THE NEW ZEALAND
MATHEMATICAL SOCIETY (INC.)

NEWSLETTER

CONTENTS

Number 46 **August 1989** **ISSN 0110-0025**

PUBLISHER'S NOTICE

The Newsletter is the official organ of the New Zealand Mathematical Society Inc. This issue was assembled at the University of Auckland and offset printed in Dunedin. The official address of the Society is:

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However, correspondence should normally be sent directly to the Secretary:

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Prof D A Nield	Engineering Science (University of Auckland)
Dr J Rayner	Mathematics and Statistics (University of Otago)
Mr G J Tee	Mathematics and Statistics (University of Auckland)

LOCAL NEWS

DSIR

AMD, Wellington

Roderick Ball now has a permanent staff position. Jocelyn Dale will return in mid-September, to work part-time. After attending the International Statistical Institute conference in Paris in early September, John Maindonald will spend four months at Rothamsted Experimental Station (Harpenden, near London), working on the Genstat statistical system.

Mark McGuinness

UNIVERSITY OF AUCKLAND

Mathematics and Statistics

Since Gordon Hookings retired (as Associate-Professor) in 1986, he has been very active in work for the NZ participation in the International Mathematical Olympiads. He was the deputy leader of the NZ team which competed in the 29th Olympiad at Canberra in 1988. In the 1989 Queen's Birthday Honours, Gordon was awarded the MBE.

Professor Paul Halmos, now based at the University of Santa Clara in California, toured New Zealand for two weeks on his way to the Australian Mathematical meeting at Macquarie University. Members of the Department met him at the Hafners' home on June 17th, and on his return to Auckland he gave two seminars on June 29.

Kevin Burrage has gone on leave to the University of Liverpool. Ivan Reilly delivered an invited address at the Oxford Symposium on General Topology and Applications, at Oxford in June. John Butcher has attended conferences at Dundee, London, Cambridge and San Diego in June and July. Nick Wormald delivered an invited address at the Combinatorics Conference at Brisbane in July. Professor Glen Anderson (University of Michigan, East Lansing) came to the Department in May for 3 weeks to work with M. K. Vamanamurthy. Dr. Tom Shively, from the University of Texas at Austin, is visiting the Statistics Unit for the 2nd term. He is involved in teaching the statistics paper 26.485 on stochastic processes. Malcolm Pullan has been awarded the Rutherford Research Studentship at Trinity College, Cambridge. He will leave in September, to work for a Ph.D. on algorithms for infinite-dimensional linear programming.

Seminars

Dr. John Rayner (University of Otago), "Hierarchical covariance matrices."
Dr. Hamish Spencer (University of Waikato), "Models for the maintenance of genetic variation."
Professor Paul Halmos (University of Santa Clara), "You think you've got problems!", and "Cosets, spinsters, clusters and the Schröder-Bernstein Theorem."
Dr. Tom Shively (University of Texas, Austin) "An analysis of the long-term trend in ozone levels using extreme-value theory."
Dr. Roy Mathias (Cornell University), "Inequalities associated with semi-definite matrices."

Analysis-Topology Seminars.

A series of seminars on analysis and topology has been organised, with the following seminars delivered so far this year:

Dr. Simon P. Fitzpatrick (University of Auckland), "Differentiability in Banach spaces", and "Differentiability and sub-differentiability."
Dr. Ch. Konstadilaki (University of Thessalonika), "On closure spaces."
Dr. Dragon Jankovic (University of Auckland), "Resolvable spaces."
Professor Lo Yang (Mathematical Institute, Beijing), "The Bieberbach conjecture", and "Some recent work in complex analysis."
Dr. Gaven J. Martin (University of Auckland), "On discrete Möbius groups", and "Aspects of the geometry of hyperbolic manifolds."
Dr. M. K. Vamanamurthy (University of Auckland), "Some distortion theorems in the spherical metric", and "Elliptic equations and quasiconformal mapping."
Dr. Jorgen Harmse (University of Texas, Austin) "On 'Lebesgue space' estimates for the wave equation."

G J Tee

Engineering Science

The Department of Theoretical and Applied Mechanics has been renamed the Department of Engineering Science. This does a bit more justice to our workers in the OR area and removes the anomaly between the name of the department and the engineering course for which it is responsible.

Dr Tony Richardson, from the School of Mathematics, University of Bristol, is spending the months of July and August with us. His interest is in the interactions between fluid dynamics, electromagnetism and thermodynamics in an industrial environment, and especially in electrothermal convection. Roger Nokes and his co-author Ian Wood (Civil Engineering, U. Canterbury) have been jointly awarded the Harold J. Schoemaker Award by the International Association of Hydraulic Research for the best article published in the Journal of Hydraulic Research during 1986-88. Julie Falkner, David Bullivant and Tim Robinson all had a Ph.D. conferred at the May graduation ceremony. Margaret Blakeley has a daughter and is taking some time off accordingly. Susan Byrne and Ian Collins attended the Mathematics Colloquium at Massey in May.

Seminars

A/Prof.D.A.Nield (T.A.M.) "Thermal convection in Benard-Hadley Problems".
Prof. K.L. Johnson (Engineering, U. Cambridge) "The rheology of lubricants at high contact pressures".
K.Regenauer-Lieb (Geology) "Plasticity theory applied to continental deformation".
Prof. I.F. Collins (T.A.M.) "The resolution of some paradoxes in the mechanics of granular media".
Dr. S. Byrne (T.A.M.) "A new variable method for unconstrained minimization".
Dr A.F. Collings (CSIRO Div. Appl.Phys.) "Dracula goes high-tech".
Prof. F.S. Hillier (Stanford U.) "The role and application of ceiling points in general integer linear programming".
D.J. Robb (U. Calgary) "Markovian model for procurement of prescribed sizes".

