30 feet Burglar proof Four sizes Models 2S 3S 4S and 6S from £1458 to £2852 *SB*



The Lamperz [illegible] model titled [illegible] magnetic devices in both seals and [illegible] with a range of disc packs from DATA EFFICIENCY LIMITED

GEISCO

GEISCO DISTRIBUTED DATA PROCESSING (DDP) capability on MARK III service allows GEISCO to offer total distributed business systems with proven communication links host processors communications protocols operating software screens and keyboards local processors and data storage together with applications software *BB*

HAYS BUSINESS SERVICES LTD

HAYS BUSINESS SERVICES LTD as part of plan to extend its services not only has established an off site storage location in Manchester which will appear to users who wish to maintain back-up sets of computer tapes and disks off-site *MB*

HYDRO-AIR INTERNATIONAL

HYDRO AIR INTERNATIONAL has extend

ed computer service available to truss rafter fabricating companies in Britain and Ireland New software package running on Commodore PET enables fabricators to take a customer's requirements and select and quote the optimum truss design for the job Immediate access to main computer via telephone lines allow user to obtain truss designs and manufacturing data for less popular truss designs *INDUSTRIAL*

LETTS

LETTS YEAR PLANNER for computer users Features computer week and day numbers Computer fixed outs can be recorded onto the planners in a purely digital form *MANAGERS PROGRAMMERS*

LINLATHEN

LINLATHEN fixed asset package PRIAS now available as a bureau service PRIAS (Plant Register & Initiation Accounting System) complies with SSAP 16 *MB*

MICROSENSE

MICROSENSE DIGITAL MUSIC SYNTHESIZER for Apple II Computer by MOUNTAIN COMPUTER INC Permits creation of sounds of real musical instruments utilising the principle of add-4 synthesis Full programmable [illegible] envelopes and amplitudes for each [illegible] Software allows editing and playing [illegible] Editor permits graphical [illegible] using standard notation Future [illegible] permits polyphonic performance *EDUCATIONAL MUSICIANS (APPLE*

MTL MICROTESTING

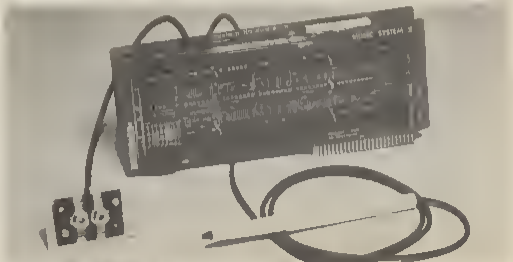
MTL MICROTESTING comprehensive problem solving service for businesses involved in testing of microelectronic components using newly installed SENTRY VII Test Machine *INDUSTRIAL*

NATIONAL UTILITY SERVICE

NATIONAL UTILITY SERVICE new subsidiary in Britain to expand its Energy Conservation Service which has operated since 1973 Services include one-day surveys and continuous monitoring of clients premises *MB BB*

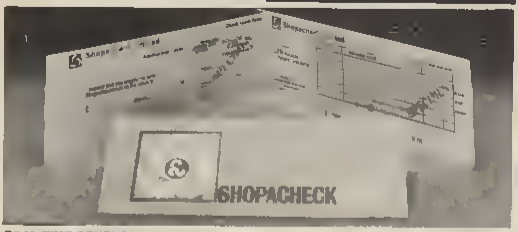
NCC

NCC COMPUTER GUIDANCE SERVICE available in London and Manchester Offers free brochure Introduction to Successful Computing Computer Guidance Talks Computer Guidance Clinics and Computer Guidance Package *SB MB*



Available from [illegible] computers national Dem[illegible] the new Music System digital synth[illegible] £254 ex [illegible] VAT Pho[illegible]

BRAND NEWs



REAL-TIME DEVELOPMENTS LTD

REAL TIME DEVELOPMENTS LTD FORM MATE system-filler simplifying report generation combines function of console display with a quality report printer. Accepts sequence of values and text from any host computer and prints them onto plain paper merged with any locally prepared form layouts *SB MB*

SEMINARS INTERNATIONAL

SEMINARS INTERNATIONAL International Conference on PROJECT FINANCING THE FINANCIAL AND LEGAL RISKS 1st and 2nd December 1980 London Press Centre *MANAGERS*

SYSTEMS DESIGNERS LTD

SYSTEMS DESIGNERS LTD one day seminar SYSTEM DEVELOPMENT STANDARDS Strand Palace Hotel London Jan 15 and Feb 12 1981 *PROGRAMMERS*

I P SHARP ASSOCIATES LTD

I P SHARP ASSOCIATES LTD now programs 150 hours of courses and seminars in the use of APL. Includes Appreciation Introductory Intermediate and Advanced courses in APL as well as seminars in specialised areas of APL application. Located at I P Sharp Training Centres in London Coventry Gloucester Warrington and Aberdeen. Special application courses include Record Management Personnel File Maintenance Forecasting Econometrics Statistical Analysis Project Management Box Jenkins and Linear Programming *PROGRAMMERS (APL) MANAGERS*

SERVICE 800

SERVICE 800 the world's only international toll free dialing service. Calls placed to subscribers in overseas cities are answered automatically and simultaneously diverted over the public direct dial network to the place where the subscriber wishes to receive his call. Caller pays for a local call subscriber for the international portion at direct dial tariff rates *BB*

SHOPACHECK

SHOPACHECK new service for credit shoppers personalised Shopacheck Books. Magnetic ink character recognition system will be used on checks enabling shoppers to make purchases on a personal credit basis NCR 7750 and Kodak IMT 150 microimage record storing facilities will control the system which is to operate at 160 offices throughout the UK *PU*

SIA COMPUTER SERVICES

SIA COMPUTER SERVICES SAS Statistical Analysis System now available on bureau service SAS is a comprehensive system for retrieving and managing data performing statistical analysis and writing reports incorporates PL1 type programming language enabling users to handle all data manipulation within the system *BB*

SISCO

SISCO (Small Information Systems Company Ltd) has opened a new computer bureau in Moorgate specifically to cater for the City of London's small to medium sized businesses. Based on MDS Series 21 computer the bureau will offer standard accounting services *SB MB*

WILKES ONLINE DIVISION

WILKES ONLINE DIVISION SUPERMAILER package for in-house mailing operations. Consists of continuous bespoke letter headings listing paper 2 sizes of coordinating envelopes magnetic media and high quality self-adhesive labels *SB MB BB*

WORDPLEX

WORDPLEX WORDPROCESSING BUREAUX Franchised operations Wordplex is hoping for about 400 franchisees by end of 1981. Rigorous selection procedures training and back up for franchisees *SB MB*

ZAERIX ELECTRONICS LTD

ZAERIX ELECTRONICS LTD range of instrument cases and boxes mainly in aluminium including DATABOXES range of desk consoles *MANUFACTURERS OEMs*

Exhibitions, Courses, Events

BIS APPLIED SYSTEMS LTD

BIS APPLIED SYSTEMS LTD course on ADA programming language examines capabilities of ADA how it will affect typical installations and the factors to be considered by management in planning language policy. First course to be held on 8th December at Kensington Palace Hotel London. Fee £120 plus VAT. In addition BIS have introduced a course PROGRAMMING IN BASIC intended to provide a sufficient understanding of BASIC so that delegates can create simple programs and develop their own knowledge. Two day residential course featuring hands-on experience Portland Hotel Manchester 9–10 December £220 plus VAT. First London date 17-18 February 1981 *PROGRAMMERS (ADA BASIC) MANAGERS*

BRITISH COMPUTER SOCIETY

BRITISH COMPUTER SOCIETY International Symposium COMPUTERS IN DEVELOPMENT PLANNING to be held at the Institute of Education London 23-27 March 1981. Planned to attract the interest of those involved in development planning in developing countries as well as appropriate British and international agencies objectives are to share technology and techniques with delegates from developing countries to receive views from delegates and to formulate recommendations. Will concentrate on four primary areas Communications and Transport Agriculture Water Resources and Finance. Registration fee (before Jan 20) £270 (members) £180 (students) £315 (non members). Thereafter £300 £200 and £350. In addition a programme of talks has been arranged for the forthcoming season 22 Jan 1981 WHAT IS THE POINT OF EUROPE by Basil de Ferranti 19 February THE U.K. COMPUTER CONSULTING AND SOFTWARE INDUSTRY ITS PLACE IN THE WORLD MARKET AND ITS FUTURE by Philip Hughes of Logica 19 March FLEXIBLE MANUFACTURING SYSTEMS (ROBOTICS AND INDUSTRIAL AUTOMATION) by John Collins of British Oxygen 23 April THE FINNESTON REPORT by Sir Montague Finneston (joint meeting with Institute of Management Services) 21 May PRESIDENT'S ADDRESS by Frank Hooper President of BCS All meetings at Waldorf Hotel London (entrance £1 for non-members) except president's address which will be held at BCS Headquarters and will incorporate AGM of London Branch of BCS

CIRCLE SOFTWARE

CIRCLE SOFTWARE KEYBOARD TUTOR a touch typing course computer program designed to run on a Commodore PET computer with 16K of memory and a full size QWERTY keyboard. Offers following features screen prompting using graphics display to ensure that student does not look at the keyboard instant feedback keys taken row by row in sequence speed of prompting automatically adjusted to suit ability of student keys repeatedly missed repeated more often and full display of performance at end of each lesson £12 *KEY BOARD USERS (PET)*

CHELMER MANAGEMENT CONSULTANCY

CHELMER MANAGEMENT CONSULTANCY one day seminar MANAGEMENT CYBERNETICS FOR INFORMATION PROCESSING SPECIALISTS Institute of Directors Pall Mall London 15 Dec 16 Dec 1980 22 April 1981 £47 per delegate including lunch and refreshments *MANAGERS*

INFO 81

INFO 81 Fourth International Business Computing Word Processing and Information Management Exhibition and Conference. Exhibition to be held at Cunard International Hotel London 10–13 Feb 1981 Conference to be held at Gloucester Hotel London 9–13 Feb 1981 Executive coaches will be laid on to transport delegates from one site to the other

INTEGRATED COMPUTER SYSTEMS PUBLISHING COMPANY (UK) LTD

INTEGRATED COMPUTER SYSTEMS PUBLISHING COMPANY (UK) LTD 4 day

Course HANDS ON MICRO PROCESSOR TROUBLESHOOTING to be held in London 16–19 Dec 1980 Teaches practical techniques supported by hands on training using test equipment specifically intended for microprocessor applications *ENGINEERS TECHNICIANS*

LIVERPOOL UNIVERSITY

LIVERPOOL UNIVERSITY course MICRO COMPUTER ASSEMBLER PROGRAMMING Consists of five short lectures each followed by an extended practical period in which full facilities of university's computer laboratory are at participants disposal Practical work centres on AIM 65 single board microcomputers which uses 6502 microprocessor APPLE and PET also available Emphasis is on principles of assembly language programming and in particular on input output routines and their communication with programs written in BASIC or Pascal Course assumes know ledge of high level programming Next course will commence 27 January 1981 Registration fee £100 per person with reductions for two or more people from the same company Details from D M D Beer *PROGRAMMERS ENGINEERS*

MSS

MSS courses in Worthing for December include O & M FOR THE SYSTEMS ANALYST MANAGING COMPUTER STAFF and PROGRAMMING IN BASIC

NODCOMP

NODCOMP SIMPLER computer based dual in system designed to run on the CLASSIC range of computers System of Information Management and Program Logic for Education and Research Developed through a project undertaken by Computer Education Research Laboratories at University of Illinois which originally led to Control Data's PLATO system Further work translated this to mini computer to provide closely analogous facilities with up to 32 simultaneous users Major portion of software written in TUTOR programming language developed by the University Instructional modes include games quiz and situation simulation Assessments are made via repeated and varied tests

NATIONAL SEMICONDUCTOR

NATIONAL SEMICONDUCTOR microcomputer courses during December MICRO COMPUTER FUNDAMENTALS Dec 8 12 ADVANCED STARPLEX COURSE Dec 15 19 NSC800 COURSE Dec 1 5 Most will be held at NS offices in Fürstenfeldbruck near Munich Germany For info contact Sandra Reiner Training Group Technical Support National semiconductor Industriestrasse 10 D8080 Fürstenfeldbruck West Germany *ENGINEERS PROGRAMMERS (NATIONAL SEMICONDUCTOR*

NCC

NCC video training package COMPUTING FOR MANAGERS to complement BASIC COMPUTING CONCEPTS training package Provides knowledge about computing and the way a project is managed and includes interviews overhead projections and video programmes to assist the experienced lecturer with his presentation *LECTURERS*

POLYTECHNIC OF NORTH LONDON

POLYTECHNIC OF NORTH LONDON Short and Part Time Courses in Electronics and Micro

BRAND NEWs

[illegible] Berg [illegible] for prototyping [illegible] components [illegible] Inte 8085 8502 [illegible] with [illegible] programming [illegible] [illegible] ILLUMINATOR [illegible] [illegible] hardware [illegible] and sensor technology [illegible] APPLICATIONS SOFTWARE [illegible] £75 £400 [illegible] Digital Control Electronics [illegible] Engineering [illegible] *PRO GRAMMER*

Literature

BROWN BOVERI KENT

BROWN BOVERI KENT new monthly magazine *Brown Boveri Review* looks at latest developments in process control industrial control industrial measurements and metering *INDUSTRIAL*

BRITISH COMPUTER SOCIETY

BRITISH COMPUTER SOCIETY MICRO PROCESSOR SPECIALIST GROUP in association with the JOURNAL OF MICROCOMPUTER APPLICATIONS JOURNAL published by Liverpool University Computer Laboratory Formerly known as Microwop

COMMODORE

COMMODORE new catalogue of APPROVED PRODUCTS Contains over 50 products from business software business peripherals educational programs medical construction and business services engineering software mains power control hardware and interfacing programmers aids utilities to literature furniture and field maintenance services *PU SB(PET)*

COMPUTER ANCILLARIES LTD

COMPUTER ANCILLARIES LTD REFERENCE BOOKLET Giving details of the extensive library of microcomputer application packages for business and [illegible] Suitable for both MAEL and ELIPAK [illegible] applied by CAL [illegible]

CAL DIPLOMAT PORTABLE BUSINESS MICRO

THE DESIGN COUNCIL

THE DESIGN COUNCIL SAFE ENOUGH TO SELL? DESIGN AND PRODUCT LIABILITY a new document book by Howard Abbott is a guide to new European legislation proposals and their implications *MANUFACTURERS*

EMI

EMI EMIDATA Booklet WATERMARK MAGNETICS EXPLAINED Intended for personnel familiar with the use of data recording on magnetic tape and the use of magnetic stripe plastic cards Free from Emidata Alma Rd Windsor SL4 3JA

A J HARDING (MOLIMERX)

A J HARDING MOLIMERX new additions to catalogue for month

HEATHKIT

HEATHKIT Catalogue of Quality Electronics you can build yourself Autumn 1980 Includes computers frequency counters linear amplifiers etc *PU*

HUTCHINSON EDUCATIONAL

HUTCHINSON EDUCATIONAL new book TIMETABLING by Keith Johnson Contains a complete listing of a suite of 12 computer programs designed to run on a micro to do compilation and analysis of data starting from pupils individual choices of options right through to printing individual pupils and teachers timetables *EDUCATIONAL*

INTERNATIONAL NASCOM COMPUTER CLUB

INTERNATIONAL NASCOM COMPUTER CLUB booklet of BASIC GAMES PROGRAMS for the Nascom 1 & 2 microcomputers called BASIC Programs Book 2 Listed from programs running on machine with 8K BASIC Additionally contains number of subroutines and a complete table of HEX codes for reserved words and graphics *PL(NASCOM)*

LINSAC

LINSAC Autumn Catalogue of books and software for Sinclair ZX80 owners *PU(ZX80)*

LOGICA

LOGICA has announced completion of the 1979 Eurodata Report Report shows data communications market is growing almost twice as fast as projected in the 1972 study with the result that already almost 1 million people in Western Europe use data communications as part of their everyday work These facilities produce about 2000 million dollars a year in revenues for British Telecom and its European counterparts *BB(DATA COMMUNICATIONS)*

MELBOURNE HOUSE

MELBOURNE HOUSE '30 PROGRAMS FOR THE SINCLAIR ZX80 1K' 112 page book making available games like Black Jack Lunar Lander Nim Hangman Noughts & Crosses Simple Simon Life Fruit Mastermind and 10 others *PU (ZX80)*

MICROSENSE

MICROSENSE new Software Booklet lists some of the many programs available for the Apple microcomputer Programs are listed in alphabetical order with short detailed descriptions on each *PU SB(APPLE)*

NCC
NCC new publication CHOOSING PROGRAMS FOR MICROCOMPUTERS looks at application packages for microcomputers describes what they are and pinpoints the benefits they offer *SB MB*

RAPID RECALL
RAPID RECALL 4th issue of bimonthly newsletter RR1 highlights company's recent move to High Wycombe and contains two page review of Intel's plans for the future as well as detailed discussion of various new Intel products (RR are Intel and Digital Equipment distributors)

SHARP PC-1211 USERS CLUB
SHARP PC 1211 USERS CLUB OUTPUT Newsletter produces at five week intervals Membership £5 per annum *PU SB(PC 1211)*

SMALL SYSTEMS GROUP
SMALL SYSTEMS GROUP WORD PROCESSING ON PERSONAL COMPUTERS

BRAND NEWs

first of a series of in depth product evaluation reports Includes sections on software hardware and applications AUTOSCRIBE ELECTRIC PENCIL MAGIC WAND and WORD STAR are described and compared 12 dollars from Small Systems Group Box 5429 Santa Monica CA 90405 USA *PU SB*

SYSTEMS DESIGNERS
SYSTEMS DESIGNERS new brochure on CONTEXT (Construction Execution Test) System for programming microprocessors in complex and time critical applications CONTEXT consists of software development tools hosted on a PDP11 minicomputer controlled from an interactive terminal *PROGRAMMERS*

SYSTEMSOLVE
SYSTEMSOLVE has published the results of latest bi annual survey of ICL 2903,4/5/50 users Shows 10% growth in 2903,4 sites in finance sector and increase in 2903/4 usage Of 65um purchasers majority of users believe 2903/4 most effective and find the range offers good upgrade path on-line processing increasing rapidly at expense of conventional data collection batch mode average time to achieve operational system remains two months 43% of users live within one month *MB BB(ICL)*

VENTEK
VENTEK has launched an 80000 circulation magazine Published quarterly and distributed to existing and potential customers *MB*

KEITH WHARTON CONSULTANTS LTD
KEITH WHARTON CONSULTANTS LTD MSRA INC report The Outlook for the mini computer industry in the 80s 32 bit Supermini's Comp of Age finds that 32 bit superminis will capture 22% of the market by 1985 Over the next five years mini computer sales will grow at an annual compound rate of 27% to a staggering 25 million dollars Full report £285

Address Bus

Abacus Software
PO Box 7211
Gham Rapids
Mich 49510
USA

Access Data Communications
662 High Street
Uxbridge
Middx

ACT
Radcliffe House
Blenheim Park Road
Highfield
Birmingham
B13 9PF

Alan Boorman Ltd
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Meriden Crescent
Chester
CH2 2BR Tel (0244) 46024

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Barton Approach
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Benson Electronics Ltd
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BS1 6NH Tel (0272) 211681

BIS Applied Systems Ltd
York House
199 Westminster Bridge Road
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TW5 9QL Tel 01 759 5532

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W1M 0BP Tel 01-637 0471

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West Sussex Tel (04446) 44111

Celdata International Ltd
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Commodore
360 Euston Road
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CompSoft Ltd
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Compuserve
5000 Arlington Centre Boulevard
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66 Staines Road
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Acocks Green
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B27 6BH Tel (021)-707 3666

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Gribumble Road
Waltham Cross
Herts Tel 01-882 2666

Datroll Group
Datroll House
Gardners Lane
Surbiton
W. London Tel (0606) 56662

Data Efficiency Ltd
Maylord Road
Maylands Avenue
Hemel Hempstead
Herts
HP2 7LE Tel (04421 63611

Design Council
28 Haymarket
London
SW1 4SU Tel 01-839 8000

Digital Equipment Corp (DEC)
Digital House
Kings Road
Reading
Berks Tel Reading 583555

