A new computer language, developed in Monash's Computer Science department, has caught the attention of the giant IBM Corporation in the US, and of researchers worldwide.

The language, CLP(R), simplifies the statement and solution of mathematical problems. For instance, using CLP(R) a versatile program to do mortgage calculations can be written in four lines, whereas a program of similar capability written in the traditional mathematical computer language of Fortran would take several hundred lines.

Since CLP(R) was released in experimental form in June, the department has received at least 36 requests to evaluate it, 26 of them from overseas.

The experimental form was developed and implemented at Monash by a research team led by former Computer Science lecturer Dr Joxan Jaffar, and including postgraduate students Peter Stuckey, Spiro Michaylov and Roland Yap. Jaffar now is part of a research team working in America with IBM on its further development.

CLP(R) is one of the first computer languages able to handle ordinary decimal numbers based on the system known as logic programming. It has particular application to complex mathematical problems with large numbers of symbols, such as in the area of stockmarket option trading and electrical circuits. The name stands for Constraint Logic Programming (Real Numbers).

Logic programming gets over the problem of having to specify to the computer in sequence and in complete detail every operation to be performed in every program.

Instead, the computer is pre-programmed with the rules of logic and problems are set up in terms of logic. The computer then can simply be asked to operate on the problem using rules of logic, and left to itself. So the language is used merely to describe to the computer what is to be done, rather than how it should do it.

The logic programming form makes CLP(R) suitable for use in the newest computers which link a series of processors together into what is called parallel processing, allowing the computer to split problems up and work on several different parts of them simultaneously.

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University to patent a Band-aid solution

Monash University is patenting a small naturally occurring protein which makes wounds heal faster and could lead to better treatment of breast cancer and other solid tumors.

The protein, one of a newly discovered family of growth factors, appears to control the development of small blood vessels or capillaries. It was first purified by a research team in the Department of Biochemistry led by Professor Milton Hearn which has developed innovative automatic techniques of protein separation.

The team also played an important role in recovering the hormone, Inhibin, which looks as though it will be of great use as a fertility drug in animal husbandry, and might be the basis of a unisex contraceptive.

Hearn said: "These new growth factors were fantastic substances on which to apply our new techniques. In low dosages they stimulate cell growth selectively and increase the speed of healing many times. They could be impregnated into Band-aids and could also be important for wound healing after surgery."

"But it is more fundamentally exciting than that, because these growth factors are involved in the development of the blood vessel network in a number of forms of cancer. They even could be tied up with Kaposi's sarcoma, the cancer found in AIDS."

He said that solid tumors, such as are found in the breast, liver and colonic cancers, can only survive with an adequate blood supply. "If we could make an..."
Reshaping the classic Lear

“King Lear seems to me Shakespeare’s greatest achievement, but not his best play”
— Dr A.C. Bradley, drama critic of the late 19th century

“The sightless Gloucester (John Leonard) lacks “a fundamental theatre economy”
— Margaret Webster, London director of the early 20th century

Putting on King Lear was part of Bartholomeusz’s third year English course on Shakespearean drama. Most of the roles were played by students of that course, and those who were not acting worked backstage or at the front of the house.

So the production brought a group of students studying a play from a literary point of view, face to face with the problem of bringing it to life and making it work on a stage. They then wrote essays on the experience — some of the best of their kind Bartholomeusz has seen.

Staging the play also provided Bartholomeusz with a practical test of the fruits of recent research into King Lear.

“Here we were not only studying texts, but realising them in performance. It illustrates the way in which teaching can feed research in a university, and research can feed teaching. And a play like Lear seems particularly important because of its social relevance,” he said.

Two members of the English Department staff and two former Monash students took on the roles of the older characters in the play.

One critic said: “Richard Pannell played a brilliantly tragicomic Lear and John Leonard, a passive and unexpectedly courageous Gloucester. Ray Goodwin created a brisk Kent who achieved an extraordinary dignity in the last, while Alistair Roosmale played a Cornwall who engendered in the end an atmosphere of almost non-human evil.