D A Nield

UNIVERSITY OF CANTERBURY

Mathematics

A sad loss for the department was the recent death of Brent Wilson. Brent was on sabbatical in Cambridge when he died suddenly. We will miss his enthusiasm, his sense of humour and his concern for maintaining high standards of scholarship.

Peter Waylen returned from his sabbatical year at the end of April. He had visited Cambridge, Waterloo, and Texas at Austin during his time away. Also returned to the department, but after shorter absences, are Alan

McInnes and Roy Kerr. Graham Wood left for his sabbatical during May. He will be spending most of his year at Madison. Richard Brookes recently completed his Ph.D. under Alan McInnes, and has gone in search of some OE. We wish Richard well in whatever he chooses to do. Some of us will miss his expertise in "Publisher", while others will miss his skill as a tutor.

Seminars

Professor Paul Halmos, "Some questions about the algebra and analysis of Hilbert space that I wish I knew the answer to", and "How to gamble if you must."
Professor George Duff, "Derivative estimates for the Navier-Stokes equations in a three-dimensional region."
Mark Hickman, "Differential forms, Newman-Penrose and general relativity."
Richard Brookes, "The local behaviour of the quadratic Hermite-Pade approximation."
Chris Price, "Semi-infinite programming."

J Hannah

MASSEY UNIVERSITY

Mathematics and Statistics

The first workshop of Massey's Quantitative Problem Solving Consultancy is to be held on 14 and 15 August. Formed in 1988, the QPSC is intended to make available to business, government and industrial users a mix of problem solving skills in mathematics, statistics, technology and computing. Its work was acknowledged by the Fulbright Foundation, which has made available funds for a Visiting Fulbright Professor to assist QPSC for a three month period in each of 1989, 1990 and 1991. The first Fulbright Professor is Stavros Busenberg form Harvey Mudd College, Claremont, California, who comes with a wealth of experience from the Claremont Mathematics Clinic. Stavros's presence is proving a great boon to the many differential equations enthusiasts in the Department—it's a shame he has such a relatively short time here.

In the last year or so we have begun to venture into extramural postgraduate teaching, with the Diploma in Applied Statistics (now well established) and now the Masterate program in Mathematics, which started this year with two papers and eight students. Additional papers will be offered in the course of the next couple of years.

Congratulations to "Ganes" Ganesalingam, who was recently elected a Fellow of the Royal Society (London). Congratulations also to Ingrid Rinsma on her appointment at Waikato, though we are very sorry to see her go; and to Mike Steel on completing a fine Ph.D. on combinatorial problems related to evolutionary trees.

Graeme Wake nipped off to Indonesia in June to give an invited address at the South-East Asian Mathematical Society 1989 Regional Conference, while Mike Hendy was invited to speak at the second conference of the International Federation of Classification Societies, held in Charlottesville, Virginia, again in June. Both enjoyed the academic activities, but returned home complaining bitterly about the heat!

We have had a number of short-term visitors recently, whose presence is reflected in the list of seminars.

Seminars

Tim Swartz (Simon Fraser), "Posterior probability and conditional confidence."
Peter Hughes (P.N. Teachers College), "New directions in teaching of mathematics in forms six, seven and stage one."
Lo Yang (Academia Sinica), "Some basic problems in complex analysis."
David Robinson (Canterbury), "On interpolating integer characters on an evolutionary tree."
Paul Halmos (Santa Clara), "Fifty years of linear algebra—a personal reminiscence."
Stavros Busenberg (Harvey Mudd), "Case studies from the Claremont Mathematics Clinic."
George Duff (Toronto), "Derivative estimates for the Navier-Stokes equations in a three-dimensional region."
Clyde McGilchrist (NSW), "Generalised mixed models."
Ian Joliffe (Kent), "Some recent ideas in principal component analysis—rotation and influence."
Malcolm Faddy (Otago), "Phase-type probability distribution and applications."
Jeffrey Hunter (Auckland), "Generalised inverses and their application to applied probability problems."
Katherine Heinrich (Simon Fraser), "Dudeney's Round Table Problem."
Brian Alspach (Simon Fraser), "Hamilton cycles in vertex-transitive graphs."

M R Carter

OTAGO UNIVERSITY

Mathematics and Statistics

Professor Derek Holton was overseas for the month of July. He left on June 30 for the British Combinatorial Conference in Norwich. From July 7 to 11 he worked with Professor John Sheehan in Aberdeen. Then it was off to Hanover for the International Mathematical Olympiad. Derek returned home on July 27. In his absence Professor Vernon Squire chaired the department.

Professor Zhang Ke Minh from Nanjing University has been visiting us from April. His interests are in Combinatorics and Graph Theory.

Since the previous Newsletter your Newsletter correspondent has crossed the Tasman in both directions. I visited my friend John Best at CSIRO's IAPP Biometrics Unit in Sydney. Then, on the way home, in Auckland, Wellington and Christchurch I talked to school teachers about the Seventh Form Mathematics with Statistics project. At Auckland, Waikato, Victoria and Canterbury universities I also talked about some of my recent research. Hopefully the news from these centres will contain glowing reports of stunning seminars. On July 12 (tonight) I will give a teleconference to Seventh Form students and teachers in the deep south. This will again be about the Mathematics with Statistics Project. Although the topic isn't novel, the medium is (at least to yours truly).