ORG Business Machines
13/14 Lynx Crescent
Winbrmeire Road
Weston-Super-Mare
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WC1B 5AH Tel 01 242 5725

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BRAND NEWs

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North Harbour (Baltic House)
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Amersham
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NW10 7BZ
Tel 01 965 0061

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Olivetti Computers (UK) Ltd
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Elstree House
Colchester
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Tel (0206) 6115

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Hull
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Avenue Road
Reading
Berks
RG2 0LS
Tel [illegible]

SISCO
4 Moorfields
London
EC2Y 9AA
Tel [illegible]

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W4
Tel 01-994 3513

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86 Hogarth Viaduct
London
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Tel 01 940 7360

Wilkes Online Stores
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W Midlands
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Wordplex Wordprocessing Bureaux
32 Fitzroy Square
London
W1P 6DX
Tel 01-388 7282

Zentx Electronics Ltd
49 Westbourne Grove
London
W2 5SH
Tel 01 727 5641

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spell ful pr –6 opr {execute the spell command giving a list of all words starting with the given characters, pass the output as it is produced to a program which converts input to six column format and pass this output to the off line spooler}

Sequencing to execute commands in sequence use semi colons as in
date, who cal 1980
Of course all of these facilities can be combined to any degree, as in
(date who)" opr

Parallel execution to execute two or more commands in parallel (i e multiprogramming with anything else that is going on) type
comm1 & comm2 & comm3
The '&' sign is taken to mean "start the preceding command but don't wait for it" Thus
comm1 & comm2 & comm3 &
starts the three programs, and returns a command prompt immediately
The above facilities can now be combined using brackets if necessary, as in
(date who) opr &
and
date & (who opr) & (cal 1980 opr)
The command 'tee' receives input puts one copy in the file given as a parameter and passes another copy down the pipe as in

tee /dev/lp" command

Branching (aaauuuggghhh) is available for use in command macros One form is

if (command) goto label

where the jump is executed if the command delivers the value "true" In Version 7 the shell has been got at by Algol 68 freaks and the constructions have become

if command sequence
then command sequence
else command sequence
fi
and
while command sequence
do command sequence
od

TYPICAL COMMANDS

Some typical commands are as follows

Edit

The command
edit file
creates a workfile (a copy) and allows general context and screen editing To use a stored script type
edit file < script

A particularly good feature is that any editing command starting with the symbol '!' is treated as a Unix command so that
'alg prog, ago < input" grep 'error'
will test compile an Algol 68 program, and execute it with data from the file input" piping to the VDU only those lines containing the characters 'error'

Unix

all this being done while within the editor Further the command
!!
means execute the same command again , so a typical debugging session might be
amendments
'alg prog, ago < input' grep 'error"
further amendments
!!
further amendments
!!
all done from within the editor

tr "abc" "ABC" < input > output

This performs a character-by-character transliteration from input to output altering in this case "a to 'A', 'b' to 'B' and "c' to 'C' The similar but more powerful command lex" allows a more complicated pattern searching process for general lexical analysis

grep "e??c" f1 f2 f3

This searches the given file(s) for occurrences of the given pattern.

find/ usr sys –type f –a ( ) .

This searches the filestore starting at the given directory (/usr/sys in this case, where the system text is stored), and accesses every inferior file checking for a given Boolean condition related to the name traps access time and type of the file and can then execute given commands on the chosen files Combined with ' grep as described above for example, we can search all files for all occurrences of a given program identifier

cmp f1 f2

This compares two files and produces summaries of the differences and/or editor commands to convert one to the other

write, wall

These commands allow messages to be sent instantly to selected users, or to all users

send, mail

These commands perform all the standard electronic mail facilities

cron

This program executes any given command to a given timetable (hourly, daily at 1 a m , on the first of each month,), very useful for running daily and weekly accounting functions

link, getfile, putfile, setup

These commands allow the interconnection of different computers and the transfer of files between them in a crude but effective way

LANGUAGES AND PACKAGES

The following languages and packages are available some come with Unix others are available for the asking from other Unix users while a few have to be bought (usually very cheaply) from various software houses Those based on DEC software require DEC licences

C

The bulk of the system as it comes is written in this high level language [reference C] It is geared for machine efficiency, and has poor compile and running time checking In return, it has many good features, and a superb system interface It is particularly to be recommended for its excellent optimisation (which can be invoked after a program has been thoroughly tested), the profiling option [referenceni²ROF] (which enables the run-time behaviour of a program to be studied) and the cross-referencing software for program analysis (giving a summary of the declaration and use of all identifiers in the program) Such additional features really allow reliable software to be written rather than the usual approach of testing against some sample test data This approach to program testing is greatly to be encouraged

Assembler

Some parts of the system (thankfully few) are written in assembler It is useful to us purely for teaching students more about processor architecture and hopefully demonstrates to them that assemblers are NOT sensible tools for producing software

Basic

The system comes with a (deliberately?) poor version of Basic Certain sites have made available a Unix variant of DEC Basic Plus to those who have bought the appropriate DEC licence

Fortran

Again the system comes with a poor Fortran compiler, but DEC RT11 Fortran is available if you pay for a DEC licence A good Fortran 77 comes as standard with Version 7 of Unix

Ratfor

This is a 'rationalised Fortran', i e an extended form to include structuring with reasonably good arrangements of 'if' s and while s [reference RAT] It consists of a preprocessor which converts the program to standard Fortran, which is then compiled using any Fortran compiler, thus offering DEC or Unix Fortran compilers

Pascal

The compiler in use at Nottingham was

written by Andy Tanenbaum and colleagues at the Vrije University at Amsterdam, other implementations are available His version uses an intermediate language of his own design (EM/1 Experimental Machine 1) rather than P code, and he has written compilers from various languages to EM/1 and compilers/interpreters to enable EM/1 to run on a variety of micros

Algol 68–S

Algol 68–S is the 'IFIP approved' subset of Algol 68 containing the majority of the language features The Unix version is not particularly well implemented, but useful for quick test programs and for students who know only Algol 68! It comes from Carnegie Mellon University via the University of Manitoba at Winnipeg It costs money!

Modula

A language for real time programming supported by SRC, and including facilities for handling concurrent processes and the communications between them Its object code includes a minimal operating system so that programs produced can run stand alone on micros It is distributed by York University, and used for example by our Psychology Department to write controllers for micros, to be loaded directly from the PDP11

Unix

Snobol 3 and Spitbol

The former of these character handling languages comes with Unix, and is sufficiently primitive to be not very useful The latter is a good implementation, and great for appropriate work one line of Snobol equals ten pages of most languages for syntax analysis, it costs money

LISP

Well?

Compiler-compilers

We hope that no one nowadays writes compilers in anything other than an appropriate high-level language Both TMG and YACC are available and make compiler writing and the analysis of sophisticated input data routine

Interactive calculators

The systems dc and bc allow the machine to operate as a programmable calculator when required with arbitrary precision up to about 4000 digits

Word Processing Automatic Documentation/Typesetting

The program nroff performs word processing laying out text numbering pages, setting out headings and so on It can be preceded by 'neqn" to lay out mathematical formulae correctly and special tabulation programs also exist We use a Diablo printer for output. There is even a program ("typo) which checks spelling mistakes to a useful extent!

Acknowledgements

Every Unix user owes a great debt to the designers of Unix and to the host of other users who have written much of the software To find out more see the issue of BST [reference BSTJ] devoted to Unix related topics or write to Bell Laboratories ■

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•Dr Eric Foxley is at the Computing Science Group Department of Mathematics Nottingham University

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03 ENTER PURCHASES	15 *PRINT AGENT STATEMENTS
04 *ENTER A/C RECEIVABLES	16 *PRINT FAX STATEMENTS
05 *ENTER A/C PAYABLES	17 GENERAL HELP
06 *ENTER/UPDATE INVENTORY	18 ALTER VOCABULARIES
07 ENTER/UPDATE ORDERS	19 PRINT YEAR AUDIT
08 ENTER/UPDATE BANKS	20 PRINT PROFIT/LOSS A/C
09 REPORT SALES LEDGER	21 RECALL INVOICE
10 *REPORT PURCHASE LEDGER	22 PRINT CASHFLOW FORECAST
11 * INCOMPLETE RECORDS	23 ENTER PAYROLL/NO RELEASE
12 *USER DBMS AREA	24 EXIT SYSTEM

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The Truth About Benchmarking

Part I

Benchmarking is a subtle complex art. In this first of two articles the author explains why simplistic benchmarks are perhaps worse than useless not just with regard to mainframes and minis but also with regard to microcomputers, now that they are being used increasingly for professional purposes

It is natural when purchasing any new piece of machinery whether it is a washing machine a delivery van or a computer, to want to make sure that it is able to do the job for which it is being bought. The most convincing way is to see a machine like the one you intend to buy doing a similar job of work. This is fairly easy with most machines, but with a computer the problem is how to define exactly the job you want done.

In some commercial applications the workload of the computer can be laid down precisely. If the computer is to perform a regular cycle of runs – say invoicing, stores updating and payroll – then a typical day's workload can (usually with a great deal of effort) be converted and run on the computers being considered. If the work can be done in the necessary space of time then you can be sure that the computer will do the job and you can move on to compare the possible contenders on *other* criteria, such as reliability, maintenance arrangements and, of course, cost.

However, it is very rarely as simple as that. Most computers are expected to perform a large range of functions which have to be fitted in with their bread-and-butter jobs. Usually when a new computer is bought it is with the intention of branching out into new, often ill-defined applications. This is especially true of educational and research establishments where the workload changes constantly as the users develop, test, run and discard programs. To compare the ability of different computers to handle this sort of usage it is necessary to set up a standard test to measure their speed. Any such standard test may be called a 'benchmark'.

But what do we mean by 'speed'?

Speed has meant many different things as computer systems have become more sophisticated. Originally people looked at the speed of the hardware instruction set. As the relative times of different instructions vary between computers it was necessary to define a 'typical' mix of instructions. Various mixes were defined to represent different sorts of commercial and scientific workload. But the user does not see the hardware instruction set. What he sees is the Cobol or Fortran compiler, and it is the rate at which programs produced by these compilers are executed that determines the throughput of the computer.

So the next stage was to develop typical Cobol or Fortran job mixes. Again, various mixes were used for different workloads. To obtain these mixes it was necessary to collect a large number of sample programs from a range of suitable installations, and to perform statistical analysis on them. However it did seem possible to obtain reasonably representative mixes for a particular environment: the frequency of use of different types of instruction was determined by the sort of job being done, rather than by programming methodology.

> *'how fairly do they run the benchmarks? Do they cheat?'*

Of course the speed of the program depends not only on the speed of the hardware instruction set but also on the efficiency of the code generated by the compilers. The increasing sophistication of optimizing compilers made the task of the benchmark writer more difficult. These compilers were quite capable of recognizing that a program carefully constructed to encompass a certain instruction mix was essentially doing nothing in particular, and then optimizing large chunks of it *out of existence*. Although this extreme situation can be avoided it is always difficult to produce benchmark programs that do not change their characteristics drastically under different optimization systems.

Now this is all very well if your main concern is with 'number crunching' jobs. In this case, if you can design a job or set of jobs that seem a reasonable average of your normal workload, then the differences in the times taken to execute this set of jobs will give a realistic measure of the relative abilities of different computers to handle the workload.

But, except in a few very specialized applications, this is never the case. Most computers installations spend their time manipulating files and databases of various sizes and producing output on a wide variety of devices. In order to operate efficiently they will multiprogram often with a large number of concurrent jobs. In order to run these jobs they will use memory management techniques involving swapping areas of memory to and from disc storage. The result of all this is that the *execution speed* is rarely the limiting factor in system performance. Other factors that must be taken into account include disc and channel throughput, optimization of disc seek times, processor to memory transfer rates, and a host of factors, peculiar to particular operating systems such as access clashes on semaphores controlling use of shared data areas.

Thus we move rapidly from the concept of measuring the speed of the hardware to measuring the speed of the system *as a whole*. In modern computer systems the hardware and software are designed to complement each other and the hardware will provide many facilities to enable the compilers and the operating system to work more efficiently. The cost of the software has now become comparable to that of the hardware. The efficiency of the software and the way in which it interfaces with and uses the hardware is as important to program throughput as the hardware instruction speed.

Can any test be set up to take account of all these factors?

The obvious method of taking a representative sample of the workload now becomes more and more difficult. The effort required to determine this sample, to convert it to run on each of the computers to be tested, to set up the files and databases that have to be accessed and to verify the results would consume so much manpower and machine time that the cost would be prohibitive. Even if this could be done a further complication would make the exercise fruitless.

When the results of running on two different computers are compared there will obviously be measurable differences in the performance of different elements of the test. But this difference will vary from job to job, according to the *characteristics* of the job. It may also be possible to tune the system under test to favour some jobs at the expense of others. There will be so many combinations of results and so many possibilities of changing the results that it will be impossible to make any comparison between the systems being tested.

So what can we do?

The most useful and widely applicable technique is the **synthetic** benchmark. This consists of a suite of programs which are synthetic in that they are specially constructed rather than being part of a normal workload. They are designed to test all aspects of the system such as the processor power, the input/output rate

the paging mechanism and the operating system throughput. The programs are usually cyclic, so that they can make repeated use of the same resources, and parameterized so that the total amount of work done or the amount of use of one resource relative to the others can be varied. The great advantage of such a benchmark is that once written it can be used in a variety of different circumstances and can test computers against different predictions of the future workload. It can also be used to probe expected weaknesses in the system, or weaknesses that become apparent during earlier tests by increasing the usage of resources which are in short supply or seem to cause bottlenecks in throughput.

In nearly every case use of a computer system exceeds all predictions and will increase until the computer is saturated. It is important to know what the limiting factor on throughput is likely to be and also whether the system will degrade gracefully when this limit is reached or fail in a way that could be catastrophic for the service as a whole.

Having begged, borrowed, stolen or as a very last resort, written a set of programs that you think can be set up to look like something equivalent to your future workload, you must try to make some *estimate* of what that workload will be.

If you are using a computer already then it should be possible to measure the processor power and disc transfer rate necessary to handle your current workload together with other factors that will have different effects on different computer systems such as the ■size and duration of individual jobs, the ■ frequency of loading jobs, the ■ number of magnetic tapes units required concurrently and the ■ number of input and output spooling devices you want to support. How easy this will be must depend largely on the amount of information that the operating system is prepared to give you.

Some manufacturers provide very complete tools to monitor system activity, others supply almost none. The information you gather about the current workload must then be scaled up to match your guess of the future workload. Then it must be scaled up again because the new computer will have new facilities and the users will suddenly find new applications and new ways of working. Notice how rapidly we are piling guesses on top of each other!

If you are not using a computer already and are buying one for a new application, then some of these calculations can be done from the *expected* characteristics of that application. However now there is obviously even more uncertainty.

Now you must persuade the computer manufacturers to run *your* benchmark. You will probably be surprised by their reluctance to do so.

The reasons are not hard to find. The manufacturer will be well aware that if he is going to do a benchmark at all it must be done well. Any apparent failings will be seized upon as a reason for rejection of his equipment. To ensure that the benchmark is done well he will assign a team of highly skilled staff to it. They will consume a large amount of computer time to set up the benchmark in a form suitable for their system, to carry out experimental runs and to make sure everything runs smoothly when the final run is done with the customer looking on. The manufacturer knows from bitter experience that the work will be doubled or quadrupled by lack of definition in the customer's requirement, by errors in the programs to be tested, by non standard dialects of the languages used, by difficulty in finding out what the results are *meant* to look like, and by the customer realizing halfway through that he is testing the wrong things anyway. The cost of a major exercise of this sort will be counted in tens of thousands of pounds. And all the time the manufacturer knows that his equipment is being compared with several others, and so the odds are against his getting the contract anyway.

Benchmarks

The amount of effort that manufacturers put into benchmarks gives rise to another concern: how fairly do they run the benchmarks? Do they cheat?

There should be no danger of any major computer manufacturer consciously cheating in a benchmark. The manufacturer has no more desire to sell you an inadequate system than you have to buy one. The customer may ask for the benchmark to be repeated at or after acceptance of the system and clearly the consequences to the manufacturer in terms of penalties and adverse publicity of not being able to repeat the benchmark test would be unacceptable. This having been said, it must be realised that even if you witness the benchmark run it is impossible to be completely sure that everything is above-board. For example with some computer ranges the power of the processor is enhanced by a simple upgrade to the existing equipment, and computers at benchmark centres are regularly upgraded or degraded to match the processor each is required to demonstrate without any external change being visible to the onlooker.

The manufacturer will obviously tune his system to run the benchmark to its best advantage. This is probably fair enough – the customer can tune the system as well, but it must be borne in mind that the system can probably be better tuned for a benchmark consisting of a few *well defined* programs than for a more *general* workload. The manufacturer may also try to optimize the placing of files on disc storage to reduce head movement and channel contention. This may be something the customer can achieve with large permanent databases, but he may find it more difficult with files that are constantly being replaced.

A far more real danger comes from the possibility of inadvertent errors • during the definition of the benchmark, • during its conversion to run on the target system • during the actual benchmarking process, or in the • analysis of the results. It is surprisingly easy to fail to notice that part of a complex benchmark has not produced the expected output, has terminated through external causes before completing all its work or has never started at all. And recently one major computer manufacturer found itself in the embarrassing situation of having to give a customer extra equipment free of charge to make the installed system work as well as errors in the manufacturer's program to analyse benchmark results had led the customer to believe it would.

Having gone to all this trouble, having calculated your requirements, set up and sized your benchmark, explained it all to the manufacturers and cursed them for wrong, incomplete and opaque results, what are you going to do with the figures so painfully obtained?

Many people start down this road with a vaguely defined goal of finding which computer is best. This is rarely apparent from the results of a benchmark. *Usually the only circumstance in which the results can be directly compared* is when the systems being measured appear essentially the same to the user. If you are considering trading in your trusty 1745 computer and buying a shiny new 1789, or of upgrading your present James II operating system to the faster James III, then the results may well give you an idea of how much more you could do on the new system. In these circumstances you may expect your future workload to be 'more of the same' and expect the way of handling the workload in terms of file and data base structure, record access mechanisms and operating system techniques to have the same characteristics and show the same limitations further up the scale.

But if you are comparing systems that have different user facilities and characteristics, then firstly you must expect your workload to be ill defined, as it will change to match the new facilities and ways of working and, secondly, you can expect great difficulty in making comparisons between the various benchmark results. Unless the computers being tested are grossly different in ability (which will almost certainly be known before the start of the exercise), then some will be better in some respects, some in others. Attempts to weight the various factors and arrive at some measure of goodness are nearly always purely subjective.

Thus the benchmark can usually only realistically be looked on as a test of capability, rather than as a contest or race between computers.

This article has concentrated on benchmarking batch workloads, that is those which are clearly defined at the input stage and essentially free of human interference while running. When we consider a time-sharing system with an interactive workload then all the previous complications remain and many new ones arise. I shall consider some of these in another article. ■

• *Alan Gay is Technical Manager at a university computer centre.*

DISTRIBUTED COMPUTING

The fundamental Von Neumann Computer is a sequential device For many batch commercial applications this is reasonably satisfactory but for many others eg process control and data communications it is not In the latter case some mechanism is required to support essentially parallel operations by controlled interleaving of resource utilisation This problem is exaggerated by the queuing problems created by the relatively low speed of peripheral devices and in some cases by the desire to process arrays of data Thus we are always looking for some means of implementing parallel or multiple processor systems

Let us look at the following simplified classification of digital computers (**S** stands for single **M** multiple **I** for instruction and **D** for data stream)

SISD	Order code processor + I/O processor (IBM 370 CDC 6600)
SIMD	Array processor (ILLIAC IV ICL DAP)
MISD	Pipelining (STAR 100)
MIMD	Distributed Data Processing

In each case multiple processors are employed concurrently in order to achieve the overall computer system

In SISD machines the function of each processor is clearly defined

In SIMD machines the objective is to execute the same instruction on multiple pieces of data

In MISD the objective is to achieve highest processor performance

With MIMD systems the function of each element is less rigorously defined and the potential is therefore greater flexibility

Why use distributed data processing (DDP)?