“The students also reached a high artistic standing. Outstanding among them were David James as Edgar and Jacqueline Horan as the Fool.”

In fact, despite the fact that it was done by amateurs, that the theatre space was small, and that the First Folio leaves out some of the best-loved and most highly regarded poetry in the play, the production was highly acclaimed by the critics. For once, King Lear appeared a coherent whole as a play and worked on stage.

Bartholomeusz said: “The production was a reaction to the extraordinary volume of brilliant scholarly research which accompanied and was stimulated by Michael Warren’s seminal paper at the International Shakespeare Conference in Washington D.C. in 1976.

“This research showed that the familiar text of King Lear, which is used in schools, universities and the professional theatre everywhere, was an adulterated text, the work of editors rather than Shakespeare. It is, in fact, a composite text made up from both the Quarto and the First Folio texts and much longer than either.

“Many modern scholars now believe that the Folio text of 1623 is Shakespeare’s own revision of the Quarto text. As we rehearsed and staged the First Folio version, it seemed to me that the revisions were indeed the work of an intensely self-critical poet and playwright — the work of a great creative genius, who could sacrifice some of his own most brilliant

* Image of King Lear (Richard Pannell) mourning his daughter Cordelia (Luisa Brett)
In transferring the text from its facsimile form into a script to be used, Worth deliberately tried to edit it as little as possible. For instance, he added no punctuation as a guide to phrasing, and left ambiguously spelled words as they were. The idea was to let the actors puzzle out what the text meant and work through its meaning themselves, a process which could well result in a fresher approach, free from the editor's views.

Another who was intrigued by the production was poet and English lecturer, Ms Jennifer Strauss. She said that the Folio version seemed to flow, that it was not static. There was also a unusual feeling of teamwork or ensemble on the stage, and less of a temptation for the important parts to dominate.

The Folio version does not include two scenes found in the more usual composite version, the mock trial scene and the scene between Kent and the Gentleman, which describes Cordelia. Strauss said while she did not feel the loss of the trial scene, she did notice the lack of Kent and the Gentleman, a scene which contains some of the Shakespeare's greatest poetry. Strangely, that scene seemed to float free from the text of the play, she said, because the poetry could stand on its own.

It seems that here is an example of Shakespeare being too good a writer for his own good — and then being prepared to cut some of his best work for the sake of the play.

Likely spin-offs of the King Lear project are publication of the text which was used and of a book on the production which would include an essay by Bartholomeusz and extracts from student essays. Bartholomeusz hopes the experiment next will be taken up by the professional theatre.

Meanwhile, Dennis Bartholomeusz continues his research for a book on King Lear in performance, to follow Macbeth and The Winter's Tale. "I've just had word from the Comedie Francaise in Paris, that they can give me a prompt book from one of their productions of Lear in the 18th century."

King Lear was made possible by a generous grant from the Vera Moore Fund of Monash University towards the costs of production.
Plasmids: the natural genetic engineers

Since the time of Louis Pasteur, mankind has been actively at war with disease-carrying bacteria. But no matter what we do, they keep bouncing back.

At times we thought we had them beaten — first with penicillin and then with a whole series of other "wonder" drugs. But each time, resistant strains of bacteria have appeared, usually relatively quickly.

Worse, the resistance seems to be cumulative. Attempts to get around the problem by treatment with more than one type of drug simply have led to bacteria which carry multiple resistance, such as the scourge of Australian hospitals, multiply-resistant Staphylococcus aureus or golden staph.

It seems that bacteria not only develop resistance with ease, but also spread it to other bacteria quickly and efficiently — even to other strains and species of bacteria.

Recent research has shown why. The genes responsible for the proteins involved in rendering antibiotics harmless are not usually part of the central bacterial chromosome. They occur on plasmids — small, circular pieces of deoxyribonucleic acid (DNA) which exist and reproduce independently inside bacteria and can be passed between them.