In addition to the talks reported below, Mr Bernie Higgins, National Mutual's Manager of Corporate Business Consulting Services, talked to prospective actuarial students on July 14.

Seminars

Robert Sulanke (Boise State University), "Counting restricted lattice paths." (30/3/89)
Professor Yang Lo (Academia Sinica, Beijing), "Some basic problems in complex analysis" (6/4/89) and "Exceptional values of meromorphic functions." (12/4/89)
Katherine Heinrich (Simon Fraser University), "Latin squares and graph decompositions." (7/4/89)
Brian Alspach (Simon Fraser University), "Long paths and cycles in symmetric graphs." (11/4/89)
John Rayner (University of Otago), "Thank you Allyson." (13/4/89)
Saunders MacLane (University of Chicago), "Graph Theory." Open Lecture. (13/4/89)
Professor K L Johnson (University of Cambridge), "Shear behaviour of lubricants in highly loaded contacts." (21/4/89)
Laimonis Kavalieris (University of Otago), "Estimating rational functions." (27/4/89)
Marijke van Rossum (La Salle University, Philadelphia), "A summation formula for dk(n) on consecutive integers." (2/5/89)
Bryan Perry (Department of Surgery, University of Otago), "When does a novice become an expert?" (15/6/89)
Paul Halmos (Santa Clara University), "You think you've got problems?" (27/6/89) "Fifty years of linear algebra—a personal reminiscence." (28/6/89)
Malcolm Faddy (University of Otago), "Phase-type probability distributions and applications." (6/7/89)
Professor Satvrow Busenberg (Claremont Graduate School), "A model for the transmission and persistence of AIDS in a heterogeneous population." (11/7/89)

John Rayner

UNIVERSITY OF WAIKATO

Mathematics and Statistics

Ingrid Rinsma has taken up her position as lecturer in the department. Her fields are graph theory and operations research. We now have three women among the lecturing staff and three women D.Phil students—equity is on the march!

Professor Douglas Bridges has arrived and has been appointed head of department for the next four years. His IBM PC compatible has also arrived but has not yet been given so senior an appointment. It does run Macsyma however when used as a terminal.

Heather Rae is recovering well from a recent operation and has resumed her duties. A recent comment: "Learning for Life is so depressing I would prefer to go back on sick leave".

Ian Urch has left for one years study leave at the University of Adelaide. We wish him well.

Vladimir Drobot has returned to Santa Clara University after a period of leave and tramping. Grant Keady from the University of Western Australia has taken up a two year research fellowship in the Mathematical Software Project. [See the notice later in this Newsletter.] Terry Robb is off to Monash University to begin a Post Doc in the Applied Mathematics Department.

John Turner and George Schaake have discovered a new technique for solving diophantine equations which they report is soon to set the world back on its ear with suprise and delight: "..we have done our best to check it out, and we are sure that some of our tools are indeed new. More our overall approach appears to be completely original. Finally, we claim that our discoveries are not merely of historical interest, but will lead to a re-examination of the central problems of quadratic diophantine analysis."

Seminars

Sir Michael Atiyah (Oxford): "Knots and braids.", "Determinants of linear operators.", and "A survey of 4-dimensional manifolds."

J C Turner (U Waikato) and G Schaake (Waikato Polytechnic): "A new theory of braiding."

B Garner (Dalhousie and U Western Australia): "Random effects in generalized linear models."

P Danaher (U Waikato): "A log-linear model for predicting magazine audiences."

A Scott (U Auckland): "Analysis of correlated ordinal data with application to data on retinopathy in the eyes of diabetics."

J Rayner (U Otago): "Heirarchic testing for equality of covariance matrices, smooth tests of goodness-of-fit, and tests used in taste-testing."

N John (W Centre Applied Statistics): "Construction of block designs using mathematical programming."

A D Sneyd (U Waikato): "Current sheet formation in force-free magnetic fields."

H G Spencer (U Waikato): "The maintenance of genetic polymorphism."

P R Halmos (U Santa Clara, California): "You think you've got problems?." and "Cosets, spinsters, clusters and the Schröder-Bernstein theorem."

T Shively (U Texas, Austin): "An analysis of the long-term trend in ozone data from two Houston monitoring sites."

Kevin Broughan

VICTORIA UNIVERSITY

Mathematics and Statistics

This report covers eight months, not the usual four, because your correspondent was foolish enough to trust electronic mail: a contribution for the previous Newsletter was sent before the deadline but arrived several weeks after it!

We are glad to welcome: Leigh Roberts as Senior Lecturer (financial mathematics) from Australia via the London School of Economics; Stephen Glasby as Lecturer (computational group theory) from Sydney; Stephen Legrand as Post-doctoral Fellow (recursion theory) from Penn. State via MIT, Loyola U. Chicago, and Auburn, Alabama; Michael Louie, Simon McLay and Mark Walkington as Teaching Assistants, all three of whom have been students at VUW, and Mark was a Teaching Assistant before going to Teachers' College last year; and Donna Hema and Inge Renner as Secretaries in Rankine Brown and 42 Kelburn Pde. respectively.

Visitors have included Sir Michael Atiyah, (UK, pure mathematics), Sir Wilfred Cockcroft, (UK, reform of mathematics teaching), Paul Ressel (West Germany, probability theory), Gunter Warnecke (West Berlin, meteorology using satellite imagery), Rolf Turner (Canada, time series), Mike Moore (NZ Oceanographic Inst., time series), Saunders MacLane (USA, algebra), John Kessler (USA, fluid dynamics) and Paul Halmos (USA, pure mathematics.)