- (i) *Performance* High performance computers are used for two distinct reasons, first to process very large single jobs eg weather forecasting, and second, for cost-effective multi-programming of many smaller jobs The former leads to array processing etc while the latter leads to DDP
- (ii) *Modularity* System expansion can be bought on an "as required" basis in reasonably sized increments
- (iii) *Reliability* Failure of one element does not shut down the system Reliability and redundance are intricately linked
- (iv) *Geographic distribution* The users are not always on one site
- (v) *Cost* The massive price reductions in hardware are best incorporated as multiple simple units

An interesting method of classifying systems which employ multiple computing elements is whether they are *closely* or *loosely* coupled

Multi-Processor (Close Coupled) Systems effectively share a common address space,

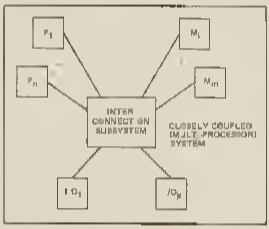

FIGURE 1

as shown in figure 1 Ideally any processor can access any memory module and use any I/O unit The fourth type of unit the interconnection sub system, is rather complex eg a BUS system or a crossbar matrix In all cases contention logic is complex Equally problematic is the software situation where ideally any piece of work will be given to any available unit Truly general purpose systems are still the subject of research projects but limited variants of the theme are common eg CDC 6600 with multiple I/O processors, 370 with order code and I/O processors coupled through a store access controller BUS structures have been successfully employed by DEC usually with one processor but multiple processors have been supported with BUS address mapping hardware Intel's BUS arbitration controller chip supports multi-processor sharing on the MULTIBUS as standard

Multi-Computer (loosely coupled) systems figure 2 comprise computer subsystems coupled via an I/O structure or possibly DMA Each machine may but need not have, a range of local peripherals The coupling mechanism may be local or remote If it is local the designer has far greater freedom if it is remote he is constrained by data communications problems – and the PTTs Multi-computer DDP systems rapidly become a mixture of computing and data communications with conflicting interests

As shown in figure 2 each computer is directly connected to every other computer, a truly distributed interconnection scheme Other topologies are more common, however For locally connected systems both ring and common BUS structures are being used Star connections are frowned upon because of the dependence on a central special purpose switching

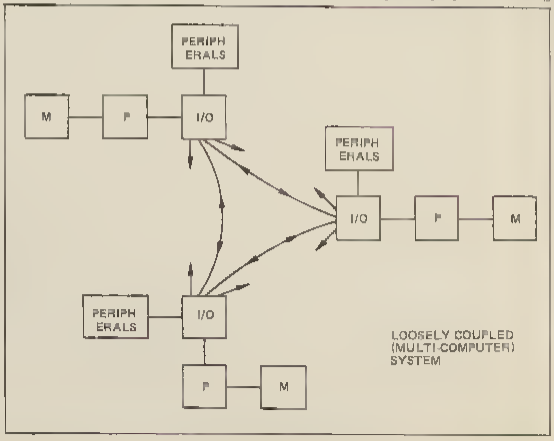

FIGURE 2

node. A compromise is to connect some machines onto one loop and others onto another and to interconnect the lobes at a common node. Dual rings are also important to compensate for possible accidental breakage of part of the loop.

For remote systems two commercial products dominate. IBM's SNA and DEC's DNA. SNA uses a star topology and depends on a central mainframe. DNA uses a general topology. In principle all possible interconnections need not exist but this requires an ability to store and forward messages not yet implemented in DECNET software. Of more importance however are the proposed public networks eg. X25. Thus while each machine requires network control software (obviously different between X25, DNA and SNA) the virtual interconnection of machines is managed by the network providing the "line" multiplexing. This weighs heavily against the star topology of SNA.

While networks of interconnected machines offer major advantages it must not be forgotten that communications costs are high. Thus much distributed processing is conducted on a simpler point-to-point basis. Most often this is a batch file transfer system, connected only for as long as it takes to transfer the data. The use of remote terminals is also common giving interactive access to a machine on another site. Batch mode interconnection by 2780/3780 emulation will continue for a long time yet.

In practice distributed processing is easily implemented distributed data is

Control Systems

another matter. It is relatively easy to run multiple small processors rather than time share one big one, but in many applications different processing jobs share common data files. With true networking the problem is reduced since this gives task-to-task rather than machine-to-machine communication. Thus a task on one machine can activate a task on another machine to read a data file and transmit a message. Thus true networking is an essential prerequisite for distributed databases. This is a problem for simple "personal computers since multi-tasking software is required to support concurrent application and communication activity.

The management of distributed systems particularly control of people is potentially a bigger problem than the technical one. Who will be responsible for standards, will programmers be centralised or distributed, can staff be retrained and redeployed, can a new management structure be satisfactorily arranged?

In summary today distributed processing is largely concentrated on remote intelligent and batch terminals to central mainframes often on a dial up batch basis. This involves very loose connection of small business computers like the System 34/38 and the equally competitive minis eg. DEC RSTS/E, HP 3000, Texas Instruments DX10. The mini is in fact more versatile than specialist products like the 3790 and this fact has enabled DEC to move ahead of the field with proper networks with DECNET. Whether we will see easy interconnection of DECNET, SNA via say X25 is scope for conjecture. Xerox's Ethernet is an example of a current concept in in-house terminal networks based on a BUS, while in the UK there is interest in the Cambridge ring architecture (see *Using A Digital Ring* by M. N. A. Lee Issue 4 **Editor**).

Tomorrow the impact of low cost LSI components will be felt very forcefully. Machines of the power of the 3790 will cost $20 000 fully configured. With low cost memory to back low-cost processors there will be an increase in multiple terminal/processor/local store machines interconnected. It makes little sense to time share a $10 processor! Complex operating systems will be traded for multiple hardware units.

The importance of in-house network schemes will increase in parallel with the growth of office automation. The integration of office data processing and industrial control will put bigger demands on cheaper, flexible and reliable communications. It will also put new demands on database technology, both in hardware (in vast increases in volume) and in storage/access techniques (since data processing uses essentially ordered data while office automation uses text data which is very unordered!). It will also require flexible interconnection of in-house and public networks if distributed data bases are to flourish. ■

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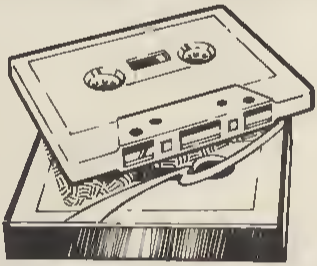

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BUBBLE MEMORIES

Bubble memories are only just beginning to come onto the market in volume quantities but are still too expensive for widespread commercial use

A bubble memory is a non volatile solid state data storage device which technologically poses a threat to traditional moving magnetic media such as tape or disk.

But it has a long way to go on a cost per bit basis before it will replace even its nearest rival – the floppy disk

Nevertheless, prices are dropping and the market for bubble memories is developing way beyond floppy-disk replacements in the military and telecommunications industries

A bubble memory has no moving parts and can therefore stand up to tough military conditions and hold data more reliably

The technology was first invented by scientists at Bell Laboratories in 1967 The bubbles themselves are magnetised domains in a thin film of material of an opposite polarity and are formed by applying a magnetic field perpendicular to the magnetised film

The presence or absence of such a domain constitutes a binary digit These domains are organised into loops and moved in similar fashion to a processor shift register to be read off as data Random access is facilitated by the use of minor and major loops

Plessey was the only British company that attempted to compete with the Americans in the fabrication of the devices

Plessey first started development work on the technology some seven years ago, after Bell Laboratories announced the invention to the world at large The company then accumulated all the published technical papers it could lay its hands on

At that time Plessey decided it could successfully make a 16 Kbit serial device The company configured a printed circuit card which was used by a small number of people who had the technical expertise and market potential to look at the technology

Last year Plessey decided to pull out of device manufacture and to concentrate on making board level [illegible] This was more in the line of a tactical manoeuvre than a withdrawal Earlier that year it had also scrapped its plan to develop holographic memory technology

Ian Chapple manager of memory products at Plessey Microsystems said 'We were really shipping our systems at very much less than they actually cost to impress upon our customers that we were already far ahead and that we understood what bubbles were all about.'

Plessey then produced a 64 Kbit serial device and configures two systems one large system for its own in house use and another for Intel Multibus systems The company has been quite open with its customers about the fact that these systems are being phased out

Chapple said 'Having got to this point we decided in our product planning about one year ago to look ahead to determine what the cost of going into world competition would be'

The conclusion was that it would cost too much and that the company should concentrate on systems level manufacture and buy in the devices from Rockwell

The first card configured with the Rockwell devices is systems compatible with those using Plessey's own devices, but has significant speed and capacity advantages

'The rest of the world had now moved on from where we were when we decided to stop development of our own device, Chapple added 'We decided we wanted to be up front in systems design and that meant using the most marketable device Rockwell is talking positively about being able to feed the military market, which is a substantial part of our forward business' he said. 'I do not think we will ever see the cost of doing all the development and other work but the positive thing as far as I am concerned is that it has given us a strong lead in Europe in our ability to configure bubble memory systems

Plessey is now producing a very large bubble memory system, the PBS 90M for the military market a mid-range system for the Post Office's (British Telecom) System X digital telecommunications network, resulting from Plessey's ability to develop Intel-compatible systems, and a small-scale program loader

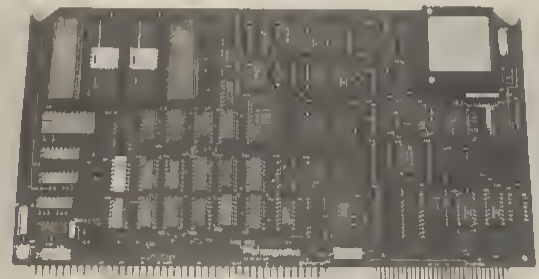
Without its own in house manufacturing facility the company is now obviously tied to the merchant market for devices But it has talked to all the major device manufacturers and is aware of all their strengths and weaknesses

'The only other manufacture I know which has any second sourcing is National Semiconductor which has recently announced such an agreement with a French company called Sagem. Chapple said

'If we talk to people like the Ministry of Defence (MoD) and they think they are going to be tied to one manufacturer, they get worried The same is true of the Post Office or any other large user' he said

The only question in everybody's mind is when bubble memory prices will be low enough to allow them to compete in the commercial marketplace

We would then be able to offer bubble



*[illegible] 12*8 byte nonvolatile one megabit bubble memory [illegible] memory module, an 80B/A based controller and standard components. The [illegible] board is designed to interface with MULTIBUS™ systems and plugs into any Intellec® Series II Microcomputer Development System*

memory systems which would be cheaper in the military marketplace than any other alternative We see a substantial future in the military market where we have more than a headstart Chapple said

Plessey

Plessey now markets only one bubble memory board commercially – the PBM 80M which is based on Rockwell 256 Kbit devices and currently sells for £3 000

A controller is also available for £500 to which up to eight boards may be connected

Bubble-Tec

Bubble-Tec memory systems are based on Texas Instruments 92 Kbit chip and are compatible with Intel Multibus and Digital Equipment (DEC) LSI11 microcomputer systems

Sintrom Electronics is the UK distributor for Bubble-Tec and sells the boards for £1 250 and £1 000 respectively

The Intel Multibus board is compatible with 8 bit and 16-bit Intel microcomputers and provides 92 Kbytes of storage complete with control logic and page buffering The board can be removed from one machine and plugged into another without disturbing the data

Included in the price of the LSI11 board is a separate Z80-based controller board which emulates the commands of DEC's RX01 floppy disk software and can control up to 15 additional 40 Kbyte Bubble-Tec boards at £615 each The boards are interconnected by ribbon cables and plugged directly into the bus or installed in an external chassis

According to Sintrom the performance of bubble memory is no better than floppy disks because although it offers faster *access* it has slower *transfer* speeds

The company says that until the prices of bubble memory drop the technology has the edge over floppy disk storage only in harsh process-control environments and where the reliability of storage is critical

Hitachi

Hitachi is currently marketing its 64 Kbit bubble memory in Japan only and is just beginning to sample 256 Kbit devices there

These devices are being used in telecommunications switching centre applications and other disk replacement applications for terminal equipment

The company will begin sampling a one megabit device (i e bubble memory chip and package) in the second half of 1981 Hitachi will launch a 128 Kbit card later this year in the UK that contains two 64 Kbit devices Thus will be followed by a one megabit card Volume UK shipments are expected early in 1981

Texas

Texas Instruments bubble memory products fall into two main families based on its 92 Kbit and its half and one megabit devices

According to the company's most recent estimates, it has shipped about 100,000 of its 92 Kbit devices worldwide The device sells for £110 in sample quantities and £88 for 100-off

Texas also offers a transistor-transistor logic (ttl) compatible interfacing kit of seven devices complete with bubble, coil and function drivers and sense amplifier and also a similar control kit for users designing their own printed circuit boards costing £125 and £36 respectively

The half and one megabit devices cost £800 and £1 500 respectively and additional interface and control kits cost £70 and £190 Complete evaluation boards including interface and control devices within a single Eurocard format are available for £1 450 and £2,100 respectively

Evaluation boards are also available containing two four or six 92 Kbit devices with prices from £760 to £1 490

Texas claims to have been the first company to go into commercial production with the bubble memory which was designed into its Model 765 portable data terminal

Rockwell

Rockwell has now been involved in bubble memory technology since 1974 when it developed a single chip device with a capacity of 102 Kbits for NASA (The National Aeronautics and Space Administration of the USA)

The company's biggest UK customer is Plessey (see above) Pelco Electronics is Rockwell's sole UK-distributor for microelectronics devices

The basic device is a 256 Kbit chip the RBM 256 four of which go on a card to make up a one megabit 'linear module' memory device

This card will fit onto Rockwell's AIM65 microcomputer or on Motorola's Exorciser development system which uses the same backplane The card costs £1 750 one off but a £700 control module is also needed to which up to 16 cards – two megabytes in total – may be connected

Pelco claims to have sold about one dozen bubble memory systems to the military but the computer market in general has been slow to latch on to bubble memory technology according to Gordon Dale-Smith, its managing director

A single-device card is also available complete with control circuitry, for £1 260 It is connected to the AIM65 via an expansion motherboard which costs £136 50 The same card with two 256 Kbit devices costs £1 470

Dale Smith said It is early days yet for bubble memory technology but the main object of the present system is to provide people with the experience to get to grips with the technology for things like file organisation.

Rockwell will begin sampling a one megabit device towards the end of this year which is pin compatible with its current 256 Kbit device and uses identical technology and packaging The US military market already has samples of the device

Rockwell has second sourcing agreements with Motorola Burroughs and more recently Siemens Motorola's 256 Kbit copy should come onto the market early next year

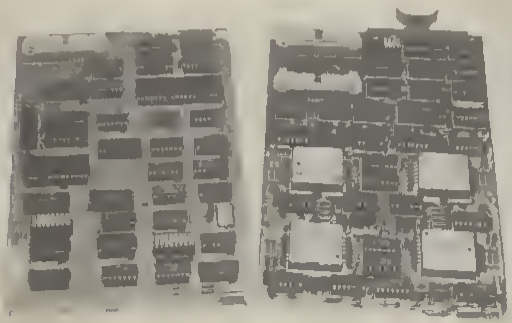
National

National Semiconductor has begun sampling a 256 Kbit device using a technology described as dual block replicate architecture

The chip is organised into even and odd loops of 1 Kbit loaded through swap gates and read via replicate gates at opposite ends of the storage loops

The device sells for £250 in sample quantities and for £190 for quantities of 100 or more

A card containing a single device sells for £600 and another which can hold four



Bubble boards for Intel & DEC LSI 11

additional devices up to one megabit sells for £1 200

National is also developing a family of support chips for the device which the company claims will provide a complete subsystem solution with only five integrated circuits including a controller a function driver a coil driver and a sense amplifier all within a printed circuit board measuring nine square inches in area

Products

The controller accepts commands and data over National's own Microbus interface

According to Geoff Pepplette National's European marketing manager for memories, the cost of the 256 Kbit device should drop to £70 in quantities of 5 000 or more when volume shipments begin next year

In the same quantities a one megabit device will cost £200, a 256 Kbit board £350 and a one megabit board £450 The controller chip will cost £18 and the other supportint chips £10

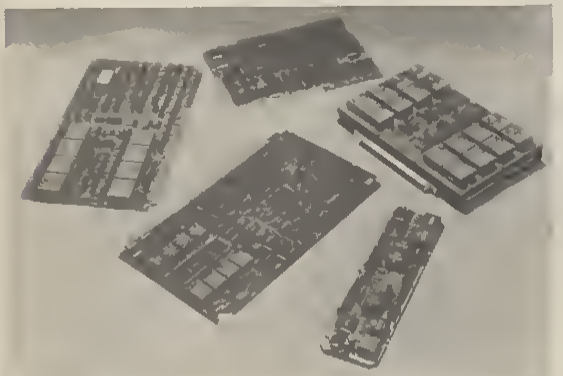
Intel

Intel set up a subsidiary in October 1977 to develop bubble memories which last year brought out a one megabit bubble device onto the market

The company offers two types of bubble memory development boards and one type of original equipment manufacture (oem) board all based on a single device per board

The two development boards, the IBM100 for use with Intel single board computers and the IBM101 for use with Intel development systems sell for £2 588 and £3 115 respectively Both utilise a single 7110 one megabit bubble device, an 8085-based controller and standard components

The oem board, called the ISBC250 sells for £2 415 in sample quantities and £1,443 for 100-off Software is provided on diskettes to enable Intellec development system users to transfer data to and from bubble memory Source code in Intel's PL/M assembly language is supplied on each diskette for board driver routines ■



Sixteen 1 Bit Bubble Memory boards with one 1 Mbit device per board from Rockwell

Boris Sedacca is deputy features editor of the trade fortnightly Computing

The VDU Scene

Scanned from the Sidelines

Lately a journalist from a computing publication mentioned he did not know anything about computers and did not want to know. For the likes of us who try to avoid conversations on rorns and rams, there is no escaping the visual display unit (vdu). This is an attempt to dissect the vdu, the window of the computer and put it into focus for those who are already, or soon will be, sitting in front of one.

A television set or space invader' screen could be called a vdu but the phrase is more often understood as an alphanumeric display and keyboard with related electronic circuits working, as a mouthpiece (with letters and numbers on a screen) between the operator and the computing process. It is alphanumerics which fed to the vdu invasion of business. Graphics and colour are added attractions and have opened up areas for computing in engineering, medicine education and entertainment.

Cathode ray hey-day

Although comparatively bulky, the cathode ray tube is still the main feature of a visual display terminal because of the complexity and variation of the picture it can produce. Over the hundred-year history of the crt, the earliest use came from oscilloscopes. In the Second World War there was the development of radar followed by peacetime television. The last fifteen years has seen the vdu take-off, perhaps launching the crt into its hey-day. Other techniques are aiming to take over by providing a flat screen to hang on a wall like a picture. The concept of a 10cm thick, 127cm diagonal screen has been proposed, but this is still not a complete break from crt technology and manufacture is not expected to start until 1990. Recently a miniature crt was announced, with a one-inch screen that clips onto the side of a helicopter pilot's helmet. Mirrors produce the aircrew's image of the target.

The crt principle is based on an evacuated glass tube, where a stream of electrons is generated at one end and fluorescent spots of light at the other. A heated cathode, the electron gun, produces the beam which is focused and directed by electrostatics or electromagnetics onto the phosphor-coated screen.

Confusingly, the phosphor is usually a crystalline compound of sulphides or fluorides. Electrons striking particles of one of the many types of phosphor (eg P1, P20) cause flourescence or phosphorescence. Which type of phosphor to use depends on the effect required, but the film of phosphor covering the screen must be uniform as the size and spacing of the particles effects colour, the decay rate or persistence' of the fluorescence and the efficiency of the light being emitted. The efficiency of the phosphor in converting the electron beam energy into light is rarely more than 20%. Heat is generated and most vdu's have a fan.

When the phosphor dots lose their excitation energy, the characters on the screen lose their stability and start flickering. The electron beam 'refreshes' the phosphor to remain excited. Refresh rate is about 50 times a second for interactive work such as editing or correcting text. For showing graphical displays, storage crt's have some advantages. They retain the image without continuous regeneration but need more energy than the refresh type and the display is less bright. To overcome having to wipe out the whole storage tube picture if only part of it has to be changed, extra software allows for particular areas of the screen to be erased. In the case of preparing the layout of a printed page this technique takes over from glue, scissors and sticky pieces of paper.