Plasmid researcher Associate Professor Viji Krishnapillai of the Monash University Genetics department says these parasitic snippets of genetic material are of immense economic importance.

He says plasmids persist in bacteria because they carry genes for characteristics that are of value to the host. Antibiotic resistance is an obvious example, but plasmids also carry genes which can cause diseases in plants and animals and which allow bacteria in plants such as clover to enrich the soil by producing usable nitrogen compounds from nitrogen gas.

Plasmids also control the sex life of bacteria. The process of conjugation, which constitutes sexual reproduction in bacteria, is initiated and directed by plasmids.

During conjugation, two bacterial cells are linked and a copy of the plasmid genes passed from one to the other. Successful conjugation involves reproduction or replication of the DNA of the plasmid and the transfer of a copy. Inside the recipient cell the transferred genetic material re-forms as a plasmid and, as any plasmid, stands a chance of being incorporated into the bacterial chromosome properly.

Krishnapillai said: "There are two types of plasmid which are quite distinct — promiscuous plasmids and narrow host range plasmids. Promiscuity is the ability of some bacterial plasmids to transfer between and reproduce in a wide range of different species of bacteria.

Promiscuous plasmids are important tools in genetic engineering. They can act as vehicles for transmission of genetic information to a wide range of bacteria, taking genes in and out. We are trying to determine the mechanisms that control promiscuity."

Plasmids consist of naked DNA — nothing else. In fact, one view is that both plasmids and viruses arise from mistakes in the replication of the DNA in the bacterial chromosome. Any differences in characteristics between different plasmids must be in the DNA and hence be genetic.

The gist of what the researchers in Krishnapillai's laboratory are doing is quite simple. They are building up a detailed genetic map of two naturally occurring plasmids, one of each type. But in order to do that they must use all the sophisticated techniques of modern genetic engineering.

In effect, the research group looks at the impact on conjugation and DNA replication of altering single genes in the two plasmids. They do this by inserting a piece of genetic material called a transposon into a gene. This effectively cripples that gene.

A transposon can be engineered to insert into plasmid DNA and its precise site of insertion identified by DNA sequence analysis.

"We have been able to identify quite discrete genes which are absolutely essential for the processes of conjugation and replication in different bacterial hosts. In other words, if you knock out these genes the plasmid cannot initiate conjugation or cannot replicate."

For instance, the promiscuous plasmid the research group is using contains about 50 genes, the non-promiscuous plasmid about 40 genes. Others found that the area which controls conjugation amounts to about 20 genes.

Work in other laboratories has determined the area responsible for producing proteins which coat the surface of the bacterial cell. These then recognise and stick to the surfaces of other bacterial cells. In the case of promiscuous plasmids, the cells can be of unrelated species.

Once glued together, the membranes of both cells must dissolve in some way to form a tunnel through which DNA can pass. The transferring plasmid DNA is then converted from the double-stranded form to a single strand and a "guide" protein is attached to the front.
The guide is passed through the tunnel drawing the plasmid DNA with it. Finally the single strand is reconverted back into its more usual double-stranded form, and the plasmid is reconstituted inside its new host.

During conjugation there are clearly donor and recipient cells. The plasmid in the donor controls the process. But the latest evidence does suggest that transfer can occur both ways.

In like manner, non-promiscuous plasmids are capable of stimulating conjugation between cells of different species although they are much less efficient at doing so than promiscuous plasmids.

In fact, says Krishnapillai, the real differences between promiscuous and non-promiscuous plasmids are in their relative abilities to replicate in a wide variety of species. Narrow host range plasmids, as their name suggests, can replicate only in a very restricted number of species or strains.

"From our own work, we now recognise that genes from hosts are required for the expression of promiscuity. It's an interaction between bacterium and plasmid.

"Promiscuous plasmids appear to be those with the largest range of genes required for replication and transfer, requiring the least input from the host. But there appears to be little evidence that anything to do with the transfer process is found on the host chromosome."

The ability of DNA to reproduce itself, to replicate, is an extremely specialised property. It is, in fact, what sets life apart. The growth and reproduction of organisms begin with DNA replication.