We were very sorry to lose Katherine Smith who had been a Secretary in the Department for two years. She went to Sydney.

Megan Clark, Peter Donelan and Tony Vignaux returned from their sabbaticals in the long vacation; Tony is now Chairperson of ISOR and Megan is Director of the VUW Mathematics Education Unit. John Harper went to the Maths.-in-Industry Study Group at Monash and the Australian Applied Mathematics Conference at Ballarat in February; Rob Goldblatt went to Santa Clara, Calif., and Rod Downey to Heidelberg, Germany in March. David Vere-Jones is in Australia at their Mathematical Society conference at the time of writing. Lindsay Johnston ran a successful two-day session on mathematics for some 40 senior school pupils from the Wellington area in the May vacation. Mark Bebbington, a Teaching Assistant last year, is now doing a Ph.D. under Peter Whittle in Cambridge. Jim Ansell is starting a seminar series in mathematical geophysics. The Department has acquired three HP workstations and is gradually accumulating software for them. Stephen Glasby is in charge. The extensive renovation of 42-44 Kelburn Parade is almost complete.

J F Harper

NEW COLLEAGUES

With this issue we start a series of profiles of new mathematician appointees at New Zealand academic and other institutions. Local Correspondents at each institution have been invited to contribute material on new appointees, and what follows comprises the replies received to date. It is intended by this means to introduce new appointees to the NZMS membership.

Gaven Martin

Dr Gaven Martin returned in 1988 to the Department of Mathematics and Statistics at the University of Auckland as a Lecturer in Pure Mathematics. His research has mostly been concerned with geometric function theory and geometric group theory.

Gaven was born in 1958. He studied at the University of Auckland, where he graduated B.Sc. with Honours (1st class) in 1980 and M.Sc. (with distinction) in 1981. He was awarded a Fulbright scholarship and a Horace H. Rackham Fellowship for study at the University of Michigan, where he graduated as C.Phil. in 1984 and Ph.D. in 1985. He won a Finnish Government Scholarship from the University of Helsinki and also an Alfred P. Sloan Prize, both in 1985. He was then a J.W. Gibbs Instructor at Yale University, and a Fellow of Saybrook College at Yale, for two years before taking up his appointment at the University of Auckland.

GRANTEE REPORTS

SHARLEEN FORBES

Sixth International Congress on Mathematical Education, Budapest July 27-August 3, 1988

Unfortunately my first impressions of ICME-6, after arriving hot and dusty from customs and being ripped-off by a local taxi-driver, were formed as I waited with several hundred other people in long queues while officials tried to get their swept-up computerised registration system to function. A drink or even a reasonable number of chairs would have been appreciated. This first evening was a distinct contrast with the following night's superbly orchestrated (literally) opening at the Hungarian National Gallery where we ate royally and enjoyed moonlit views of the plains of Pest across the Danube.

As seems to be usual with international conferences, the quality of organisation varied. But the daily newsletters were excellent, and the nightly Happy-Hour was a feature which not only supplied enough free Hungarian nibbles and drinks for many of us to forgo dinner but also provided a meeting place and venue for informal and often most stimulating discussions.

The streaming of speakers can never be to everyone's satisfaction, but I did find the assumption that one would wish to participate in the one Theme or Action group for the whole week rather daunting. Physical distances and timing made it difficult to move between sessions. This was of particular personal annoyance when the only sessions on statistics teaching ran concurrently with the International Organisation of Women in Mathematics Education (IOWME) sessions on gender issues. Is there a message here? The comment was made in one presentation that "the current push towards statistics was coming more from politicians than mathematicians or teachers of mathematics", and certainly I saw little evidence of a push towards statistics at this conference. The sessions on gender differences were amongst the most popular of the conference—apparently a sharp change in attitude to the 1979 ICME-3 conference where IOWME was born. Unfortunately, the best of these were often tucked away in one of the Theme groups or happened upon by chance in the Short Oral

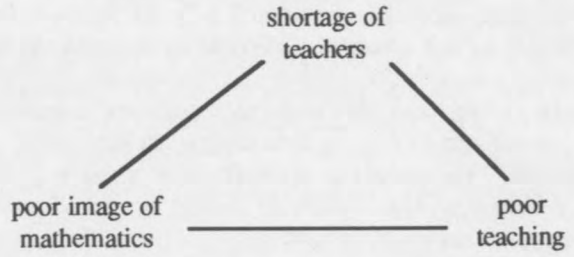
Communications. Canadian Gila Hanna and others expressed the fact that different countries and especially different cultures are not experiencing the same order or even direction of gender differences in mathematics performance. This must surely and finally discredit the belief that these differences have innate or genetic causes.

While I didn't really come to grips with the concept of ethnomathematics, there were several excellent papers on ethnic differences in mathematics performance including that of Steve Rhodes on "People's Education in Mathematics: A Developing South African Revolution". The performance differences between "black" and "white" were alarmingly similar to those between "Maori" and "pakeha" in New Zealand. However our general concern in this area was made evident by papers such as Andy Begg's "Mathematics, Maori Language and Culture."

One of the highlights of the conference was a special day organised by the International Commission on Mathematical Instruction (ICMI) which covered cultural influences in/on mathematics education, society and mathematics interactions, and institutionalised mathematics education.

I was interested in the current perception of megatrends in mathematics curriculum development expressed at the plenary panel discussion for the Secondary School Action Group. These included "a rebellion against formalised content and process", more applications-based mathematics and use of technology whenever possible, "a need to relax difficulty and widen scope", and concern at the "lack of match between technological change (1 year) and curriculum change (10 years)". "Problem solving" seems to be the catch-phrase of the 1980's in terms of mathematics education.