The *persistence time* for a particular phosphor is how long it takes for the luminous intensity to drop to 37% of its initial value. For short persistence phosphors this period is less than one millisecond, for medium it is less than two seconds and for long persistence phosphors the time can be several minutes. Both television and vdu screens use short to medium.

As the electrons have to travel further to one part of the screen than to another, not all the characters will be in focus. A horizontal line would appear as an arc if no circuits corrected it. Distortion is worse in the shorter tubes having a deflection angle of 110° compared to 90°.

Character building

Writing characters on the phosphor by an electron beam must be methodical. The controlling circuits sweep the beam in regular 'scan' lines either vertically or horizontally to build up the page on the screen. The phosphor particles are excited leading to fluorescence by varying the energy of the beam as it passes. Quality or resolution of the vdu page is effected by the number of scan lines. In the USA 525 lines is the standard while in Europe it is 600. There is a problem in sacrificing refresh rate for resolution though this can be eased either by scanning alternate lines or by the beam jumping from one block of characters to the next.

The dot matrix method of forming char-

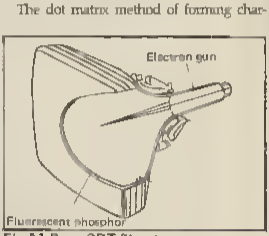


Fig A1 Basic CRT Structure

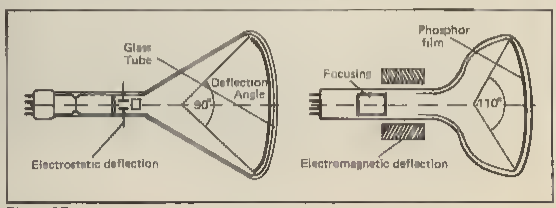


Figure A2

acters on the screen is the most common for processing text. Dots make up the character shape and the positions of each dot are kept in a memory. When a key is pressed the dot positions are retrieved from the memory and this information controls the intensity of the electron beam.

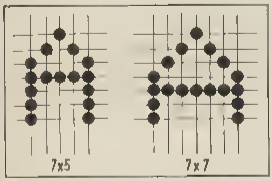


Fig 8 Dot Matrix Character Build-up

As part of a system a terminal's role is to enter data or commands for processing and then to retrieve, inspect and edit both the input and output before and after computing. It is fast and accurate and can handle impressive quantities of information. Semiconductor technology has reduced the cost of storing data at the terminal by expanding the memory. Most modern vdus are labelled as 'intelligent' being no longer totally dependent on a main computer for processing.

They have grown into microcomputers but if the data storage of the terminal cannot cope with the size of a problem the main computer will be brought in on-line. When working off-line independently an average vdu might have a storage capacity of

Visual Display Units

between 1000 and 10 000 characters of text. Cassettes, paper and magnetic tape, punched cards and floppy discs extend memory and processing power.

On line over long distance communication between computer and vdu terminal is by telephone line. The information is passed at about 500 characters per second and usually it is sent only in one direction at a time. This is called the half duplex mode while in the duplex mode data travels in both directions simultaneously.

New vdus with greater capacities are frequently being launched. Recently, multi-lingual systems for Arabic, Chinese and Russian text have appeared on the market. Arabic letters change shape according to their position in the word and are written from right to left. Now a vdu automatically alters Arabic characters into their correct forms and positions them for left to right or right to left addressing.

Viewdata software extends a colour television to connect through a processor to a mainframe computer and operate as an interactive vdu with graphics and in colour. Graphics has been said to be the most rapidly growing area of the computer field. It has been predicted there will be a hundred fold increase of computer graphics by the end of the 1990s and this implies a parallel boom in numbers of terminals. In the USA a generation is growing up with personal computers. These teenagers are apparently more interested in graphics and interactions in manipulating diagrams than in the memory potential of the computer.

Systems for handicapped people should aid certain individual problems. Christopher Nolan is a 14 year old Dubliner who cannot speak or hardly control his movements but he has a great talent for writing. In his case instead of using a keyboard at a terminal to write cheek and knee switches have been developed for inputting his words. Helping in other ways household appliances like lighting or the radio could be controlled at a vdu. The next step is input by eye movement. ●

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● *James Pembrey is a journalist with the magazine* **Displays** *published by IPC. His second article will deal with the health hazards of VDUs.*

THAT FIRST COMPUTER

Stop and Think

John Maclean attended Strathclyde University and graduated in Mathematics from Lancaster University. He spent [illegible] years in the aerospace industry [illegible] in programming and project [illegible] in mathematical and computer aspects of Personnel Psychometrics.

He joined NCC at the beginning of 1978 as a Senior Consultant in the Courses and Advisory Services Department and has been involved in a number of short advisory assignments, particularly for first time users.

That technology has progressed at a bewildering speed over the last few years is undeniable and can only be marvelled at. But for those who are considering acquiring the results of the technology, the wonder can turn to dismay and sheer frustration. There is no area in which this applies more than computers. One is now confronted with an amazing range of new, cheaper computer systems right down to the very small desk top computer no larger than a domestic T.V. which can cost around £600.

This has produced a situation where the computer is within reach of just about every conceivable organisation.

Unfortunately although the costs have fallen the potential problems have *not* disappeared. The arcane ambience around very large computers still surrounds the very small ones the same baffling jargon applies above all the consequences of computer disasters are still there, and, to be realistic their effect on the small organisation can be much more profound than on the large company. In this and the subsequent articles the way to approach acquiring one's first computer system will be discussed. Initially the emphasis is on preparation and groundwork, the all too often omitted stages which entail gaining an appreciation of computers and then applying that to one's own organisation by examining the feasibility of computers. Depending on the outcome and whether it is decided to acquire a computer then the problems associated with actually selecting the system have to be faced i.e. which systems and suppliers should be considered, how should they be approached, how does one assess the computing systems? Finally having made a selection the onerous task of actually implementing one's first system has to be faced, what is involved, who is responsible for what, what should the contract cover?

There is of course an alternative to proceeding in this way and that is by being lucky. The lucky method involves keeping one's fingers crossed, the careful way means approaching computers in a rational and planned manner – easier said than done.

There are few guidelines that can be given to those taking the lucky way, apart from saying All the best. We shall concentrate on the careful method.

When confronted with the baffling choice of available computers and attacked by the accompanying armies of salesmen the one straightforward idea of getting a computer can start to be a little daunting. Throughout the process of moving from simply thinking about a computer to actually operating one, there are many questions that will need answering on the way, questions such as:

- What sort of computer system will I need?
- Do I really need a computer?
- Will floppy disks be sufficient or will hard disks be necessary?
- What is a 'floppy' disk?
- What will be the cost of the computer to buy and to run?
- What jobs could a computer do for me? And so on and so on.

To answer these, and the many other questions that will arise one needs to arm oneself with at least a basic knowledge of modern computers. The value of a basic appreciation cannot be underestimated. In depth knowledge is not necessarily required but one will at least need to understand what they are, and how and where they fit into an organisation.

It is surprising just how many organisations acquire a computer system without really appreciating what it is they have bought. Consequently, until it is too late, it is impossible to know whether it is the right computer for the right jobs, whether it is too big or more importantly, whether it is *too small*. To be realistic one never recruits a new member of staff without some basic groundwork. You find out as much about him as possible, assess his capabilities and relate them to the position in question. Similarly, a computer should not be recruited without the same basic attention to detail. (What is more a computer can be more expensive to buy and run than a member of staff is to employ.)

Having armed oneself with this knowledge one should then attempt to investigate the feasibility of using a computer in one's organisation. Many people say quite confidently, that they need a computer to solve this problem or to help them with that bottleneck. But it is doubtful if they can say exactly why a computer is the only solution or what sort of computer system they need or even what the total cost will be.

Therefore it is essential that one determines whether a computer system is worthwhile financially. We can any benefits be quantified, what they are in relation to the cost. Also whether a computer can fit into one's organisation and how, and of course exactly what type of computer system should be considered.

A study of this type be it formal or informal would normally commence with identifying the long term objectives that you would wish to achieve. Rather than just say, I want a computer for stock control, you should aim to be more precise about your aims such as reduce stockholdings by 20% or improve customer service and get a 2 day delivery lead time. These objectives would then indicate those areas of your organisation that will be affected and therefore should be involved in the work. In the case of improving customer service the relevant areas may be sales order processing,

stock control department

Having identified those areas they should each be investigated in turn to ascertain the volumes of data involved the flow of information into and out of each one the procedures used and their simplicity/complexity This process should identify any problem areas and also indicate whether a computer is a possible course of action overall This will be suggested if some of the following criteria are satisfied

- large volumes of input/output data
- repetitive processing
- logical complexity of processing
- need to search access process large files
- relatively large numbers of clerical staff
- need for better management information.

A computer may however be only one of a number of possible alternatives and each one should be identified Each should then be assessed in terms of all the identifiable costs involved and the potential benefits some of which will obviously defy quantifying such as an improved working environment

With a computer system the volumes of data and transactions together with the nature of the required solution – e g is instant access required to stored data? – will enable a particular configuration of computer system to be identified in terms of the physical hardware elements and software necessary for the defined tasks With reference to known costs of similar

Series

systems it should then be possible to assess a range of likely acquisition costs However one should also note that the cost of a computer system does not end with acquisition There will be significant continuing costs which must be accounted for when considering the overall cost of ownership over a period of say five years Thus the following cost elements should be assessed

- **Acquisition Costs** –
  all hardware all software (applications and systems) training delivery and implementation
- **Recurring Costs** –
  annual maintenance insurance extra personnel stationery etc

With the full cost picture of a computer system it should be possible to assess this option vis à vis the alternatives such as increasing staffing levels To complete the picture one should take account of any organisational and personnel implications of acquiring a computer For example, are one s staff capable of working within the discipline and control required by computers? There is no truer saying with computers than garbage in garbage out Thus one must be sure that one s staff will not provide the computer with garbage Also will the impact of a computer system on staff and the organisation as a whole call into question the wisdom of doing it?

All these implications should be carefully assessed before finally making one s decision to either acquire or not acquire a computer system

If the decision is for a computer the above work will have generated much information needed in the following stages of approaching suppliers You should now be in a position to say

- a What is the nature of the system required
- b What tasks it should undertake e g ledgers stock control
- c What will be the costs of acquiring and running the system
- d What other effects need allowing for e g personnel

You should now be in a position to approach suppliers confidently the next stage ■

North Star Horizon at Volvo Concessionaires

While the Americans are still smarting from the impact of the Japanese computer industry, there are signs that in respect of big companies using micros, the tables are turning. Many UK data processing departments enlightened by years of experience with mainframes already put micros and minicomputers right on the heels of mainframes and staff. Here is a mainframe man using micros in his department. Volvo Concessionaires. The discussion took place between Peter Radmall of Volvo Retail Information Systems and the Editor.

R The system configuration consists of a North Star Horizon Computer with 48K bytes two disc drives Hazeltine VDU, and Teletype 43 printer The units were chosen because we felt them to be extremely reliable, and they have proved to be so in practice The system has been operating since September 1979 Since January 1st of this year it has been in constant use producing daily reports and other items During that entire time we've had two hardware problems And they were trivial One was a deficient board, which was replaced under warranty and a rubber band fell off a disc drive – we hooked it back on again with a wire coat hanger

S What's the total capacity of the disc drive?

J One third of a megabyte

S Who selected the configuration?

R The decision was ours in terms of the equipment used based on a personal recommendation A friend of our department manager's recommended the Horizon

S Can you give us a quick run-down on what the system does for you?

R. The most important application at the moment is the daily flow of cars so called a cash control document produced daily It is used as a key management document and is circulated daily

It shows us the stock levels of cars and their various movements Obviously there's a lot of money tied up in stock in the car industry and it's vital that we know where it's all going It's very important to control all this and match it against targets The program written to our specification does that more than adequately We can input the daily movements of cars from one stock category to another and it is very versatile in terms of amending details We often make decisions based on yesterday's figures for instance and then, perhaps a week or even a month hence wish to correct them

S Do you consider it a management tool?

R Insomuch as information of this nature is the key to our business definitely You *could* produce the information by hand we did that for many years The enormous difference now is in the accuracy of the reporting the clarity of production and the saving of clerical time and effort It's a vast improvement

S Can you give us a run through?

R Yes We have a program selection menu here first a new year routine for creating a new model then a new month routine the system produces two reports a monthly and a daily report At the beginning of the month you put in your operational forecasts and targets for the month Then the daily routine which is the everyday inputting of figures Then we have a 'print a daily' report The print end of month report is what it says and the most powerful part of it is the amend function There are about seven programs here you choose the one you want when you're prompted When you input your requirements, the screen asks you to confirm that's what you want before accepting the input The way the screen is laid out – the screen formatting is such that you can very easily change any figure on the screen and you can move the cursor to any position on it If the screen expects numbers to be input and if you input anything else the system bleeps a warning at you

S Say that ten minutes later you find you've made a mistake What do you do?

R We set things up and go back to amend daily details option six That particular program is loaded – we go to the line where the mistake was made the file is searched, then we have to confirm a valid new input after which it is written back to the file And similar things can be done for the other programs such as monthly details A set of targets and a set of headings are stored, so that we are free to add comments and messages to the reports produced The system always asks you to confirm if you've finished with a particular program before returning you to the main menu

J What I think is most important to a sophisticated user is not to use a basic approach where the display scrolls upwards and you're always in the bottom left hand corner here we use the formatted screen which is a layout concept that also avoids errors and which results in the screen looking like that of a mainframe In fact the Horizon with its VDU is standing right next to an ICL 7500 which is a VDU terminal to Volvo Concessionaires large ICL mainframe And one may ask, why have a Horizon at all when you've got a mainframe in the house?

S You took the words right out of my mouth

R The two systems are put to entirely different uses For instance take the daily report I have just been discussing It is

AN ALL-TIME SALES RECORD

Clean [illegible] provided by the new [illegible] at Volvo [illegible] Ind[illegible]

(This [illegible] and [illegible] the [illegible] and [illegible])

Registrations [illegible] in the UK in August 1979 [illegible]. This was 13.3% above the 71,711 units registered in all time record for this month. Volvo's market share of 1.3% was [illegible] and [illegible].

In August the [illegible] Rover and Granada [illegible] the 3 series increased registrations [illegible].

As a franchise Volvo at the end of August are 3% above 1979 despite the difficult market conditions

Commenting on the result Dr James Maxmin said "The success of Volvo is a testimony to the hard work and commitment of everyone in the Volvo world wide franchise including the Volvo UK component suppliers. The reliability and durability of our products make them particularly attractive to those people who want to keep their cars longer. This is all reflected in the high resale value of the Volvo

User Study

arguably one day ahead of everything else You may say that s trivial but it can involve an awful lot of money in this business The mainframe is slightly slower simply because it handles such an enormous amount of detail It takes time to process all that especially in batch processing overnight there are always delays in punching input, and so on Which means we can get a total picture on this program a day in advance, because – in general – for a day's processing of say, cars landing in the country somebody can count them on the boat and I can produce a report on the Horizon on the following day The main computer will only find out about it a day perhaps two days later – after all the details have waited their turn to be punched in It s not exactly going into competition with the ICL but it s a different though complementary application Take forecasting, which most people would do using a terminal connected to a timesharing bureau we can do a lot of that on this machine, which makes it very cheap We have a program for that.

We ve not hesitated to make some of our own changes to the supplied programs We also have some programs which deal with forecasting Here we wish to look in bulk at the cars we are ordering: if we ordered these many, sold that many and our dealers held this amount of stock, what would be the result? We can also feed in actual information derived from the ICL mainframe and then our forecasts and various rule-of-thumb operations – a lot of exercises which previously we couldn t do

S You re happy with the results

R Very pleased indeed Overall, we re very aware that in the last year in this department we ve made a quantum jump in the accuracy of the information, the degree of control that we have over the movement of cars

S In other words, you ve saved yourself money

R That s really what it comes down to – saving costs on stocks and providing a better service for the customer Obviously if we know where a car is when it can be supplied then we can be more accurate in quoting delivery times

S Are all these details also available on the mainframe?

R Not necessarily in the same format; the advantage of the mainframe is that it can process an enormous amount of detail

S I was thinking about this isolation of a particular department just because it has it's own micro its isolation from the data processing department

R I d say there s a clear distinction between the uses Other departments here are using terminals on a timesharing basis and nobody raises an eyebrow we happen to be using a micro here The main reason for getting the Horizon was the daily flow of cars which is giving us information – in broad terms – a picture of the business daily – about a day in advance of the mainframe, for reasons I gave earlier The mainframe processes that information in greater detail

Take this program here we can work out how many cars we ve got The factory in Sweden will be closing down for the summer holiday shortly We know how many cars will be coming from the factory how many in transit how many we have at our import centre how many the dealers have We can do a whole lot of exercises on where best to deploy the remaining cars and match them to customer requirements notably as we run up to the first of August when we have the new 'W' registrations

And this program deals with matrices One dimension is makes of cars the other the colours of cars We tend to treat them in bulk, whereas the mainframe details every car For forecasting the quantities required we don t go into the details of an individual car The matrices are manipulated by the program and we can do things like multiplying the quantity of cars of a certain colour We can add up a lot of matrices using quantities from the main computer and compare these with our own estimates for a particular month

With the same amount of management time and effort we can present three or four alternative scenarios and projections, can cover our options, and so on In the past everybody would be running round in circles just trying to make things work in the first place

'Just try adding thirty matrices by hand, for a start'

S Has it made your work easier?

R I wouldn t say that We work just as hard but the quality of work is greatly enhanced We have more knowledge of how the business is doing it s more accurate knowledge and we can respond faster and more flexibly

S With regard to discs I have come across the complaint that small discs mean data that has to be spread out over two or three or more Do you find this a drawback?

R We have never produced anything that uses more than one data disc so we are not pulling them in and out of drives all the time We just stick two discs in the machine program and data – and let it go In terms of "how long – for the matrix program, the machine could quite happily sit calculating for an hour at a time But we see this in an unethical way It's light years ahead of what we were used to previously Just try adding thirty matrices by hand for a start And then try to get all the errors out at the end Very often we will set the Horizon to do something then go away and do something else We can live with that.

S Have you found that you re using it for things you d never thought you d use it for?

R Yes

S For instance?

R It s remarkable As I said we've shamelessly chopped the programs around for instance to produce a physical flow of cars report.

S Who did that?

R Duncan Bell our supply planning manager In fact none of us had any previous experience with micros

S What s the attitude of the Data Processing department to all this?

R I doubt if they ve even got a corporate attitude towards this machine The present DP manager, Keith Hutchinson, was previously the distribution manager so he s well aware of the situation here – he was actually in this department when the machine was bought I can't see any particular antagonism, if that s what you're plumbing for

S I remember you telling me the last time I was here that having the micro in your department was the product of a very enlightened policy from the top

R You can see that we have this machine, bought – I wouldn't say as an act of faith, but – certainly as the result of wanting to try a new technology instead of saying that things could be done the usual, other way And the attitude is of justifying the machine if it can do one job well and we gain experience by it For the expense of about £4,000 it has done a lot for this department, and not just because of what it is used for Even if it had failed miserably it would have been very worthwhile for the experience

J You previously mentioned that some people felt it a great nuisance to keep changing discs My answer to that is that they must have bought the wrong system initially They should have had sized up the capacity needed for the applications they had in mind

S Would they do that themselves or get a consultant to do it for them? Because it s quite a difficult thing to do

J Either a consultant or the supplier should supply them with the right hardware – provided he knows their requirements

S That means that they've got to themselves have a clear idea of what they want

J Well I think the reason why the applications have been so successful here is that the customer has had some experience of computing and knew the value of a good specification Most of the people here have in the past had to supply a specification to their own data processing department That is why there is a great similarity between what they asked for from a systems house and what they received finally And it also saves about twenty percent of the cost This saving comes from having that initial specific understanding of what you want from the computer

S Any problems?