Because the DNA replication process is so crucial to life, it has been very resistant to evolutionary change. "The enzymes involved and the controls appear to be quite general," Krishnapillai said.

"The replication machinery in plasmids is analogous and similar to other DNA replication systems in cells. Where plasmids differ seems to be at the level of controlling initiation of replication — a very important and unique property.

"Recently the area of the plasmid where replication begins has been identified. This section is essential, it's where the plasmid is cut and rejoined. It turned out to be typical of origins and very characteristic of similar structures elsewhere in the cell and in other types of cells.

"If we understood plasmids properly, we could begin to increase the efficiency of genetic engineering. Promiscuous plasmids have been exploited for the past 10 years to clone genes of interest and transfer them between bacteria."

For instance, they were the first tools developed to study the molecular genetics of how plants "fix" atmospheric nitrogen into useful nitrogen compounds. Now researchers are looking at using plasmids to develop new nitrogen fixing plants."
A programming language is one which can be specified to the machine exactly what to do. Some languages are better for expressing certain things that others. For instance, if you want to write science, it's the same with computing. If you want to write mathematics the traditional languages have been Fortran and, more recently, Pascal, but in these you had to specify the machine exactly what to do. With CLP(R) you simply write the problem down and let the machine get on with the work." At base level, computers are machines that store and manipulate data represented by patterns of electric switches which are either on or off. So, the earliest low-level computer languages were sets of numbers called machine codes which triggered switches. The next stage in the development of computer languages was the replacement of numbers, which are difficult to remember, with words, each one representing a specific number. For example, low-level computer languages were sets of numbers called machine codes which triggered switches. The third stage of computer language evolution was the development of Fortran—a language which looked and operated like ordinary mathematics. And since then, there has been a proliferation of higher level languages, as close to everyday written language as possible. Now, the trend is towards logic programming languages in which only the problem need be specified, and the machine can be left to itself to work on the solution. But in this growth of computer languages, and with the wider application of computers to everyday life, the word computing has become something of a misnomer, as mathematical computation has tended to get left behind. Peter Stuckey said: "So far, most high level languages are concerned with processing and manipulating data, and as such, only incorporate rather simple, 'counting' mathematics. Less than 10 per cent of computing is now mathematical." Even the first logic programming language, Prolog, deals easily only with whole numbers, but not fractions and decimals. It is based on pure logic and only manipulates symbols. There is no built-in concept of mathematical operations such as addition and subtraction. Constraint logic programming makes knowledge of these operations, and of the properties of decimal numbers, an integral part of the language. This means it works much more efficiently than if the extra information simply had been tacked on to Prolog. Stuckey said that one of the great strengths of the new language was that, because it operated according to the rules of logic, the order in which elements were entered was unimportant so long as the relationship between them was clearly defined. He said this meant that, in cases where there was no simple single numerical answer to a particular problem, the computer was capable of giving all the answers. Highly complex answers of this type can be represented using graphics. The thrust of further development of CLP(R) at Monash is to try to diversify from numbers into other kinds of mathematics such as set theory and Boolean algebra. At the moment the experimental version relies on an interpreter program to link it through other languages the computer understands. A Monash postgraduate student, Roland Yap, has been hired by IBM as a summer vacation scholar to link the words and numbers together—that is, to translate the words into numbers. The research group has developed sophisticated new techniques to automate the separation of proteins. Using microcomputers to control the process the time taken to develop a scheme for purification can be reduced from years to days in some cases. Professor Hearn said: "Genetic engineering makes the production of large amounts of valuable proteins easy, but not necessarily harvesting and purifying them. In fact, the cost of purification is about 70 per cent of the production cost. Only about 15 per cent is spent on the actual genetic engineering. "The impact of our work on the production of therapeutic and industrial proteins is potentially enormous, as we have developed some of the best procedures for the recovery of biological material." Application of the group's research into protein separation will form a central part of the proposed Biochemical Process Development Centre being developed in conjunction with the Victorian Government through the university's research and consulting company, Montech Pty Ltd. Hearn thinks it could form the basis of an Australian bioprocessing industry potentially worth tens of millions of dollars a year. Traditionally, proteins have been separated in terms of their size, shape and average electric charge, but the purification of closely-related proteins demands knowledge of the distribution of that electric charge and also how attracted to water the protein is. The necessary information can be obtained from a series of carefully planned, but essentially routine, experiments. And that is where the microcomputer comes in. The various steps can be plotted and controlled by computer, which can then join the formerly independent experiments into an automatic process, and can use the emerging trends to simulate behavior of the protein under different conditions. Using these simulations, the optimum conditions and steps to purify the protein
Where there’s a will, there’s now a way