There was a general acknowledgement at this conference of the need to find ways of making the classroom a more stimulating learning place, to make assessment itself contribute to the learning process and to break the cycle



that the majority of attending countries face.

At the end of the conference I was excited but mentally exhausted, and I was very grateful for the thoughtfulness of the organisers in arranging free public transport anywhere within the city for all participants. A day's random walking around Budapest was much appreciated.

Thank you to the New Zealand Mathematical Society for its assistance towards my expenses.

Sharleen Forbes
MAF, Wallaceville

NOTICES

MEETING OF THE HEADS AND CHAIRPERSONS OF DEPARTMENTS OF MATHEMATICS AND RELATED SUBJECTS

Massey University, 17 May, 1989

Following the visit of the first Forder lecturer, Professor EC Zeeman, in 1987, it was proposed that the heads and chairpersons of departments of mathematics and related subjects in the New Zealand universities should meet on an annual basis to share ideas and concerns. The first such meeting was held during the Colloquium in Hamilton in May 1987 and the second in Wellington in August 1988 (there was no Colloquium in New Zealand in 1988). At these meetings participants discussed matters of mutual concern and agreed to share information, particularly about resources allocated to the subject in New Zealand universities. Each of the meetings has been well-attended, though this year, for the first time, one of the departments was not represented. At this year's meeting it was agreed that a report should be written for the Newsletter to enable the wider mathematical community to be acquainted with the existence and content of these meetings, and that this should happen on a regular basis.

This year's meeting was attended by the following people: Professors Ian Collins (Engineering Science, Auckland), David Gauld (Mathematics and Statistics, Auckland), Rob Goldblatt (Mathematics, Victoria), Derek Holton (Mathematics and Statistics, Otago), John Turner (Computing and Mathematical Sciences, Waikato) and Graeme Wake (Mathematics and Statistics, Massey). Professor Ahuja (University of Papua New Guinea) also attended for part of the meeting.

With the end of David's term as Head of Department coming at the end of this year it was agreed that the informal way in which he had organised these meetings in the past two years be replaced by a more formal structure. In general there will be an annual meeting held at the same time as the Colloquium and the head or chairperson of the host department should chair this meeting. Accordingly, Graeme took the chair. It was also agreed that David continue to act as secretary until the meeting next year.

It was suggested that the list of people invited to attend the meeting should be widened either by inviting each head or chairperson of department to nominate a further participant or else to invite automatically all relevant professors.

It was agreed that we should approach the New Zealand Mathematical Society, the New Zealand Statistical Association, the Operations Research Society of New Zealand and the New Zealand National Committee for Mathematics with a view to setting up a working party to consider the funding of mathematical sciences in New Zealand universities. It was agreed that David and Rob should represent this group on such a working party.

The group has maintained, and updated annually, a document listing resources enjoyed by the Departments; this document presently includes information on staffing (both academic and non-academic) and computing equipment. To assist the working party, it is intended to extend the information listed on the document to include other resources such as total departmental grants (including running grants and salaries) and space allocation compared with the situation in mathematical departments of universities in other countries and in other departments in New Zealand universities. An article by EC Zeeman in the *Bulletin of the London Mathematical Society*, v.23, #8,9 is a good reference document for the situation in mathematics within British universities.

It is felt that we should aim to have the staff:student ratio improved to the extent that it is considered to be a semi-laboratory subject like computer science, geography and psychology.

In the discussion of resources, it was noted that the inadequacy of resources allocated to mathematics in all of the universities continues to be a significant problem. Indeed, staff:student ratios have deteriorated at all universities except one since last year's document was prepared.

There was discussion of administrative developments in the universities, basic skills courses and mathematical education. Several universities are offering substantial programmes in each of the last two named areas.

David Gauld

1990 NEW ZEALAND MATHEMATICS COLLOQUIUM
University of Auckland, 13-16 May, 1990

The 1990 Colloquium will be held at the . Anyone who wishes to suggest speakers to be invited to that Colloquium is asked to notify Garry Tee, the Secretary of the 1990 Colloquium Committee, at the Department of Mathematics and Statistics, University of Auckland.

THREE YEAR LECTURESHIP
Statistics Unit, Department of Mathematics andStatistics
University of Auckland

This position is available as a limited-term appointment for a period of three years.

Applicants should be suitably qualified with academic or professional research and teaching experience in one or more of the areas of applied probability, operations research and data analysis. However, applicants with an interest in any area of applied statistics are encouraged to apply. As a member of the Statistics Unit, the appointee will be expected to be available for statistical consulting in his or her area of expertise.

The present salary scale for a Lecturer is $35,000 per annum rising to $42,500 per annum by seven annual increments, then to $46,000 by a further three.

The starting date is 1 February 1990.

The closing date for applications is 1 September 1989.

Further information about this position may be obtained from the Head of the Statistics Unit, Professor G.A.F. Seber, Telephone 64(09)737999 Ext 8745, Fax 64(09)737934. University of Auckland, Private Bag, Auckland, New Zealand.

THE SENAC MATHEMATICAL SOFTWARE FROM WAIKATO
By Grant Keady

I have taken leave-without-pay from the University of Western Australia to take up a two-year research fellowship to join Kevin Broughan's mathematical software project at the University of Waikato. Kevin asked me to write a popular article, as a new user, of his mathematical software system, called SENAC, before I became too familiar with all the technical details—and thus able to accidentally inflict them on readers. What attracted me to come to Waikato to work on SENAC is that it addresses a problem that I see as central to improving the way scientists can undertake numerical computing, that is providing symbolic computing front ends to major numerical libraries. SENAC/NumLink works with the NAG library, and I will describe that later.