R The ones we had were trivial And as the backup was very good, these were cured swiftly

And here s another program, which in itself cost justifies the machine The basic set-up is, Volvo divide the

country up into five geographically distinct districts that have different requirements in terms of the sales mix – that is, in terms of the variants and colour of cars We find for example, that people in the London area use more automatic transmission cars At a moment in time, we are committed to a certain number of cars, worked out months ahead with the aid of the software I mentioned earlier and these cars are arriving in a certain month We then wish to split that month's supply of cars five ways in such a way as to match the sales targets of the districts and to come as close as possible to the requirements of each district for the different types of cars which is a sort of a square peg in a round hole problem Invariably there's no exact match We devised an algorithm which makes sure that discrepancies are fairly spread over the five districts

It used to be done manually by rule of thumb and used to take the best part of six man-days to do the calculation – and then we received heavy flak, usually well-directed how come all my cars this month are red? And so on

But now the difference is remarkable it's down to two man-days We put in numbers the machine comes up with recommendations which we modify and match up to various operational requirements We're trying further distribution now or maybe now we've got the machine it gives us more time to sit back and think of better excuses as to why they have not got the cars'

S You seem to have the advantage of having some computer experience already I recall you telling me that you did FORTRAN at college But there will often be inexperienced people in other companies holding posts similar to yours Do you have any advice for them?

R We *do* have people here who've had no experience but have acquired it here and are now quite happy sitting in front of the machine and attempting their own programs

User Study

Take Richard Kidd there the ordering manager He's total absolutely no programming experience with computers at all but is the heaviest user of the matrix handling program as he's the one who orders from Sweden He himself has made various modifications that weren't originally specified and has done so very successfully In fact he's working on further developments on it

S So he's pretty happy

R I would say that it's come to the point where often people put in extra hours after work – almost as a diversion I do that quite a lot myself After a day spent running round in circles it's a stimulating challenge to sit down and write a few small programs ourselves

S Did you advise this department to go straight over to the system or keep their old manual system running in parallel?

J They kept to the old system for a short while First, not only in case the machine makes a mistake which is very likely in the first month or so, but second also because it builds up the user's confidence when he sees that the machine is producing the same results correctly – and much much faster You're getting, to be too happy with the machine if you don't see *confirmation* of its effectiveness there'll always be a question mark over it otherwise

R Now here's another program written in house It's a complete breakdown of the car models in a given district They've requested certain percentage splits of the different kinds of cars Having produced that there are two ways of looking at it One way is by looking at the broad picture then taking parts and sub parts of the picture in more and more detail Or else you can build the picture up the other way The program was written by our graduate trainee Clive Ellings who had no more than three or four hours messing around with BASIC at college We can print out the form containing the information circularise it to district managers then get it back and work out what it means nationally This used to involve a lot of sweating over calculators It was a program I'd been intending to do for a long time but I was too busy Then one afternoon, Clive was stuck for something to do – so I suggested he sit in front of the Horizon and try his hand He went away and did True it took him more than an afternoon but it shows what can be done by somebody who begins with minimal experience but who has a mind to he can use to gain the experience to write a program that is reasonably complex

S There are some people in the world of big systems – some only who are very worried because it's taken the mainframe world some twenty years to get anywhere and they are saying that in the micro world all these mistakes are being repeated and by people especially users – who are even less able to handle the problems

J That's less widespread then you think The fact is that the day of the amateur in the micro world as far as serious applications of microcomputers are concerned is virtually over Professionals very many of them with mainframe experience are moving in, and the lessons they have learned have not been forgotten The argument has no substance for serious users and qualified microcomputer professionals

The mistakes are being made, no doubt of that but they are being corrected very quickly What happened in years before is happening in months now

S How much did you pay approximately per package?

R About a thousand pounds per package

S And do you think it was well worth it?

R That is really for David Openshaw Director of Supply & Distribution to answer! From my point of view – yes true what the exact cost – benefit is depends on a lot of things my own *personal* view is that it is justified I was interested to hear what you were saying earlier about making mistakes Now my knowledge of computing such as it is is almost entirely theoretical in the sense that I did do computing as a subsidiary subject Psychology was my subject at university We've made the classic textbook mistakes of computing here! But, I think, the machine's so small the programs are so small the costs are so low that within a few days of making the mistake – what on a mainframe would count as an enormous mistake but on this highly accessible micro verges on the trivial – you can set things right The penalty in terms of time and money is slight when set against the marvellous gain in experience It's there, it's accessible

But beyond a certain point, of course you definitely need some training in good programming and good computing If you do not you can work yourself into quite a hideous corner that's the real danger In terms of employing the ma

Peter Reddaway in action

chine to its full in a department like this, you really do need somebody with data processing experience

S Do you think that the DP department of a company as big as yours should take some responsibility for educating and looking after the users of micros in departments such as yours?

R First of all it's difficult to think of a successful company as big as ours that wouldn't have somebody outside the DP department without some sort of computer experience. Just look at the hardware and paper around you can see that although we are a supply department our involvement with data processing is very high. That's always a good base to build on. But certainly an enlightened data processing department puts you miles ahead of other companies

J The manager of a non DP department gets to realise he can do a lot locally and have things at the control of his fingertips. What will be a problem is how the DP department at the very top are going to control not the introduction but the use of the micros. It's extremely difficult to say what the relationship should be. What one can do is to look at a company then make a particular judgement.

The DP department does need to come out and have a look at the micros and advice on their use, standardise some hopes on a language and provide the necessary training as well, so that the other departments can do the ordinary small jobs themselves but of course the DP department handles the more complex jobs ■

User Study

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FADOC PROGRAM TEST DATA RUN

LISTING OF FILE DATA FOR PERIOD P1

VARIANT     M    TLO  BIL  MAB  LBM  NBB  SBR  SBO  BMM  RCM  UNS   TOT
3438L M     2    4    6    4    5    8    71   25   14   1    4     140
3438L A     2    4    50   7    4    69   2    1    3    3    5     160
3438L B/RM  1    21   4    5    76   4    36   1    6    1    5     150
3438L S/RA  4    5    21   4    7    8    65   20   0    0    1     145
3450L M     2    1    0    45   7    1    8    10   1    0    1     60
3450L A     2    2    5    4    63   5    4    7    6    9    6     112
3450L B/RM  0    1    41   5    1    2    2    5    1    4    31    114
3450L S/RA  1    21   4    0    52   91   4    0    1    41   7     230
GRAND TOTAL =   1119

END OF FILE LISTING FOR PERIOD P1

LISTING OF FILE DATA FOR PERIOD P2

VARIANT     M    TLO  BIL  MAB  LBM  NBB  SBR  SBO  BMM  RCM  UNS   TOT
3438L M     1    12   45   64   51   10   20   16   4    4    0     245
3438L A     1    4    5    8    71   1    2    10   25   61   54    272
3438L B/RM  74   54   12   20   106  0    1    4    7    5    7     287
3438L S/RA  0    47   5    0    4    51   91   41   45   41   7     312
3450L M     1    0    1    45   41   6    21   4    5    74   1     191
3450L A     12   52   61   417  84   52   10   0    0    62   12    782
3450L B/RM  0    15   84   51   21   12   41   14   74   47   4     385
3450L S/RA  10   281  214  19   88   14   54   14   0    34   45    875
GRAND TOTAL =   3115

END OF FILE LISTING FOR PERIOD P2

CURRENT MATRIX CONFIGURATION :