An Australia-wide computerised registry of wills, believed to be the first of its kind in the world, has become the basis for Monotech’s first subsidiary company.

The Wills Records Office Pty Ltd, launched officially on 1 October, will allow solicitors and any other professionals involved in the preparation of wills to register with their own name, a client’s name, address, date of birth, and the date when a will was made or last amended. No details of the will’s contents will be recorded.

Upon registration, the client will be issued with a plastic card outlining the information in the computer file. The file can be updated at any time, and a new card issued to show the most recent information.

Until now there has been no central system to record when wills are made or where they were prepared, and solicitors in Australia have had to spend millions of dollars a year advertising for wills all over the world. That expense is probably small compared with the cost of the time that lawyers and courts spend in determining active wills and resolving will-related disputes.

Registration with the Wills Record Office is inexpensive — only $25 for an initial period of five years. Those wills registered before the end of the year will be entitled to re-register free of charge.

Solicitors can apply to the Wills Records Office for a report which will show, in chronological order, all of a client’s registered wills and codicils. In fact, a list of all the solicitor’s registrations can be sent out regularly, so that he or she can gain an indication of which clients may be at the point where they wish to update their wills.

The idea for the register came from Melbourne solicitor, Mr Henry Burstyn, now one of the company’s directors. The other directors are Professor Les Goldschlager of the Department of Computer Science, which developed the computer software, Dr Paul Hudson, the managing director of Monotech, and Mr Peter Wade, the university’s comptroller.

The wills register was developed with the encouragement of the Law Institute of Victoria.

The directors hope that registration with the Wills Records Office will become part of the normal practice of making a will.

It is not the first time Australia has pioneered such legal innovations. The land registry was invented by a lawyer in Western Australia.

For further information, contact Paul Hudson on (03) 565 3038.

MONTECH HAS has established an Information Systems Division which will undertake consultancy work and is marketing Jobcode, a suite of computer software to manage manufacturing.

Heading the division is Professor Nick Hastings of the Department of Econometrics and Operations Research. He said Jobcode had been developed and tested over 12 years, and has enabled medium-sized to large companies to co-ordinate and schedule their ordering, production and delivery across a wide variety of jobs and departments.

Jobcode already is in use in four companies in Australia and the UK — a printing firm, a high-tech metal machining business, a transport maintenance company and a glass manufacturer. At Monash it has been employed extensively in management training programs and the Master of Business Administration degree in the Graduate School of Management.

It is an interactive, multi-user system available on magnetic tape for mounting on VAX computers. Using Jobcode, for instance, a manager can plan materials requirements to fill several different orders on time, taking production schedules and capacities into account.

"It tackles problems that, in the past, have been notoriously difficult to solve," Hastings said.

For further information, contact Professor Nick Hastings on (03) 565 2441.

**Professor Milton Hearn of Biochemistry**
Religion is everywhere assumed to be in decline, but in the 1981 census more than three-quarters of Australians identified themselves with some religious group. We have an expectation that this is a secular society. And it is true that our major institutions are secular. Appeals to the supernatural are not heard in the land of BHP and the ACTU.

The Government of Australia, courts, parliaments, university councils, boards of governors all seem to be able to conduct their business with little reference to God or supreme beings. Even the "Joh for PM" campaign was lacking in the religious dimension.