Kevin Broughan gave a talk about SENAC at the May meeting of the N.Z. Mathematical Society. If you already know all about SENAC, feel free to skip straight to the final paragraph of the article questionnaire after the references, etc.

There are two extremes of mathematical computations. The more familiar to most scientist and applied-mathematician users is where the computer is involved with tasks like finding a numerical approximation to an integral, or to a solution of a differential equation, which cannot be evaluated explicitly. Such work involves numerical approximation: it is not exact. The opposite extreme, "symbolic computation", has, until relatively recently, been less familiar and will be described soon. One of the many and varied uses of symbolic computation is to generate programs for subsequent numerical computation. Such automatic production of the code removes much of the drudgery of routine programming chores from numerical computing.

Symbolic computing packages are basically concerned with manipulating, exactly, mathematical objects such as, to name just one particular instance, polynomials with rational coefficients. The package might be asked to factor, over the rational numbers, a polynomial, which the user has already specified to the computer and called **pol,** say, using a command something like **factor(pol);**. Because of the computers' "patience and accuracy" the calculus manipulative abilities of the main packages are now better than those of most professional mathematicians. Integration in finite terms (when it can be done!) is one of the success stories of the past two decades. Work continues on building more special function knowledge into some of the systems. Many engineering and physics problems involve solving differential equations. An ordinary differential equation which arises in a similarity solution of the heat equation is:

$$y'' + 2\,x\,y' + 2\,y = 0\,.$$

Here the prime denotes derivative with respect to x. It is still a bit messy telling a symbolic computation system about this. With the Maple system, widely used not only by researchers but also by undergraduates at many universities, including my own at University of Western Australia, one says

```
dsolve(diff(y(x),x,x) + 2*x*diff(y(x),x) +2*y(x)=0, y(x) );
```

$$y(x) = -1/2\,\exp(-x^2)\,(-2\,C + C1\,Pi^{1/2}\,I\,\mathrm{erf}(I\,x))$$

Thus the system knows about the error function. Here the I is the imaginary unit, $I^2 = -1$, and C and C1 are the arbitrary constants associated with the general solution. In fact, the solution, though correct, is not how a typical mathematician would like to see it! In the further work below f is just a different way of representing the solution y(x).

```
f:= exp(- x^2)*(C - C1*sqrt(Pi)*I*erf(I*x)/2);
g:=exp(x^2)*f;
h:=simplify(g);
diff(h,x);
evalc(");
```

$$C1\,\exp(x^2)$$

The last line indicates another way we could write the error function term in terms of an indefinite integral.

Exact closed-form solutions are sometimes useless: when they run to ten or more pages, for instance. The major efforts and advances in differential equations this century, starting with Poincaré's work, have concerned the *qualitative* behaviour of solutions. Present symbolic packages know nothing of this work, and can only do "nineteenth century" manipulative mathematics, although they do this very well. The modern

approach to differential equations involves theorems on their qualitative behaviour and, if one needs numerical approximations, one finds them with well-established numerical methods. The modern approach works with all differential equations, not just the small class which happen to have closed-form exact solutions. (The main use of closed-form answers capabilities of symbolic packages may well be not so much to solve new problems, though this will continue to happen, but to help a wider range of users—engineers and physicists—to solve, easily and efficiently, relatively standard problems with closed-form solutions.)

Symbolic computation has a history almost as long as computers. However a substantial reduction in the cost of computing was needed before packages became widely used. There are now four general purpose systems in widespread use: REDUCE, MACSYMA, Maple, and SMP/Mathematica. (Almost all universities have at least one of these systems. There are textbooks, at varying levels, for each of them.) Popular accounts and comparisons are available, e.g. Davenport [1988], Foster and Bau [1989]. There are also several more specialised systems, sometimes with special strengths in areas of physics such as general relativity, and, in the case of SENAC, in interfacing with numerical computation involving numerical libraries. Mathematica's special strength is in faster-than-average floating point computation and graphics.

Major development on symbolic computation packages started with the LISP programming language introduced in 1960. In the mid 60s an expatriate Australian, Tony Hearn, developed the first of the longer-lasting systems, REDUCE. REDUCE has been through several versions to reach its present state. It differs from most of the others in that the code is made available to the purchaser. This has encouraged library development and recent contributions to the system have come from many parts of the world, especially Britain, Germany, France and Japan.

MACSYMA is a very much bigger LISP system which grew during the 70s and was released for commercial sale in the early 80s. It is the only one of the above not to be now available on (what I would call) a microcomputer. Maple and SMP/Mathematica are written in C, but LISP like constructions occur in the intermediate language really used. [Incidentally, I believe that Maple is, at present, the best choice for smaller (1Meg) Macintosh computers.]

Besides Hearn's efforts, Australians have been involved in the related areas of modern-algebraic computations. Cayley is the world's best group theory system and is developed in and sold internationally from Sydney. Scratchpad is a package developed by IBM and only available on moderately large IBM machines and is available in Australia in Sydney.