PERIOD  FACTOR
-       -

P1      4
P2      1

VARIANT     M    TLO  BIL  MAB  LBM  NBB  SBR  SBO  BMM  RCM  UNS   TOT
3438L M     3    -8   -36  -28  -81  -6   132  40   22   -2   8     45
3438L A     3    4    117  8    -88  137  2    -8   -15  -83  44    48
3438L B/RM  -72  12   -4   -8   53   -8   71   +2   -7   -3   3     45
3438L S/RA  0    -37  37   8    8    -35  49   19   -45  -81  -9    -42
3450L M     3    2    -1   45   -27  -8   -21  6    -3   74   1     -63
3450L A     -8   -46  51   -409 44   -42  -2   14   18   -44  12    -548
3450L B/RM  0    12   -2   41   -19  -8   -35  -4   72   -28  94    127
3450L S/RA  -8   159  -206 -3   16   160  -46  -14  2    46   -11   -219
GRAND TOTAL =   -877
```

AN EXTRA PAIR OF HANDS

Part II Typical Applications

Editing and storage are the main advantages of the word processor over the typewriter These features help us to identify the essential principle of word processing: *never type anything twice* Once you've typed something into memory you can use it again just as it is, or slightly changed to suit individual requirements That assumes of course that you can find it You'll need an accurate index – more of this in the next article

Editing

It's quite a relief when you scribble the last page of a report Off it goes to the typist who delights in turning a scruffy manuscript into a crisp clean document. But even the best typist occasionally transposes letters or repeats themmm, or just hits the wrong key While you check the document for typing errors, you realise – no, that's not what I meant to say. I'll just move a few paragraphs around and reword the odd sentence or two

Typing errors and author's changes may leave no alternative but a *complete* retype on a typewriter On a word processor the typist types *only* the changes and the system integrates the changes with the unaffected text to produce a new clean copy It's very easy – so easy that the author may become careless and ask for more drafts than he really needs The problems of discipline and training will be discussed in the next article

In the previous article I discussed the influence of the magnetic card on word processing software Even on floppy disks much of today's software breaks up the text into units which correspond to a paper page Now think about writing a report You think in units of the report—chapter section paragraph—but not the page. The paper page is simply a convenient unit for physical filing As a unit of thought it's irrelevant So why should you have to think about paper pages when you're recording text on a magnetic disk?

Document-based software solves this problem It lets you type continuously without considering the number of lines that will eventually appear on the paper page You can edit the document as much as you like moving chunks of text around within the document, without worrying about page endings When you want to print on paper you define the number of lines on a page and the printer breaks the document into pages

Page-based software doesn't have this flexibility When you type on the screen you have a fixed number of lines on a page and you file each page as a unit on the disk It can be a cumbersome process to move text between pages just as it was with mag cards There are variations between the two extremes you may have to define page endings on the screen as you go but they needn't all be the same size, or you may be able to ignore page endings until you're finished editing, then break the document into pages on the screen before you print

The point of this discussion is to stress that there are several ways of filing and manipulating text on disk The best way for you depends on your work If, for example you edit long complex reports you need software which is very flexible geared towards the documents rather than the page To illustrate some of the points in the previous paragraphs you may like to compare a demonstration of the CPT 8000 and the Data Recall Diamond 5

A useful point to watch in demonstrations is how the typist moves text while editing If she wants to delete a paragraph she may have to press two special function keys marked Delete and Para Or she may press a special code key which changes the function of the normal keys followed by the keys 'D' and 'P' Function keys are useful but they may clutter the keyboard The code method has a simple keyboard but the typist may need to remember thirty or so codes The Lexitron VT 1303 and the Philips P5002 are examples which illustrate each approach

Storage

You can use stored text in four main application areas

- electronic filing,
- standard letters,
- standard paragraphs
- records processing or information retrieval.

Electronic filing

Reference manuals, procedure manuals and all kinds of lists and directories are useful only if they're up to date In a dynamic organisation they get out of date quickly An internal telephone directory can soon look a mess when a list of amendments is issued Numbers and names are crossed out new

STANDARD PRINTOUT

There are certain printing industry standards that apply to continuous forms and listing paper These standards are not particularly helpful to the computer user but are worth noting

The form depths generally used are 12" and 11" with intermediate depths of 2" 3" 4", 6" and 8" on 12 forms and 2⅓ and 5½ on 11" forms

The width of the form is only limited by the width of the users line printer but the standard widths of listing paper should be remembered i e 8½" 9½" 10⅝ 12 27 32" 13⅜ 14⅞" 15 5/16 and 17 25/32 At least these sizes can be filed in D P Binders

The microcomputer revolution has had an effect on the sizes of listing paper and business forms used Especially the vast increase in 9½" wide paper The majority of microcomputer systems use an 80 or 132 column printer while some printers have a fixed form width others are adjustable from 4" upwards The most suitable form width for either type of printer is 8½" so the print area is virtually A4. The forms or listing paper should ideally have perforations down either side, to enable removal of the sprocket holes and should have a form depth of 11" or 12" The forms can then be filed in standard D P Binders or A4 binders

The case for standard documents and business forms with a simple layout is very strong There are many thousands of small businesses that only use between 1 and 5 thousand invoices a year and the average cost of 5 thousand pre-printed 2 part continuous invoices is approximately 80 pounds a thousand while 1 thousand standard invoices or statements without any company name can be supplied from stock for half that price and 5 thousand would cost even less per thousand Even printing the company name on 5 thousand standard forms would show a considerable saving

So either use your existing A4 form layout for your continuous forms or adapt your print format to fit a standard form •

Philip Clark
Case Computer Services

nties are scribbled in arrows point from here to there and so on

What you can do is store the master version on your word processor When you have an amendment you change the master version then when you've had enough amendments to justify the printing cost you run off a clean copy for each user In the meantime, you can print a copy of each affected page whenever there's an amendment and give it to the switchboard

You may be able to go further than that Why print the information on paper at all? Suppose you want to keep a list of business contacts name company phone interests dates of social or business meetings Most of the changes will be adding in dates of recent meetings When you want to examine the list you can browse through it on the screen What could be more convenient?

Word Processing

Mail shots and debtors letters are typical areas where standard letters can be useful Each letter may be the same except for the name and address or the body of the letter may have gaps for variable information such as the amount of debt and the date at which it was calculated

Pre-printed standard letters have been in use for years It's usually obvious what they are The gaps for variable information have to be large enough for the longest item Our salesman will be in Newcastle-upon Tyne next week' and Our salesman will be in Truro next week are both valid alternatives The variable items may be written in by hand or in a typeface that is different from the body of the letter The final impression is messy

The advantage of standard letters on word processors is not only the increased productivity from re-using standard text. The printed copy looks completely individual as the standard text adjusts to fit around the variable information however long It looks crisp clean and efficient

Most word processors offer some facility for producing standard letters and like the curate's egg, they're good in parts It is worth looking at these in some detail to make sure you get what you want Consider these five possibilities

- 1 You can type the standard text into memory and everywhere you want variable information on the printed copy you include a special feature known as a **stop code** You then print the standard text on paper and at every stop code it stops You type the variable information on the paper then the standard text prints automatically until it reaches the next stop code And so on This is obviously pretty crude The typist has to sit and twiddle her thumbs while she waits for the next stop code But if you want a cheap machine that produces standard letters without frills this may be the answer
- 2 You can type the standard text – let's call it LETTER – into memory and the variable information – call it NAMES – into another part of the memory Instead of stop codes in LETTER you put **switch codes** You start LETTER printing When it reaches a switch code it stops It then switches to NAMES where it finds the first variable item and prints it It then switches back to LETTER and continues printing until it finds the next switch code It switches to NAMES again finds and prints the next variable item then switches back to LETTER This ability to merge information from two files is very useful particularly if you need to write several letters to the same group of customers But you'll find on cheaper machines that while this application is running you can't use the machine for anything else
- 3 There's a quicker version of example 1 using stop codes *on the screen* You display the standard text with stop codes on the screen move the cursor to the first stop code and type the variable information. You then skip over the standard text to the next stop code and continue This is obviously quicker than printing all the standard text between stop codes When you've typed the variable information into each screenful of standard text, you file the complete document on disc and print it at your leisure
- 4 Example 2 with switch codes also has a screen version You type LETTER (with switch codes) and NAMES into memory then merge the two on screen to produce a new document for printing later While the two files are merging, the screen will be fully occupied but this is still quicker than the previous methods
- 5 We're getting quite sophisticated now More advanced systems will let you type LETTER and NAMES then merge the two files when you send them to print While the printer looks after the merging you can use the screen for other jobs

An important point to consider is whether you can merge items of variable information with standard text in any order and more than once **Figure 1** illustrates the principle of standard letters and this point in particular

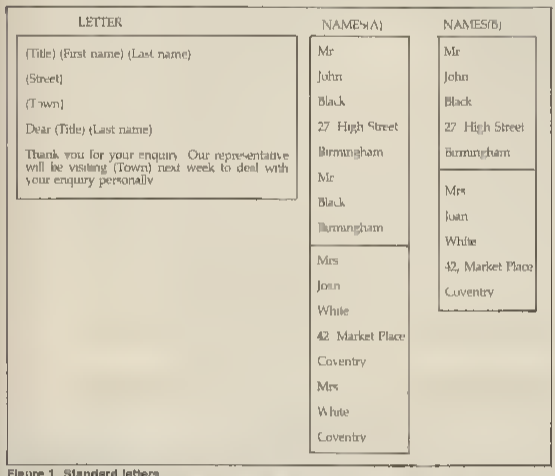

Figure 1 Standard letters
The items in the lists called LETTER items in brackets are gaps which will be filled by data from NAMES The lists called NAMES contain the variable information for the example NAMES(A) is across Dr M Black and Mrs White Two versions of NAMES are shown in NAMES(B) each item appears in the order in which it will be used in LETTER The entries for (Title) (Last Name) and (Town) are repeated NAMES(B) is arranged as software Each item appears only once the software knows (for example) that the name Black will correspond to (Last Name) and it keeps the information in LETTER where it finds (Last Name)

John Brown	Jim Green	Jan Blue	Peter Purple	Dick White	Jill Cream
Male	Male	Female	Male	Male	Female
25	42	31	45	30	41
Accounts	Accounts	Personnel	Accounts	Accounts	Personnel
£3 000	£3 800	£3 500	£4,200	£3,500	£4 100

Jim Green £3 800
Dick White £3 900

Figure 2 Records processing
*We have a personnel file which records for each employee name the age department salary We want to print the name and salary of each male employee in the accounts department aged at least 30 with a salary of £4 000 or less The records are selected (marked *) then the required items are chosen from the selected records These items may be printed displayed or combined with standard text*

Standard paragraphs

While standard letters have many uses there are some applications which though including standard elements require more flexibility Leases, contracts and wills for example each have a characteristic pattern though each document may mould the standard elements and some original text to suit individual requirements ▶

A lease may follow a general pattern such as introduction, definitions, references to schedules, schedules setting out specific rights and obligations. If the lease refers to premises for example an individual lease will usually refer to the obligations of both landlord and tenant, if the property is let to several tenants there may be a section on service charges and maintenance of common parts, there may be other sections if any tenant has the right to sub-let.

In word processing terms the final document will be composed of standard 'building blocks' and some original text. Most word processors have the facility for reading text from one document into another. Some have an extra facility for recording 'building block' text in a special document which lets you find any block very quickly and insert it in your working document. This facility has various names, for example *abbreviation* (Qwiel), *glossary* (Wang) and *paragraph file* (Wordplex).

Each building block may be 'self-contained', or like the standard text in LETTER, may include gaps for variable information. On more advanced systems you can display the selected block of text on screen with two or three keystrokes, the cursor will move in turn to each gap where the text automatically opens for you to type variable information, then the whole block, with variables is reformatted within the current margins, and the cursor positioned ready for the next block or original text.

One very impressive feature is that the building block may be not just text, but a sequence of command keystrokes – in effect a program routine. When typing an invoice, for example, you may type name and address, product code and quantity and the code for 'invoice building block' which would:

- select the text for product description,
- calculate prices, VAT, and totals, and
- format everything within the current margins.

Word Processing

Records processing or information retrieval

People often think of a word processor as an advanced typewriter. This application lets you think of it as an intelligent filing cabinet. Suppose you have on your word processor a simple personnel file, which records for each employee:

- name
- sex
- age
- department
- salary.

You can select the records of, say, all male employees in the accounts department. Selection criteria may be quite complex, for example all male employees in the accounts department aged at least 30 with a salary of £4,000 or less. The software may select the records by examining each chosen item, or field, within the record, or you may have to summarise the contents of each record by codes when you first type it: then the software will examine only the codes, not the items within the records. This latter method requires careful preparation and identification of appropriate codes.

Some systems display selected records on the screen for later printing, if required others may print them straight on to paper. Each selected record may be displayed or printed as a whole, or you may be able to display only chosen items from selected records. For instance, although you may want to select all male employees in the accounts department aged at least 30 with a salary of £4,000 or less, you may wish to display only the name and salary of each selected employee. See figure 2.

This is a common feature of microcomputers. The real advantage of word processors is that you can combine the chosen items from selected records with standard text. When you've selected your accounts clerks, for example, you could merge each name and salary with a letter awarding them a salary increase.

You can even combine the selected information with automatically selected standard paragraphs. At this point I'm reminded of Hymn 102 in the English Hymnal. It's Bach's Passion Chorale, and the second version has some of Bach's more intricate harmonies. A note in small print says, with deceptive mildness, 'This version should only be attempted by good choirs.' If you're devising systems applications combining records processing and standard text you need a clear head, plenty of practice, and even more patience – but the results can be very impressive. ■

• *Next issue: The implications and management problems.*

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NDPS
Microcomputer Payroll

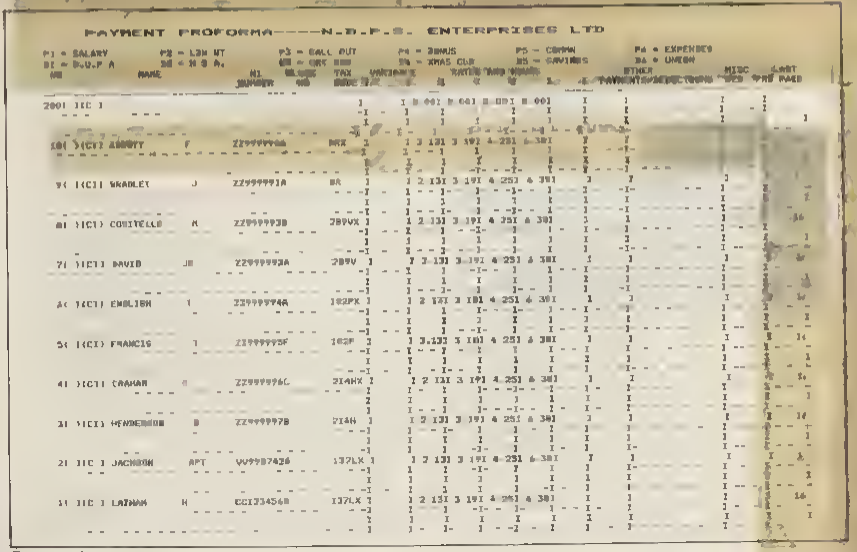
This package is offered by NDPS, a Post Office subsidiary and has grown out of work the Post Office has done for its own internal requirements

New Book-keepers Start Here

Every business has to pay its employees weekly and hourly staff, even today, mostly get paid in pound notes. Monthly staff get a salary and normally have it paid direct to the bank as a Credit Transfer. I am told that some staff get cheques which they then have to pay in. There must be some reason why they want payment by cheque, but it escapes me at the moment. Credit Transfer seems so much more elegant for both weekly and monthly payments.

You can calculate payroll by hand using tax tables supplied during March by the tax office, ready for the start of the tax year on April 5th. Figures are written into a wages book with preprinted columns bought from the stationery shop. Though not particularly difficult it is a little tedious. You can work out the pay for 50 people in a couple of hours on a Monday afternoon, draw the money from the bank on Friday morning and spend another couple of hours stuffing the pay packets and distributing them round the office. Or you can send a batch of credit transfer forms with a listing to the bank about five days before the pay date, so they have time to transfer the money to employees individual bank accounts on or before pay day.

How does it work? Firstly we calculate the overtime and bonuses and add up the gross pay. Every company has its own way of paying extra money. Most computer packages allow you to specify hourly rates, or decimals to adjust three different overtime rates, and then the program



Payment proforma

will work out the amounts to be added to the basic pay

There are sometimes additions to the gross pay For instance London Allowance (taxable), or a clothing allowance (not taxable if the tax office agrees) Gross taxable pay goes forward to the Pay As You Earn (PAYE) calculation By hand, this involves two sets of tables a new pair of tables for use each week or month Each employee has a tax code This represents the yearly amount of his tax-free allowances for wife, children, mortgages, dependent relatives Single men get low tax allowances £1375 for 1980/81 Married men get more The code ignores the junior digit £1375 comes out as 137 One tax Table A for the period gives the cumulative allowances due up to the current period for each tax code On the computer, we do not use tables we work it out from the period number and the tax code by simple arithmetic

Table B takes the net pay after deducting the allowances and provides the tax payable at the appropriate scales these rise as his income rises The tables take account of the earned income relief up to the appropriate earnings limit The tax codes have some letters after them Some are a visual check that the code value is reasonable L is single person H married P single plus age allowance, V married plus age allowance The letter T indicates that any code change must be notified to the individual like is normally done anyway NT stands for no tax BR is basic rate Single numbers show the tax rate 20 to 120 shows a fixed amount of tax. In cases where the pay fluctuates wildly, unfortunate things happen to the amount of tax deducted so it is calculated on a week 1 basis In the computer again we ignore the tables and work it out from scratch

Next, the National Insurance (NI) deduction part of it is to pay for health and unemployment, but it is mostly for pensions Each company has an option to contract in or out of the government scheme If they contract out then they must set up a pension scheme at least as good as the state scheme A small payment still has to be paid to the government The NI letter code references a table of deduction percentages A is contracted in, normal B in, reduced married woman, C no employee contribution (over age), D out normal E out reduced, F no contribution (retired) There are tables to look up the amounts from the contribution letters Again, the computer can work it out from scratch and take note of the lower and upper earnings limit. The employee contribution is deducted, and a note made of the employer's contribution

Company pension schemes vary Normally there is an employee and an employer contribution within earnings limits or there may be scales of percentage against earnings There may be also a voluntary contribution for a bigger pension Computers can be programmed to look up company specified rate tables accordingly

Then there are a whole raft of deductions There can be a dozen different schemes that employees can get into Some are collected and paid over by the employer in bulk, for example union dues Others are accumulated to pay off loans, perhaps for season tickets, and cease when fully paid off Yet others are paid by the employer to a specified recipient as happens for an affiliation order or children's maintenance Some of these payments can be deducted before tax One hopes that not all the deductions will be taken up by any one employee otherwise his payslip showing deductions in detail, is going to be about a foot long

With luck, we now can add it all up and pay out the pitiful remnants to the employee The payslip is printed and either sent off to him in an envelope, or inserted in the pay packet The company will keep a hard-copy printout of the payroll for the archives, the totals on this printout will be the payments and deductions, and the employer pension and NI contributions for posting to the Nominal Ledger It will normally also provide a way to analyse the gross pay to cost centres or departments for costing purposes

'leavers and joiners always seem to end up with manual payslips'

Lastly a list of staff for each payment method is printed out separately Staff paid in cash are listed with a coin analysis, normally you draw the exact cash from the bank and there should be exactly nothing left over when all the pay packets are stuffed Some companies specify a coin analysis with a minimum number of small coins in each packet—to feed the coffee machines! Other companies round up cash-paid-staff amounts to a next higher round sum Cheques can be printed if you have the special cheque stationery together with a listing for use as cash book Credit Transfers are printed with the employee bank name code and address and the account name and reference number, and sent with a list to the company bank or direct to the Bankers Automated Clearing System (BACS)

Joiners and leavers pose more problems Joiners have to be paid, but a number of them will not have brought their P45 tax form from their previous employer and you have to deduct at an emergency rate code currently on a 137L, week 1 basis Leavers have to be given a P45 to take away At the end of the year there is a P35 listing of every employee paid during the whole year to send to the Revenue and a P60 certificate of pay and tax deducted for the employee Weekly paid staff get money in advance to go on holiday and every week there seem to be a number of people who want to be paid now immediately forthwith and can not wait till Friday

New Computer Users Start Here

There is no doubt that a Service Bureau is a very painless way to do Payroll You write out the changes and the overtime on data entry forms and send them to the bureau about 10 days before payday - and the bureau do the rest Some bureaux are operated by the banks and thus have a very smooth contact with BACS for credit transfer but *all* bureaux can do this painlessly The bureau will of course look after all the problems of tax and NI budget changes and any new legislative requirements The cost tends to be very low at around 12p per payslip

The main complaint about bureau processing is that the lead time is rather long For weekly employees you have to pay overtime one or even two weeks after it was earned And any changes that miss the cut-off date have to be sorted out in the following pay period In particular 'leavers and joiners always seem to end up with manual payslips An in-house computer has a more instant turnaround and if you can live with the program maintenance problems for budget changes it can work well If you already have a computer you have probably considered using it

Microcomputers are even more instant in their turnaround but do have a fresh range of problems Most of the buyers are first time users The buyer need not be concerned about how payroll works inside the computer he would always buy a package selecting from quite a wide range the one that best suits him With this must come a very comprehensive hardware and software maintenance contract, and an identified standby machine should all else fail Understandably software maintenance on payrolls is at a premium rate, sometimes in excess of 15%

Notwithstanding the payroll problems any first-time user requires a lot of hand holding at first And as additional packages are installed and enhanced over the years this after-sales support remains a valuable part of micro processing Not all users are prepared to buy a Pet Apple or Tandy from a discount store and install and program it themselves A very large number of users are prepared to pay a premium price for guaranteed continuing and comprehensive after sales service

Many vendors offer this The reason why IBM and ICL stay in business is because their service is appreciated On a micro level there are probably 15 nationally known computer companies who offer good, standard (but often unexciting) products with good installation and support service at a premium price

National Data Processing Service

NDPS is the Post Office organisation set up originally for internal work but more and more offering bureau service to outside customers Notably they operate the LACES system to control and sched-

ule the customs clearance at London Air port cargo facility on behalf of the airlines and freight agents

The microcomputer service they are now offering is tending to supersede the book keeping services they offered on mainframes *The service is only offered on a rental basis* Once the contract is signed NDPs will install in the customer s office a British made, small business computer with package programs customised if required and with all the manuals training and support you need If there is any problem at any time there is a single contact point in NDPS to ring a quick response is promised this single contact will call in the NDPS software people the software house that wrote the package and who will customise it or the hardware maintainers as necessary No purchase price No extras Just a monthly service fee

The computers currently on offer are the Research Machines Ltd Casu Super C Rair Black Box and the Transdata CX400 The Casu is interesting since the Post Office itself has ordered a very large number of them for internal use Upwards extension is promised through the provision of hard disks which are now being evaluated All the machines run with the CP/M operating system which assists the software house in supporting a fairly diverse range of machines

Most users will take the accounting systems on offer as well as payroll Sales Ledger and Purchase Ledger are currently demonstrated as part of the Micro COSM system produced in association with the British Federation of Builders Merchants A usual monthly service charge tends to be around £500 For a Casu computer and payroll only the service charge is £330

Initial sales contact is through normal Post Office sales offices and micro expertise is being offered initially through London (01–432 9258) and at Leeds St Albans and Bristol One of the applications people will call on the customer and talk it through arranging a demonstration There are a number of options on which to decide Delivery of the computer and configuring the software for the options by the software house Reading Computer Services would take about four weeks When I saw the system demonstrated the NDPs had installed three payrolls to date The system is delivered with dummy files set up The new user is given about a day s initial training, and then left for a few days to experiment with the system and gather confidence The user can then load the employee file a job which takes a few days one day for each hour it is estimated the payroll takes to run each period is a rule of thumb

Another rule of thumb is that one pays up takes half a minute Allowing for interruptions and mistakes allow 50 employees per hour or 300 employees per day

Payroll

How it Works

As with most other computer applications Payroll is designed to have a very complete accurate and carefully maintained *master file* and then to enter the bare minimum of essential variable information each period for fast processing So the master file is quite large Up to 44 fields may be used

Each employee is given a payroll reference number in the range 1 199 This number is in addition to any staff number or clock number which can also be quoted and displayed This restricts the size of any given payroll but there is no reason why you should not have several such payrolls It has the convenience that separate departments or locations can be processed separately you don t have to delay all the payrolls because a single department has not sent in its clock cards yet

Each employee has an optional cost centre code up to eight digits and allowing for three levels of report sub-grouping The codes are validated as they are entered There are reports for analysing gross pay with these codes

The system is sensitive to dates of joining and leaving and for each employee the system will record the last pay period for which he has been paid So the system can check that you only pay for valid periods Up to five hourly rates of pay can be specified with pounds and pence with two decimals Hours entered against a rate number will be automatically calculated to gross pay plus a flat rate for the standard hours

Pensions can be flat rate or percentage In both cases there will be both employer and employee contributions Flat rate schemes have the two fixed contribution amounts held in the employee record There can be up to six percentage schemes the one scheme applicable to the employee is coded and refers to a table of contributions held for the company There can be additional voluntary contributions from the employee and these will be accumulated

A single loan per employee can be repaid by instalments

Up to six standard voluntary deductions can be named for the company Each employee can make all or some of them In a similar way up to six standard permanent payments can be made and an employee can receive all or some of these For each payment type the company can nominate whether it shall be pensionable and/or taxable The amounts for each of these deductions or payments are held on the employee record the descriptions that will be printed on the payslip being held on the company record

Bank details are only held for employees who have opted for payment by Credit Transfer

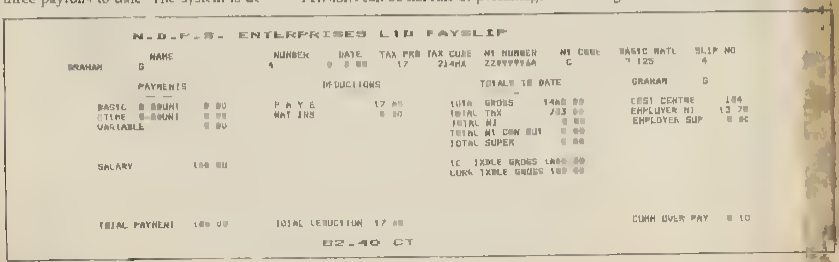
To amend an employee record is very quick The field number is entered from a menu, and this positions the cursor by the particular box into which the correct data is then keyed One thing needs to be watched If you have made a manual wages payment and have altered the employee record accordingly the rounding adjustment may then be wrong and this field will also need to be corrected

Joiners have a special display to assist entering previous pay from the P45 Leavers are marked as such and then must remain on the file until the end of year otherwise the P35 return to the tax office will not balance

Two Ways of Processing

Weekly-paid staff will normally overtime and bonuses each week Salaried staff and pensioners will seldom have any variations from period to period You can set up a particular block of employees as a separate payroll and then make a choice on how to enter the variable data either on an exceptions basis or on a screen assisted basis

In either case a proforma listing of the whole file is produced each period as a working document As amendments are



N.D.P.S. ENTERPRISES LTD PAYSLIP

NAME — NUMBER — DATE — TAX PRE — TAX CUDE — NI NUMBER — NI CODE — BASIC RATE — SLIP NO

GRAHAM G — 4 — 0 0 80 — 17 — 214HA — ZZ899956A — C — 1.125 — 4

PAYMENTS — DEDUCTIONS — TOTALS TO DATE — GRAHAM G

BASIC 0 BOUNT 0 00 — P A Y E 17 85 — TOTA GROSS 1440 00 — COST CENTRE 184
OTIME 0-BOUNT 0 00 — NAT INS 0 00 — TOTAL TAX 283 60 — EMPLOYER NI 13 78
VARIABLE 0 00 — TOTAL NI 0 00 — EMPLOYER SUP 0 00
TOTAL NI CON BUT 0 00
TOTAL SUPER 0 00

SALARY 180 00 — TOTAL TAXABLE GROSS 1440 00
TOTAL TAXABLE GROSS 180 00

TOTAL PAYMENT 180 00 — TOTAL DEDUCTION 17 85 — CUMM OVER PAY 0 10

B2-40 CT

Sample payslip

notified during the period they are jotted down against the particular employee s details When clock cards or overtime records are received these are also written in summarised form on the proforma

If there are not too many changes to be made then these are keyed on an exception basis in payroll number order, giving a code from a menu for the required field and the new value Any employee not to be paid this period is marked NP When all the amendments are entered the data is printed out and checked The payroll is then entirely automatic and all the documents will be produced If you change your mind after acceptance you will have to unscramble it yourself and produce a manual payslip altering the master record in the following period

The other option is the recommended one The screen assisted method works again from the proforma but this time the employee reference number is keyed and the employee record displayed on the screen The operator is lead from field to field to enter the necessary period data Pressing return at any field accepts the standard value The screen assisted method can be substantially quicker if there are a lot of entries to be made

Payroll Output

There are six standard reports printed by selecting from the report menu Payslips are on NDP5 supplied stationery with a tear off portion on the right hand side for the employer contributions The carbon copy of this forms the company payroll record for the archives and has all the required totals at the end The Proforma can then be printed ready for the next period Control is based on the P35 end-of-year listing which is also run each month for the archives and for balancing

Employee details should be printed in full at least once a year, and selectively during the year for any change in the master file The P60 is the end of year employee certificate of pay and tax deducted Credit transfers and bank listings are for employees paid in this way Cheques are not printed on the system they will be manual Reprints are available selectively from the file if any payslips transfers or other documents are spoilt

Each period there is an easy procedure for balancing The total pay tax and NI columns on the P35 are manually added to the previous period figures carefully filed away and checked to see that the new period-end figures are correct This is a final check that everything is working and that in fact all the correct files were used for processing

Summary

It all seems to be very workmanlike The manuals are very complete and easy to read They obviously have a lot of experience in running payrolls

Proper forms and stationery are provided to make it easy to use including a run control sheet to be dated and initialled as each stage is complete The correct end of year procedures are available A system for backing up files is provided but I would comment that the time taken to do this is over 20 minutes including the reorganisation of the records This seems overly long, even if it is only once a period

Limitations that I see are the comparatively small number of deduction types allowed and the rather free and easy way you can run the payroll at any time for any employee It is all in the charge of the user and he must be responsible for his work, but other payrolls I have seen tend to log the work into definite payroll sessions with dates and serial numbers to discipline the activity

I like the close support available to the user who at least in the early stages is going to need help, as on any new business system With the stability and marketing strength of the Post Office behind it the NDP5 should have no difficulty in selling this package ■

Payroll

• *Richard Waller is with Spicer and Pegler Management Consultants*

Editor's note *Readers are reminded that the Brand News section of our magazine carries brief but up-to-date details of other application packages available*

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ADRIFT

The Captain who sails without any goal is constantly complaining that the wind blows from the wrong direction
Lucius Seneca (4 BC–AD 65)

I recently met two executives from two very different companies who were lamenting the social and technical implications of the recent introduction of various systems in their companies. Their main problem appeared to be that they were managing *discontinuity* and so were now being forced to deal with the changing rules of the game.

Each of them was faced with having to overcome the social and political criticisms that confront any technical innovation. One executive's company was in the forefront of our aerospace industry and the impact of its technical programme would be felt on the skills and jobs of highly skilled workers like development engineers and instrument designers. The other executive's company was a professional City based firm where the introduction of integrated office systems would affect the jobs and roles of line managers (like valuers, accountants) and their secretarial community.

And they shared other problems. For example, both their companies were in a highly competitive situation and both were multinationals.

They had to compete, therefore, to international productivity standards and so felt they had very little time to introduce and gain changes within their organisations. And they knew this meant that they could expect greater penalties for any mistakes. Both their companies had to compete for capital to finance new projects and needed more effective ways of turning innovations into successful products.

They admitted to me that many of their senior managers had failed to keep up with the technological, social and political changes that were affecting their employees. Those same managers had tremendous technical ability, but little socio-political expertise. As a result these managers complained that the wind was always blowing from the wrong direction and that they were constantly menaced by hazards to making technology pay. Both organisations had put technology into various offices and sites, mainly to improve their effectiveness, productivity and competitiveness. But they had failed to strike a balance between what technology is capable of doing and achieving, and the practical limitations of human resistance to change.

The executives admitted that the human factor had been given minimal consideration at *any* level, although, in the aerospace company, there was deliberation as there was a strong trade union involvement, especially with the technicians. Also much of the introduction of systems had proceeded on an *ad*

[illegible] basis and [illegible] human behaviour and [illegible] power structures. They argue that [illegible] designs technological systems [illegible] designing [illegible] relationships.

The reason why the human factor was not debated at any length was that those who had to introduce new technology were all technologists each excellent in his field (whether engineering finance or computer science) but limited in the managing of the "human" side of an enterprise If some of them were aware of the inherent inertia of human society its resistance to change and manipulation they certainly ignored this when designing the dawn of their organisations' technological future

In fact, in a recent survey [1] four findings radiate strong warning signals which industrial managers will tune out at their peril The survey of 1000 people was designed to represent a cross-section by sex age group type of job, union membership and type and size of organisation of the workforce

The four findings are that ■ two-thirds of the workforce think the microelectronic revolution is likely to cause widespread unemployment ● eight out of 10 people think it is very likely to mean the loss of many job skills ● three-quarters of employees believe it is likely to bring strikes and industrial disputes and ● 83% think it likely to bring many redundancies among older employees

Whether true or not, many people *believe* these findings This forms opinion which becomes the basis of reactions and attitudes which ultimately affects their acceptance of change So the management of people's attitudes and uncertainties hopes and prejudices is an indispensable and organic ingredient of introducing new technology

There must be much more emphasis on training in human relations management if the technological pay-off is to be anywhere near commensurate with the financial input to the system

THE RATE RACE

Maybe we could start with some systems designers! I met another recently who referred to a human being as a human operating unit This brought to mind two real dilemmas that occur with technology and people

The first dilemma perhaps explains why there is discontent at the introduction of technology when it involves skilled people This happened for example in the aerospace industry

Mike Cooley is a senior development engineer in the aerospace industry a trade unionist with TASS and the author of a book called Architect or Bee? the human technology relationship (published by Langley Technical Services

Relations

95 Sussex Place Slough Buckinghamshire)

He believes that the intensity and monotony of the work done by manual workers will also affect intellectual work then as tasks become dehumanised there will be seething industrial discontent This certainly was the case with many companies I was involved with at a time when automation was occurring in their plants and where little regard was given to the social consequences [2]

In his book Mike Cooley gives an example where a mathematical graduate could be set to work on a computer system carrying out immense computations the task is fragmented and runs at an ever increasing tempo The implication is that the human being tries to keep pace with the rate at which the computer handles the quantitative data so that he can make his qualitative value judgments The resulting stress is enormous

Some systems I have looked at increase the compulsive decision making rate by 1900% and work done by Bernholz[3] in Canada has shown that getting a designer to interact in this way will mean his creativity or ability to deal with new problems is reduced by 30% in the first hour by 80% in the second hour and thereafter he is shattered!

> *'Some systems I have looked at increase the compulsive decision making rate by 1900%'*

There is no doubt therefore that a crude introduction of computers into design activity could result in the death of the quality of design especially as Cooley says if done in keeping with the western ethic of the faster the better

There are arrangements in some systems where there is a set length of time for handling the data (I saw one recently set at 1 5 seconds) If you cannot manage this, you are downgraded to 'headscratching status *and the anxiety can be measured* for you display all the signs of stress perspiration, higher pulse rate and increased heart beat If for example the image is about to disappear from the VDU and you have not finished with it, although you could hold or call it, you are still being paced by the machine and you start headscratching

The pace at which someone works becomes more and more visible In fact, everyone in an office can point to the headscratcher Finally there comes a time as Cooley puts it 'when your efficiency as an operating unit is inadequate'

It is this worry about the "computer" abusing the employee and the attitude that it is the human being who has to be modified or selected for suitability to the machine which makes people cautious even hostile to new technology Systems must enhance human beings rather than relegate them to being subordinates of the machine

This brings me to the second dilemma could we introduce some systems designers to the fundamentals of human relations and behaviour? This is what one leading systems designer has said and I quote Robert Boguslaw[4] whose written comments are not too dissimilar to ones I have heard in my own conversations with systems designers – I regret to say

> Our immediate concern let us remember is the exploitation of the operating unit approach to systems design no matter what materials are used
>