Yet the data of the 1983 Australian Value Systems Study clearly show that Australians are more religious than many think. It cannot be said that Australians are essentially secular and irreligious when about 38 per cent claim to be religious persons, two-thirds pray, meditate or contemplate occasionally or more frequently, and only 4.5 per cent claim to be atheists.

The notion of the growing secularisation of Australia depends on the idea of a point in the past which was a "Golden Age" of religion. It can't be found statistically.

It is not true that a higher proportion of the Australian populace went to church in 1880, or 1920, or 1950, than in 1970 or 1980. With a few minor variations, regular church attenders in Australia have always constituted about 19 to 24 per cent of the population. The figure is running about 21 to 22 per cent at the moment.

Despite the fact that Australia's dominant culture is definitely Christian, the society is not dominated by Christian churches and values. It never was. In that sense the present secularity is not new. It has been the continuing condition of the church in this society.

It is probably best to see Australia as a pluralistic or multi-cultural society. This is much more true than saying Australia is secular. Most individuals are searching for some meaning system by which to integrate their lives, and in Australia people and groups are permitted to choose from a wide range of meaning systems. Most can make some sense of their lives — and if they can't, we lock them up.

It could be argued that Australia has never been quite so religious as it is now. There is more religious ferment in Australia today probably than ever before.

Look at the bookstores. Books on religion and meaning of life abound. Church attendance is up. Most denominations are growing in numbers. (From 1975-1981 only the Uniting Church showed a decline in numbers.) Attendance at church schools is booming.

In the past in Australia there has very much been the feeling that the religious dimension is under control — along with all those other things which are "all right". This feeling is fundamental to the established Anglican view and provides the freedom to be laid back or a mower within the church. Australians generally don't like such views mucked with.

For instance, the recent rejection of the idea of the ordination of women by the Anglican General Synod cuts against the assumption that everything's all right with religion, because it goes against the fundamental Australian sense of fair play.

And that's why there has been such a ground swell of reaction against that decision, even from people who are not normally active in the church. It's also why, in the Australian context, the arguments put against the ordination of women come out sounding as hysterical as they do.

What's happening in Australia now — and I don't know how things are going to work out — is that to an increasing degree religion is regarded as an option. In the '50s you didn't opt for it, it was just an accepted part of life.

But in choosing a particular church, people expect to have more say in it. And if you opt for something, you can always opt out of it.

Those Christian groups which are confident and unashamed of their faith, and present that faith in a positive, affirming fashion seem to be growing. Liberal, washed out, secularised Christianity is waning. The feeling is that Christianity is much more than social action.

In the near future churches will tend to move to emphasise the mysterious and transcendent. They will continue to move away from social issues, seeing their mission as attending to things eternal.

The two largest Christian religious groups in Australia are the Anglicans and the Catholics. Taken together these two groups comprise over half the population and two-thirds the Christian population.

This demographic characteristic makes Australia very different from the UK and New Zealand, where Anglicans alone make up more than 60 per cent of the population, and also from Canada where the Catholics are the largest group followed by the United Church and then Anglicans.

These facts of religious composition give markedly different flavors to these societies, which must be considered when comparing them.

Catholics and Anglicans — both accounting for about 26 per cent of the population — will continue to hold up half the sky in Australia. By the 1986 census it is anticipated that Anglicans will be surpassed by Catholics as the largest single religious group in Australia. This is due primarily to differences in migration and fertility between the two groups.

In fact, the Orthodox churches could well become the third largest church block in Australia in the near future. They have grown from almost nothing in 1947 to three per cent in 1981. And it seems that a high proportion of those people who did not state their religion in the 1981 census are Orthodox adherents whose ethnic origins did not prepare them to answer questions about religion easily. They had a high rate of church attendance.

It's hard to measure the influence of the church in Australia because the only time it becomes apparent is when the church vehemently opposes general societal views. I believe the future for religion in Australia will be no more bleak than the past has been golden.