The "classical" systems, REDUCE, MACSYMA, Maple, and SMP/Mathematica, are all designed to try to do the sorts of nineteenth century calculus manipulations that many engineers and physicists want to do. (However Maple has separate libraries for number theory, group theory and so on, and even on a small machine these can be useful, especially in teaching.) One thing that is noticeable in using them is that, if one asks them to do significant numerical computations, the first three of them are slow. Such computations are needed before any graphics can be done, for example. Indeed, REDUCE has resisted the temptation to put numerical evaluation of special functions and graphics into the main part of its system. Various add-ons are available. A far worse problem than the speed is accuracy and reliability. I have printout of an instance where an early version of SMP has got the numerical work wrong, with errors of about 15%. All the systems provide the facility to output a single expression in a style suitable for including in a FORTRAN (or C) program for numerical computation. There have been many refinements to this aspect of the symbolic computation packages since I first used it (from REDUCE) in 1981—the main improvement being that (at least with GENTRAN from REDUCE, and **fortify** in SENAC) the packages can produce whole subroutines and not merely single statements and can "(partially) optimise" the code they produce for more efficient FORTRAN numerical work. Such code generation capabilities are in routine use: for a typical one of many recent examples, see Liggett [1988]. A typical use of the FORTRAN code writing abilities of any of the established packages is that the user (i) writes a short main program, usually of the form:

repeat
  read values of some variables, a;
  evaluate answer:= F(a);
  write answer
  until done enough

(ii) the functions F(a) having code produced by the symbolic computation package from the specification, always more natural than FORTRAN(!), given to the package by the user. (SENAC can do this and more as is described below.)

In the overwhelming majority of real problems there is no closed-form explicit solution: numerical approximation is inevitable. In virtually all partial differential equation problems arising from engineering (e.g. fluid mechanics or elasticity) mathematical existence proofs and numerical computations—once the code is written—are straightforward, but closed-form explicit solutions cannot be found. Unaided by separate numerical

computations, symbolic computing packages are close to useless in any general treatment of partial differential equation problems. A relatively simple partial differential equation problem, the torsion problem, is, with Ω a bounded domain in the plane, to find u defined on Ω such that

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = -1 \quad \text{in } \Omega$$

$$u = 0 \quad \text{on the boundary of } \Omega$$

(For examples of Ω, consider triangles or rectangles or, for a more elaborate domain, three rectangles joined to form an I shape.) Subroutines from standard numerical libraries, such as routine D03EAF from the NAG library, can solve the torsion problem in any domain (after the domain is prescribed to it). The present symbolic computing packages can do almost nothing towards solving this problem. One of the few things they can do unaided by numerical computation is the following. In certain very special domains exact closed-form solutions have been found and the symbolic packages can check them. The engineers also want to find the torsional rigidity

$$S = 2 \int_{\Omega} u .$$

Even when u is known in closed-form the torsional rigidity is not necessarily obtainable in closed-form, and even if it is, all the present symbolic packages are not good at evaluating definite integrals (as they don't know the usual third year complex variable material on residue theorems and so on). Reliable numerical integration is more likely to be achieved using a good numerical library than using routines which might be built in to any of the present packages.

Instances of wrong numbers from SMP have been mentioned. One way to reduce the chance of numerical errors, and to do the numerical computations efficiently, is to use one of the standard numerical libraries. The NAG library is probably the best general purpose numerical library in the world, and is in regular use at about four thousand sites through the world. There are many others of course, particularly in specialised areas. The scientific community gains through not having too many libraries though as it is better to have few but well-tested libraries than many less well-tested ones. The NAG library has sufficiently many users that it is economically viable to provide good documentation and a good on-line help system. There is also a NAG Graphical Library. There are regular updates to the library, thereby ensuring that worthwhile new algorithms can be included if demand warrants it. The NAG library is available on a range of machines: special versions of parts of it are designed to exploit vector-processing architectures.

SENAC is a program which enables a user (typically a mathematician, engineer or physicist) to use symbolic computation to set up and interactively access complete FORTRAN subroutines covering a very wide range of different numerical computations. SENAC stands for "software environment for numeric and algebraic computation". The NAG Numerical Library is available to SENAC through a package called NumLink.

I have used all the main general-purpose symbolic computation packages. Within a few days of my arrival at Waikato I had repeated some work I had done earlier in Maple. It was from a rather messy real problem from Alex McNabb at Massey. A preprint version is noted in the references. This exercise involved analytical differentiation and numerical solution of nonlinear equations. For the numerical solution SENAC/NumLink was very much faster than Maple.

Rather than inflict a messy example on the reader I will give just one simple example to illustrate how SENAC can simplify the coding for a NAG library user. Rather than choosing a differential equations example, consider simply the numerical integration of a given function f(x) over a given real interval [a,b]. In practice some experience of using the NAG library helps, but is not essential as the documentation is superb and the NAGHELP program gives on-line help. Suppose that after considering the behaviour of the function f(x) it is decided that a general purpose adaptive integration routine is appropriate. The appropriate NAG routine is D01AJF. The parameters needed to call this from one's FORTRAN (or C or Pascal) program form the following long list:

D01AJF(f, a, b, EPSABS,EPSREL, result,ABSERR, W, LW, IW, LIW, IFAIL)

(Although this is reasonably complex, some NAG routines are much worse, with thirty parameters!) Writing the FORTRAN code for the function f can also be quite a chore. SENAC simplifies all this. First one specifies to SENAC in a mathematically natural way the function f, and SENAC produces the FORTRAN code for it. Next it turns out that a number of the parameters in the NAG subroutine are related (and in a better language than FORTRAN it might be done better), for example **LIW=LW/8 +2** , and some of the parameters are for

workspace:

W is a working array of dimension **LW**,

IW is a working array of dimension **LIW**.