> We must take care to prevent this discussion from degenerating into the single-sided analysis of the complex characteristics of one type of systems material namely human beings What we need is an inventory of the manner in which human behaviour can be controlled and a description of some of the instruments which will help us achieve that control If this provides us with sufficient handles on human materials so that we can think of them as metal parts electrical power or chemical reactions then we have succeeded in placing human material on the same footing as any other material and can begin to proceed with our problems of systems design There are however many disadvantages in the use of these human operating units They are somewhat fragile they are subject to fatigue obsolescence disease and even death They are frequently stupid unreliable and limited in memory capacity But beyond all this they sometimes seek to design their own circuitry This in a material is unforgivable and any system utilising them must devise appropriate safeguards

For this system designer that which is most precious in human beings the ability to design their own circuitry, or to think for themselves now must quite deliberately be suppressed As Mike Cooley states in his book,

> the whole introduction of these systems is being based on the notion of Taylorism in that Taylor once said in my system the workman is told precisely what he is to do and how he is to do it and any improvement he makes upon the instructions given to him is fatal to success

(Quote from F W Taylor – On the Art of Cutting Metals, ASME New York)

Here are two dilemmas interlocked often systems designers are not designing systems for human beings – and those same systems are now being put into organisations with human beings whose attitudes and characters are ignored This happens in far too many organisations So it is no surprise that two of the findings of the ORC survey equated the introduction of new technology

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[1] *The survey on the fears and hopes of employees and employers about the introduction of new technology into industry was published in July 1980 by the Opinion Research and Communication organisation 2 Wesley Street London W1 01 486 8294*

[2] See *Children with a Hammer* Issue 11

[3] *Read companies experiences and solutions in the author's Not for Bread Alone published by Business Books 3rd edition 1980*

[3] *Bernhol CAD conference IFIP Eindhoven*

[4] *BOGUSLAW R The New Utopians A study of Systems Design and Social Change Englewood Cliffs– Prentice Hall*

with loss of job skill and continuous industrial relations.

Adding this to hardware being introduced piecemeal and within an hierarchical structure as opposed to a vertical approach gives the not unexpected picture of those two companies I have mentioned having little idea of their *long term* goals and requirements when discussing technological policies.

ADRIFT

Seneca may have said that "the captain who sails without any goal is constantly complaining that the wind blows from the wrong direction. But to my mind it is not important from what direction the wind blows. What is vital is how the captain sets his sails.

Important as it is to have a corporate policy more important is to have a captain responsible for managing the impact and implications of the systems being introduced. To have heard in 1979 a senior manager in a company state that his job was "to introduce computers through out the Group in production sales customer accounts departments etc." was to witness the first symptoms of a disease.

For this was *not* his job. He was a manager and he was *managing* change changed job roles, changed tasks changed structures changed power lines changed behaviour patterns and social relationships. And at this moment in his company the electronic mail system brought nine months ago is 'stillborn and abandoned for the time being'. Resistance to the technology and the changes has been resolute and is rife in the Group not just from the workforce but also from the professionals and middle management.

STUDIES

That many managers resist change is brought home in a study undertaken in the USA in which nearly 300 managers and professionals in 15 major US corporations took part. Harvey Poppel the senior vice president of Booz & Allen admits that 'behaviour adaptations are still a very slow process'. His project team found that managerial resistance was not so much a function of age echelon or education as it was of tenure within the organisation. Because they are moving on an established career path executives who have been with the company the longest have the least incentive to change.

One of the companies in the survey the First National Bank of Chicago found that overcoming top management resistance to change was hard and, without their full support any move towards automating the office is doomed. However Cornelius Sullivan the manager of the advanced technology group at the Bank says that a lot of resistance will evap-

[1] A Booz Allen & Hamilton client study published August 1980 by their US operation. For further details contact their London office.

Relations

orate if one sees one's boss instead of a secretary using the equipment.

True or not even in the United States they concede that managers and professionals resist change and that it must be taken into account *before* any moves are made towards wide scale integration of office systems.

Most of the companies in the survey plan to wait until the new office automation equipment is easier to use before they provide their managers with terminals on a wide scale. They do plan to start experimenting with the technology which according to Harvey Poppel, is the crucial step *right now* for five years from now there will not be an opportunity to telescope the time it takes to get these things done – enough will be unique to each organisation that unless you get your feet wet (now) you won't know what is happening.

This is very much the attitude here in the UK with those companies that participated in the Text processing/office automation project undertaken jointly between the Computer Services Agency (CSA) and the Dept of Industry (DOI) and to which I referred in Issue 8 (July). In October, the consolidation of their findings was published. It discusses the findings from the text processing strategy studies undertaken for ten major UK organisations during the last year.

'Everyone in an office can point to the "headscratcher"'

The ten companies involved were:

Abbey Life Assurance
British Institute of Management
British Leyland
Citibank
Knight Frank & Rutley
Metal Box Co
Paymaster General's Office
Royal London Mutual Insurance Society
Spillers Limited
Thames Water Authority

The work in each company covered the examination of current practices and work loads plus future objectives and then compared them with equipment available or likely to become available. In this environment, as the two executives mentioned earlier discovered it is easy for large companies to run the risk of losing market share because their competitors innovate faster or run the risk of *ad hoc* movements in several aimless directions.

In the CSA/DoI report long term strategies were produced for the ten client companies involved together with short and medium term recommendations as stages towards an overall strategy.

The term text processing was taken to cover *all* the ways in which new electronic systems can help before and use the information which is or might be recorded as text. Emphasis was on systems where information is processed rather than simply stored.

This includes word processors for typists viewdata systems (such as the Post Office's Prestel) and more complex retrieval systems allowing a user to recall all documents containing any particular word or combination of words.

The report also offers a current picture of text handling activities along the following lines:

a. There is limited but fast growing use of word processing. Very few examples of *other* advanced forms of text processing equipment were in use. Many companies have installed their first word processing machines within the last year or two often in ones and twos and often equipment at the cheaper end of the market.

b. About one third of all typing work analysed was of the sort where word processing could produce good increases in productivity. Secretaries and typists averaged together spent just over half their time typing rather than doing other work. (Thus if a company wanted to separate the work which is best for word processing productivity and do just this on fully utilised word processors the number of word processors needed would be after allowing for the increased productivity equivalent to about one tenth of the number of typewriters currently in use.)

c. Just over half the typists and secretaries worked alone rather than within a group of secretaries and typists. In this situation the introduction of word processing can only be cost justified if one of the following apply:

- the work is regrouped
- the word processor is very cheap and can be cost justified on low utilisation and small overall increases in productivity
- the justification is based on factors beyond typing productivity (for example increased executive productivity benefits of having information in machine readable form for subsequent electronic mail or information retrieval systems).

d. Far more of the work which was typed had been originally hand written than had been dictated. This suggests that in the longer term providing voice recognition systems for workstations used by professional and managerial staff, while useful will not be the only form of input. Such stations will either need to accommodate handwriting as well or executives will need to accept learning keyboard skills.

e. In the larger organisations nearly three quarters of the mail was generated by *other employees of the same organisation*. The overall average including the smaller companies was just under 50%. Thus organisations have a high degree of control over the form in which mail is sent and in house electronic mail systems could be developed.

f. Nearly half the mail is for information and much of it is stored. More was copied than

was thrown away

g Salaries were the largest component of office costs The cost of equipment for office workers is low on average less than 10% of office costs

Each company participating received a detailed report relating to its own strategy Some general recommendations were also made, for example

a In each of the ten organisations the consultants could see ways where more text processing could be usefully undertaken (even in one organisation which might have been considered unlikely as the percentage of typing and secretarial staff there was already less than one percent)

b The best scope for improvement was surprisingly among the most experienced users of text processing equipment The experience already gained was a springboard to helping staff appreciate new opportunities and helped quantify and justify the implications of more advanced projects Thus while it may appear tempting for companies to sit back and wait while the market stabilises and prices fall before introducing new equipment this is unlikely to be the best course

c In nine of the ten studies word processing was a cornerstone where companies had taken or were advised to take the first steps towards achieving a larger strategy Only one of the ten included any recommendations to use in the short term word processors without a screen

d The recommendations went well beyond using word processors to increase typing

Relations

productivity for example

- in one organisation the forecast was that new equipment would produce increased sales of £30m p a
- in one organisation the recommendations were directed exclusively towards increasing managerial productivity and effectiveness

The ultimate strategy usually involved integrating different systems which handled information and included providing systems which would help professional and executive staff

e The capital cost of equipment recommended within the next few years divided by the numbers of staff in areas studied was only £750 Thus the investment in equipment per office worker is likely to continue to be low compared with current costs for workers in agriculture and manufacturing The cost of current equipment is such that although some equipment can be unjustified prices limit the amount which will be installed For example the number of word processors recommended in the studies meant that much of the typing work would in the short and medium term continue to be done on electric typewriters

f In many cases the recommendations included organisational aspects, and the need to set standards and guidelines on the purchase of new equipment to reduce the risk of incompatible systems In practice such standards need to be regularly reviewed

g There was considerable emphasis on purchasing working models to fit progressively together There were comparatively few instances where the consultants recommended companies to undertake extensive development of software for their individual needs There was however some software development needed to interface and tailor systems

Meanwhile, it cannot be stressed enough that the sharing of this type of information and activity is of unique value for those companies who are concerned at various levels with deciding on their organisation's policy and plans for text-processing equipment It not only helps companies to compare their own performance to that of others but also offers an initial idea of the benefit of using new equipment the most likely starting points and some idea of cost

The study cost over one third of a million pounds shared between the DoI and the organisations participating This amount is as nothing compared with the costs of a company getting its strategy wrong or when it cannot reach the destination of its technology because the captain is lost or has set his sails wrong

But more information is needed on the social implications and the management of change ■

Lynda King Taylor is a management consultant and the author of several books on management labour relations

HOW TO BE CHOOSY

Standards you can apply

As more and more established and respected bodies such as the National Computing Centre and the British Computer Society turn their attention to applications packages for microcomputers the signs are that the software famine is now being relieved. No potential package user should neglect this article

The crucial element in the successful implementation of a microcomputer is the user's recognition of the overriding importance of *application* software in the buying decision.

Many users will be prepared to do their own programming and software development. Others, especially those with no programming staff of their own or with limited computer knowledge will be looking for programs which have already been in existence for some time and have been tried and tested on other users. In this way the user avoids the difficulties of expensive development lack of qualified personnel and in general all the problems associated with producing software which is well developed well documented, and well adapted to the application. One solution to these problems involves purchasing the software as a package rather than producing it for yourself. However the very factors that make software difficult to develop also make it difficult to purchase.

'How can you choose good programs when you are not exactly sure what makes a program good?' No established standards for software testing, quality control documentation or maintenance exist. A computer program is similar to a book, a musical composition or a work of art for its development depends upon complex thought processes that are difficult to define objectively.

Since software development is so labour intensive little capital is required to enter the software business. Companies come and go, only a few establish a lasting reputation and none grows to the size of the leading hardware manufacturers. A software company also faces the obvious problem of protecting its products, since no patents are possible and the copying of programs is as simple as the duplication of tapes or records.

All these problems are likely to lead to the prospective user asking

- is most of the available software very uncertain in quality, reliability and maintainability?
- is the viability and integrity of many software companies questionable?
- even though some companies write and market good software packages, how do I overcome the very difficult problem of identifying, obtaining and using them?

The microcomputer is fundamentally no different in these respects from any other computer on which existing users have acquired considerable experience. The principal lessons learnt can provide many of the answers.

In this article I have drawn upon these lessons to provide a framework for the rational selection of software packages. In choosing a package, the objectives of the decision making procedure are basically to ensure that the proposed product can do the job and to select the best and most cost-effective solution to your requirements. The selection process must cause you, in a rational fashion, to

- ask the right questions
- assess the package against those questions

Only then can you identify the best product.

Identification of the 'best' product

Most suppliers produce a brief specification, glossy or overview on their packages, which should give some idea of feasibility, coverage of application, general characteristics, hardware requirements etc. However, it is unlikely that this information alone will provide a sufficiently comprehensible and common base from which a rational evaluation can proceed. It is suggested that this can only be achieved through the creation of a *questionnaire* suitable for the submission to the suppliers. It is essential to ensure that the package is suited to the application. Therefore the primary aim of the questionnaire should be to determine information on the application functions provided. The *functions* of the package should be defined and within each function the related *desirable features* should be itemised.

It will be difficult to produce a definitive list of required functions and features, but the aim of the questions included should be to determine the package philosophy, what it does and how it does it. An essential step towards producing this list is the drawing up of the **Requirement Specification**. Only by undertaking a comprehensive study of the application and producing a document of this nature can the user determine what features a package must have and which are merely desirable. The understanding of features in this sense is important in the drawing up of the questionnaire and the selection of the package.

The format and content of questions relating to the application functions and features of the package are of a very specific nature and can therefore only be compiled by the user himself. However there are other key areas, apart from the application functions, which have considerable impact on the selection of packages and, as they are likely to affect all users, they merit special consideration. These are such areas as

- hardware
- software characteristics
- documentation
- technical support
- terms and contracts

Hardware constraints

Some constraints on the use of packages on microcomputers are imposed by the physical limitations inherent in the hardware design. These are constraints such as the number of customers, number of transactions and the number of daily postings in the case of a sales ledger package, the number of employee records in the case of a payroll package and the number of stock items in the case of a stock control package. These are all governed by the size of control programs and files that can be accommodated in the total main store and backing store capacity available on the system.

The availability of main store capacity is dependent upon the type of microprocessor used in the configuration. With an 8-bit microprocessor main store capacity

is limited to 64 kilobytes. In practice, the degree of constraint, if any, is determined by the nature of the application.

The availability of backing store capacity is dependent upon the nature of the storage media used with the computer. Cassette tapes have a very limited individual capacity and hence severe constraints will be imposed. Floppy disc units have a much greater capacity than cassettes but certain applications may still be limited by the maximum capacity. For example, a stock control package may have general purpose stock control files carrying a large number of categories which will result in the file being limited to about 3000 stock items or less on a standard disc.

Constraints imposed by the limited capacity of floppy discs can be reduced by using large-capacity discs and additional disc drive units. Alternatively the information can be structured into multiple volume files each stored on separate discs but this raises the problem of identifying the location of information in a file and hence creates access difficulties and operating system problems which may in themselves introduce other constraints on the operation of the package. Hard disc systems with their much greater capacity are less likely to impose constraints on the same magnitude as either cassette tapes or floppy discs.

In addition to the limited capacity of floppy discs, their slow backing store to memory transfer speed can contribute to limitations revolving around the processing speed of the system which will affect the *response* time of the system when the user attempts to do too much. For example, an increase in the volume of business transactions may impose restrictions with a single VDU terminal single task system which call for an increase in the number of terminals together with the addition of further tasks.

It is theoretically possible to run several tasks simultaneously on the system with on line data entry inquiries provided on a number of terminals. However the poor response time which results unless the disc memory transfer speeds are considerably enhanced creates practical problems which might not be acceptable. It may be necessary to resort to a system using hard discs to achieve an acceptable level of performance with this type of multi-terminal and interactive operation.

Software characteristics

No established standards for software testing, quality control, documentation or maintenance exist. This has resulted in much of the available software being very uncertain in terms of quality, reliability and maintainability. These characteristics are largely determined by the type of *programming practices* adopted by the supplier in the development of the product. In particular, the use of good design methods, a powerful fully expressive high level language and programming standards improves the integrity and reliability of the product, produces better documentation and reduced the maintenance effort. Adoption of these tools and techniques also given a product that is more easily transferred from one set of hardware to another and easily amended or modified when future requirements change.

Software quality, reliability and maintainability

The production of reliable software can be eased by the use of structured design and programming techniques. Because structured programs are more readable and self documented any program

modification is greatly eased. Although the benefits of structured programming are beyond dispute a lot of software is still produced unstructured. This is especially true of microcomputer software.

The potential buyer should ask to see a sample of the program *source code* listings, even if this is not to be supplied as part of the package. If the listing is clear and well-documented with headings and comments and shows a structure of short statements (50 or so), program modules or segments it is likely that good programming techniques and style have been used.

Software standards specify the *languages* to be used in writing the program, and *method* of programming to be used, the *layout* of the programs and the means of *documentation*.

Unfortunately the computer industry spends a great deal of time talking about programming standards but very little time developing or applying them.

Software flexibility

The major problem confronting the user of software packages is that of deciding whether a package in spite of all its potential benefits such as low cost ease of installation removal of the problems and risks of development and in expensive maintenance often will be too inflexible to adapt to the user's own *unique* requirements. If the package cannot be adapted to his requirements the user must either go to great lengths to accommodate his existing procedures to the package or accept that the package will require some tailoring.

The trouble is that tailoring appears expensive to the user of microcomputers because the cost will be high relative to the cost of the hardware. For example tailoring of a good accounting package might well cost in the region of £3000 on a total hardware/software system costing under £5000.

In the past the most widely used applications of packages on mainframe and mini systems have been in areas where requirements are most similar for users. These tend to be general business applications such as **payroll** and **purchase ledger** this trend is very prominent in the development of packages for microcomputers.

Other areas such as **stock control** and **production control** have in the past been the target of packages but they pose more problems for the supplier and user because packages of these types usually need individual tailoring to suit the user's requirements. This situation is again very much the case with packages being offered for microcomputers as was shown by the results of a recent market survey by the NCC (National Computing Centre).

However before embarking on extensive tailoring, the user is advised to consider the degree of flexibility that can be provided in standard packages.

The introduction of some level of flexibility into the package makes it more suitable for general use.

Within this context the package can be provided with parameters which enable the user to amend a series of predefined options. Each package has its own set of parameters which drive the system and which contain all the various options available to the user. For example accounting periods can be defined the choice between open item or balance forward can be specified and much common information can be introduced by parameter to minimise file creation times.

The list of parameters is set up at the time of installation and once established it can be readily amended to enable even major changes to be made quite simply.

This approach increases the attractiveness of the package because it provides a fair degree of flexibility, and reduces the need for tailoring, which in turn means that the package can be quickly and easily implemented at a much lower cost than that of a package requiring extensive tailoring.

The drawback with the provision of options in a package is that they tend to make the system inefficient. This in turn means that the number of options may be limited. In this situation it may thus be found that there is still insufficient flexibility in the package to adapt it to the user's requirements and it may be necessary to resort to making modifications at

the program level In these circumstances the user is dependent upon the authors of the package for any amendments which he requires and as such is likely to be confronted with additional charges for tailoring and with possible delays in installation

It is also quite possible that it amendments are requested at some time in the future so as to keep the package up to date as business requirements change the authors of the package may no longer be available to undertake this work Also if the package has some scheduled enhancements made by the supplier to improve its general capability there is no guarantee that these changes will not conflict with specific user s own amendments

To minimise the risks of this type of situation, the user should ensure that the package is provided with *options* which enable him to modify the input and ideally the output and processing functions of the package, whenever his requirements change Also before embarking on extensive tailoring he should consider how much he really needs something different and how much he is prepared to pay for it

Software portability

The benefits of software portability will be particularly appreciated by large commercial companies who have chosen to decentralise their computing as the best strategy for fulfilling their DP requirements, and by users with replicated sites But caution is needed when considering the portability of software packages because the terms of the licence under which the package may have been purchased may restrict the use of the package to a specified machine and/or prevent the giving of copies to a third party

The microcomputer hardware market is very dynamic with new and technologically improved products being frequently introduced In contrast to this the development of any application software package is costly and time-consuming and, once developed for a certain hardware base the application is often unadaptable

The faster the changes in hardware the greater the need for software to be *independent* of it Some of the most recent microcomputers offer impressive advances in speed and storage capabilities An application package bought for a system should still be compatible with the system when it is upgraded by the addition of hardware improvements Writing portable software which is easy to transfer from one set of hardware to another allows the application to take advantage of hardware improvements

In practice, it will be difficult to determine whether a particular product meets the requirements for portability without a very detailed understanding and an in depth knowledge of its design It is far easier to simply ask the supplier to state to *which other* computer configurations the package can be transferred without it requiring extensive modifications

Packages

For the purchaser who already possesses a microcomputer system or the larger organisation which is considering further implementations of the package in the future, it is important to ensure that the package is fully compatible with the chosen computer environment i e the system software and computer configuration This means asking additional questions such as

- what language is the package written in?
- if the package requires an operating system what is its name and source?
- what are the models of microcomputers on which the package will run?
- what type of backing store medium is used?
- what is the total backing store capacity required?
- if the package has special peripheral requirements what are these?

Documentation

All documentation supplied with the package should be examined before placing any orders

The documentation should provide the user with a clear and concise understanding of the package together with full details of its operation to enable the user to communicate intelligently with the supplier about errors or particular problems

Preferably the documentation should also include the source code of the programs so as to facilitate the programming of special amendments and future modifications Unfortunately because of the proliferation of unauthorised copying of applications software, most suppliers will not normally provide program source listings

If these are available, and the user feels that they are vital both for future maintenance, assuming that this is to be undertaken by himself and as a form of insurance in case the supplier goes out of business, then it may be possible to come to some form of agreement with the supplier For example, it may be possible to have a clause in the contract that ensures that listings will be made available in the event of the supplier ceasing trading The documentation should be studied in detail to verify its extent of coverage and accuracy of information

As a minimum the manuals or manual should provide information on the organisation, installation and operation of the software package In addition, to assist the user in resolving operational problems that may occur from time to time, all **error messages** that can be produced by the system should be listed together with advice as to how to correct them

Technical support

Technical support of the package is required prior to its installation in the form of *training*, during its installation in the form of advice and *on site assistance* and after its installation in the form of *error correction* and updating

The main issues are

- Are specific training courses in the use of the package provided?
- How much support is provided for installation of the package?
- During what period of time from the date of purchase is technical support provided for the package?
- If new facilities are added does the purchaser receive updates?
- Are there any plans to alter or enhance the package?
- Is an error reporting service provided?
- How many staff work full-time on support of the package?
- Where are the support staff located?

Terms and contracts

Purchase prices may be based on outright purchase, rental or lease agreements Any additional charges should be identified particularly maintenance contract payments and licence fees It is also important to ensure that items such as installation, training and documentation are either included in the purchase price or if not can easily be identified as extras

If appropriate, costs of other associated items such as supplies of magnetic media, stationery cabinets and ancillary equipment (bursters, guillotines, etc) should be obtained

It is unlikely that the user will be able to purchase a software package outright. Only specially commissioned software will become the property of the purchaser Packages are usually offered on permanent licence with a contract to prevent the purchaser selling or giving copies to a third party

A prerequisite for the successful implementation of a software package is to negotiate an acceptable contract

A copy of the software package contract should be obtained from the supplier and details scrutinised to confirm such points as

- is there a full definition of the package describing the programs, systems requirements input/output techniques file contents etc?
- is there any warranty with the package?
- will the package be installed for you?
- is there any maintenance support with the package, and for how long?
- are statutory changes to the package such as those resulting from government legislation, issued free of charge?
- should a revised version of the package be released is this offered and if so is there any additional cost?
- what limitations are there on your rights to use the package?
- can it be run on a bureau or another user s machine, in the event of breakdown?
- are you allowed to make your own modifications or enhancements to the package?
- is a full definition of the documenta-

hon to be supplied?

- are source and object code listings available to the user?
- what happens to the proprietorship of the software if the supplier fails?

All such points should have been taken into account during the evaluation of the proposals but must be *confirmed* before the final acceptance of the contract

The contract should be read very carefully and *professional advice* should be obtained by the potential customer before it is signed

Finally, factors which relate to the *background* of the supplier the general business conduct of his organisation and the history of the package being offered should be considered. Typically questions should be asked regarding the type of firm its financial backing and the number and quality of staff

Determine *who* wrote the package *when* the package was written and *why* it was written. If the supplier is marketing agent for another firm then determine who looks after the development of the product

Reliability demands that the package be sufficiently widely used over a long enough time such that most of the bugs have been discovered and corrected. Check that the product is available now. If a facility which is required is currently being developed ask to see it *demonstrated* first before you buy. Check how many *live* installations in the UK already use the package and find out the date of the *first* installation

Packages

It is also a good idea to contact one or two *existing users* of the package. The supplier should be willing, with the users permission to give suitable names to telephone and if possible visit, but be wary of reference sells

A further and most important stage of product evaluation should consist of actually *testing* the software package. In general it is possible to 'try before you buy'. Some suppliers will allow a free trial period or if not will undertake to demonstrate the package with your own data

Points to watch for during a demonstration are numerous and are largely determined by the nature of the application and the type of facilities provided. Some of these points might include

- how fast does the package run?
- how much data can it handle?
- what error detection correction and recovery procedures does it implement?
- how easy is it to use?

A good program should not be interrupted by mis-keying nor should it 'fall apart' or display unintelligible messages as the result of abuse of the keyboard. Data entry input should be verified by the program for *validation* of numerical or alpha fields and *range checks* should be made against numerical quantities. A good program should not accept invalid entries at the time they are keyed in

Although a subjective factor, ease of use depends upon how simple the *input procedures* are, how clearly the outputs are *identified* and how *well suited* the documentation and usage are to a particular application. Buying a package without careful study of the documentation and verification by an actual demonstration of its capabilities is risky and asking for trouble

Conclusions

The choice of a package is bound to be partly subjective and requires a certain amount of care and additional effort. With a view to minimising the subjectivity of the decision-making procedures a rational approach has been presented in this article. This approach will also, I believe, provide answers to many of the problems faced by the prospective user of microcomputers.

The decision to adopt such an approach, which at a first glance may appear too much of an 'overkill' in terms of the money, time and effort entailed particularly on systems costing under £10 000, can only be made by the individual. Personally I would suggest that anything other than a rational approach of this type is courting disaster: disaster waiting to strike only when the system goes 'live' ■

- *Choosing Programs for Microcomputers* by F E Lane is published by NCC Publications Oxford Road Manchester

BIM BIM

SAVE IT-WITH MICROS

Today and for the future one of the most pressing issues our country and indeed the rest of the world must face is that of energy utilisation. The oil crisis of 1973 brought the problem to a head and since that date the price of oil has rocketed the first half of 1979 alone saw a 50% increase in its cost. Concentrated attention on energy management is now of vital importance, particularly in view of the EEC's commitment to restrict its oil consumption to 470 million tons per annum until the mid 1980's.

The problem of energy saving has many facets. One worth serious consideration is the major role which may be played by the microprocessor. Ever more companies are recognising the potential of the microprocessor as it becomes proven that automatic energy monitoring and control systems can produce very substantial savings without creating either installation difficulties or vast initial outlays in expenditure.

Scarcely any enterprise is free from worry about its expenditure on energy consumption, whether that refers to simple lighting or the efficient running of an extensive boiler system. Clearly concerns such as large retailing organisations with many branches, manufacturing and processing plants of all types, schools and hospitals are obvious targets for the application of energy management schemes. Such large users of power have dramatic variations in power demand, hourly, daily and weekly. These fluctuations present not only one of the main economic efficiency problems but also a prime target for microprocessor application.

Not energy saving but *equalisation of demand* (reducing peaks and troughs) is the main objective in order to optimise energy cost and allow more efficient generation.

For instance, in a large retailing organisation the problem crops up in many areas such as sales floor lighting, air conditioning and ventilation and building insulation. These areas and numerous others all involve energy management functions regarding supervision and energy optimisation. The microprocessor comes into its own in tackling problems of monitoring and control since it can automatically provide 24-hour supervision in ways which humans would find very difficult to equal. Energy requirements must be sorted into load identity, levels of priority, minimum operating times, maximum maximum times, duration of operation, size of each load and required procedure in the event of power failure. Heavy electrical users connected to the national grid find themselves on a maximum demand tariff: the boards make a charge proportional to twice the largest number of kWh or kVAh supplied during any demand period throughout the supply authority's accounting period. This is known as the kW or kVA Maximum Demand and is additional to the charge made on each unit metered.

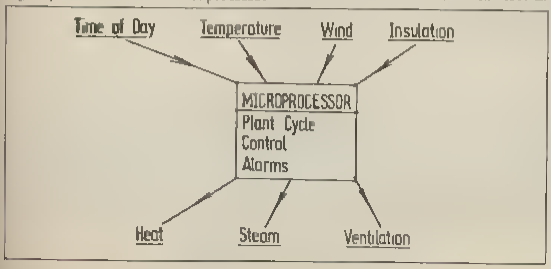
Clearly it is important to reduce the MD (maximum duration) charge and to achieve this the level of demand must be monitored and the high loads manipulated to minimise the peaks, the idea being to keep maximum demand as close to average demand as possible. The type of equipment best suited to load control is that which operates intermittently with relatively large gaps of inactivity, e.g. plant on thermostatic control or pressure control or non-essential auxiliary equipment. Examples include arc furnaces, cold storage, water heating, space heating, ventilation fans, pumping equipment, incinerators, drying ovens and battery charging. Available microprocessor systems give cyclic or demand control options on many channels, integrating the energy consumption picture and providing visual display or print out and manual over-ride if desired.

A further simple example illustrates the basic principles of microprocessor application and the versatility of this tool in energy management. A small market gardener was trying to find ways of reducing overheads while keeping the production and quality of his mushrooms constant. His methods utilised a number of small huts with the greatest outlay of money being on the provision of a suitable supply of steam at a steady temperature for optimum growth of his produce. It was noted that excessive steam was often pumped into the growing huts and the heat provided was not regulated with regard to external temperature fluctuations, i.e. even though the external air temperature was rapidly rising, the simple thermostatic control was unable to recognise and take advantage of it.

The new microprocessor technology is thus presented with a prime opportunity. The diagram (Figure 1) shows the type of information gathered from the real world and after processing that information the sort of command instructions relayed back into the world to effect the control. The constant monitoring and control of all the variables resulted in more efficient operation and a gain for the market gardener of £1,000 per crop: the £3 000 saved on three crops covered the cost of his simple microprocessor hardware in less than one year.

Clearly there is no end to the possibilities; a microprocessor system such as this may be extended to include consideration of many variables, e.g. fuel costs and market prices, and also to deal simultaneously with stock despatch reports, schedules and enquiries control. The essential difference between this example and the previous one is that in load shedding the microprocessor is involved in monitoring and control of energy usage, but here the capabilities of the microprocessor are extended to make simple predictions based on typical weather patterns.

Thus the microprocessor provides an extremely efficient, low cost replacement for traditional methods of control. Indeed the microprocessor opens up vistas of control for applications previously thought too tedious and costly to be undertaken. Recent advances make the technology even more attractive since the development of high level languages enable the user to converse with the machine in real English, rather than having to employ programmers to act as interpreters. The way is now open for those in industry and commerce to put their faith in the new technology. ■



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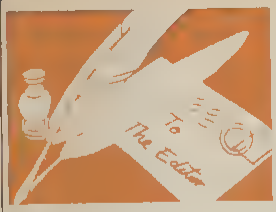


Clause for concern

May I start by saying what a relief it is to find a publication that takes programming seriously and prints articles like those by Martin Beer.

I was interested to read his article in the september issue of Computer Age in which he discouraged the use of the nested if clause on the grounds that it is difficult to read. This is a matter of opinion but what are the available alternatives to this form?

Either the structure of the program would need to be changed so that the multiple branch was not needed or a better technique of expression would need to be chosen. If the nested if form is disliked then this may be a good reason to amend a program's structure but there are circumstances where this would be unnatural particularly when the various conditions are mutually exclusive. In this case it is surely clearer to somehow combine the conditions.

There are two alternatives to the nested if. One is to put the various conditions together into one condition using Boolean operators. With many conditions this soon becomes cumbersome and unreadable to the uninitiated. The other is the case clause or its equivalent. It has long been realised that repeated testing of an integer is cumbersome so languages have allowed clauses like

```
case x in [ 1      2      3      esac
```

However as Martin points out integers are not always the most natural means of representing data. But does any language provide a choice using strings as standard? Could we write

```
" case colour in      red
                      green          esac?
```

And what of the case where the program includes a Boolean variable being used as an error flag? Surely the most readable form is something like

```
if colour is red then ...
                 else if colour = green then ...
                                        else ...
```

Martin's article poses interesting questions for those watching the progress of language design for micros. It is interesting further to consider how a feature of higher level languages currently in use such as the next did could be programmed in existing languages more clearly and how new languages might benefit from things like the havoc using string.

Incidentally Martin Beer is probably aware of the work that has been done in the area of Hierarchadatalysis of various if clause forms. E.g. [illegible] this is covered in J. E. Nicholls book in the Structured Programming Series (Addison Wesley 1975) The Structure and Design of Programming Languages.

Anthony Greenwood 19, Lumsden Avenue Shirley Southampton SO1 5EL

■ £10 book voucher

The Searcher

The article written by Peter Prescott which appears on pages 73 to 76 of your issue 11 dated October 1980 is pertinent to my work and useful as an educational tool.

It was the mention of this article on the front cover of your magazine which introduced me to it. At present I am not well versed in computers but expect to become increasingly familiar with them. Your magazine makes a favourable impression the article by David Bishop on Searching at page 35 also being of immediate relevance to my work.

R. D. Marsh Brewer & Son Chartered Patent Agents 5–9 Quality Court Chancery Lane, London WC2A 1HT

■ Copy of Martins Banks *Living With the Micro*

Foundering search

The Searcher (October Issue) I was disappointed to find the article contained a number of errors.

1 It is very rare for a secondary service to use the abstract provided by the author of a paper.
2 Online searching has been available in the USA for nearly ten years and in the UK for over five.
3 At the bottom of p35 there is a passing reference to the Mullies System with no explanation of what this is.
4 Search languages are different for each provider but the European Common Command Language is only available on Euronet Diane.
5 Online searches are available not only from university libraries but from public libraries and many commercial organizations.
6 As far as the table of contact addresses is concerned Learned Information Ltd are in Besselsleigh Road Abingdon the Euronet Diane contact point is in Alphage House Inforline (now Pergamon Infoline) has only one database and does not offer online ordering of booths (sic) and SDI. Search Service have an office in Fleet Hampshire.
7 The world's largest database service with more databases than all the others added together namely the Lockheed Dialog service is not even mentioned even though their UK agent Learned Information is listed in the table.
8 As far as the list of databases is concerned numbers 8 and 37 are the same database which is COMPENDEX and not as given 17 18 and 19 are the names of the printed section of the INSPEC database and online they are collectively called INSPEC.

29 (Ringdoc) is only available on a special subscription basis.

38 is World Aluminium Abstracts and not as printed.

41 is a highly sophisticated file and is not available on public access services.

42 and 43 are also not available on any of the services listed in the article.

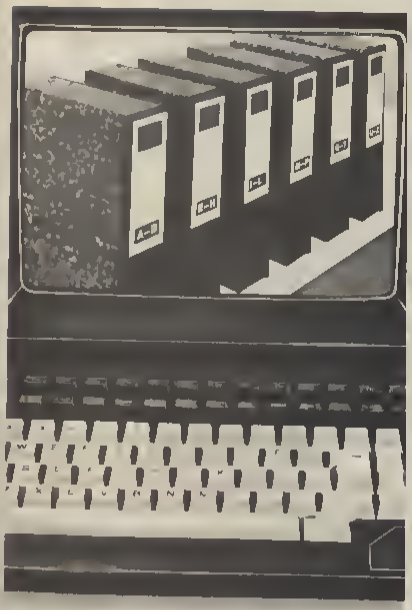
51 is called METADEX as an online database.

9 Those are specific comments on the listing. The author says that he regards the list as giving generally useful databases. Since there are over 1000 databases and databanks currently available any list is going to be a subjective selection. Having said that many of the 51 listed are highly specialized and very expensive to use.

I have already mentioned the glaring omission of the Lockheed Dialog Service. Other omissions include no reference to the Online Information Centre (set up by the Department of Industry to provide assistance to anyone interested in online information services) no reference to the excellent search service offered by the Technology Reports Centre no reference to the fact that access to the US services requires a password from the Post Office in order to use the IPSS network and no reference to even one of the excellent books on online searching or directories of database.

Martin S. White. European Director Creative Strategies International Banda House, Cambridge Grove London W6 0LN

Editor's Note *The article was intended only as a first approximation. Martin White has promised Computer Age a follow up article that will expand on the theme. That said errors and omissions are the responsibility of the editor.*



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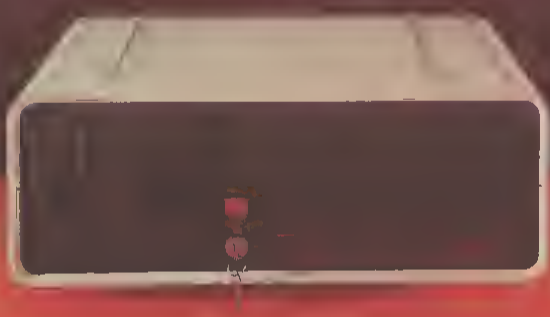

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