Although the simplification is partly achieved by some sensible choices of defaults (which one can over-ride if necessary) the SENAC function call is

d01ajf(f, [a,b])

and the answer comes back being called **result**. It is admitted that this is less mnemonic than the corresponding Maple (or similar Mathematica or Macsyma) command where something like

`evalf/int`(f,x=a..b);

will usually do the same job. The gains are (i) that the user can choose the integration routine appropriate to what is known about the integrand which leads to accuracy and speed gains, and (ii) the numerical calculation can, if desired, take place with no overheads associated with a symbolic package being resident in the computer's memory. Of course the real payoff in using SENAC is for larger numerical tasks than just a numerical integration. The ordinary differential equations and the partial differential equations chapters of the NAG library (D02 and D03 respectively) are examples where the payoff in using SENAC is substantial.

More realistic examples are now described. A user sometimes uses just one routine from the NAG library, for example to solve a two-point boundary value problem for a differential equation. A more usual situation is, I think, for several calls to the NAG library to be made. I haven't, until very recently, made it a hobby to interrogate NAG library users about their usage, so I'm now generalising on the basis of very few examples. In the only examples in published research that I know, several routines from the NAG library are used. Asking around in the Maths Department at Waikato for information for this article, I discovered that both Alfred Sneyd and I have published on problems in which nonlinear equations for unknowns u,v were solved, where the functions in the equations were definite integrals involving the parameters u,v in integrands involving special functions. This requires routines from NAG's Chapters C (for nonlinear equations), D01 (for integration) and S (for special functions). The references for these are Bardsley and Sneyd [1987] and Keady [1988].

Waikato is no longer alone in developing symbolic-numeric systems. Another group at the University of Bath in England very recently began to develop a somewhat similar system. See Dewar [1989]. The system from Bath will be called IRENA, Interface from REduce to NAg. IRENA will appeal to existing REDUCE users. Particularly if your site doesn't already have REDUCE, SENAC is likely to be very much cheaper, and stands alone, not requiring the purchase of any other symbolic computing program. Of course I expect and hope that the two systems, IRENA and SENAC/NumLink, when they are doing similar things, will feel similar to users. (REDUCE has, I think, a larger market share in Britain than in Australasia which might explain the different developments in the two places. REDUCE is particularly dominant in teaching in Britain. There are many more Macintosh computers in Australasia and Maple for the smaller Macs and Mathematica for the larger ones are the main sellers.)

At present SENAC runs on SUN3, VAX-VMS and micro-VAX-VMS computers. In the present version both the symbol manipulation and the numerical computation is done on the same computer. There are plans for VAX/microVAX-Ultrix versions.

I now want to guess what the world might be like 5 or 10 years into the future. Packages like Mathematica might succeed in combining graphical, numerical and symbolic computation better than REDUCE, Maple and Macsyma. If so, it might be appropriate to develop packages based on Waikato's present work where the separation between the symbolic and numeric work is even more emphasised. In this possible scenario, the symbolic computations might be displayed on one window or one terminal. When a numeric computation (and perhaps associated graphics) is requested it is envisaged that the results would displayed in a separate window or terminal. For numeric computations on a larger scale than might be appropriate to the workstation the numerical computations might run on specialised hardware: a vector-processing machine, for example. The specialised computing hardware need not be on the same campus as the workstation, merely somewhere on some convenient computer network. In the case of Australasia the network might be SPEARNET or some development therefrom. Sometimes there might be cost reasons, rather than machine size reasons, for the numerical library not to be available on all machines on a network, yet the preprocessor might be available on machines on the network but not having the particular library.

Returning to present-day realities, SENAC is a working program, but it would benefit from users who offered their criticisms, suggestions and assistance in locating bugs. Waikato University has set an inexpensive price for New Zealand sites with the NAG Library on SUNs or VAXes. I believe that people with some familiarity with any of the established general-purpose symbolic computation packages would find SENAC relatively easy to use. For such people I will provide a manual for "translation" of the commands in SENAC and their approximate equivalents in some of the other systems. We would like to receive well written, interesting case studies which we could circulate to other users. Should there be any demand, training courses could be provided at Waikato presumably in non-teaching periods. People at Waikato would try to offer user support, initially by e-mail, phone or ordinary mail. If this fails to solve a problem and it is necessary to offer-on-the-site assistance this might be possible provided the user was able to meet reasonable travel and accommodation costs of the person attempting the support service.

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Liggett, J.A. "Free surface flow—exposing the hidden nonlinearity." *Communications in Applied Numerical Methods*, 4, 509-516.

McNabb, A. and Keady, G. "Some explicit solutions of $-\Delta w=1$ with zero boundary data." Research Report of the Department of Mathematics, University of Western Australia, 1988.

Availability of products:

SENAC is distributed in New Zealand by the Mathematical Software Project at the University of Waikato.

The NAG library, and other products from NAG, are available in Australasia from: SIROMath, Head Office, 156 Pacific Highway, St Leonards, N.S.W. 2065, Australia.

REDUCE is from North Western Computer Algorithms, PO Box 1747 - Novato, CA94948, U.S.A..

Maple is from Waterloo Maple Software, 608 Weber Street North, Waterloo, Ontario, Canada, N2V 1K8.

Mathematica is from Wolfram Research Institute, PO Box 6059, Champaign, Illinois 61821, U.S.A..

Mac versions of Mathematica are distributed in New Zealand by Personal Computer Systems Ltd, PO Box 41158, Auckland, N.Z..

Macsyma is from Symbolics, Cambridge, Massachusetts, U.S.A..

If you have the NAG Library on a VAX or SUN we would like you to complete the following and return it to Kevin Broughan at Waikato.

QUESTIONNAIRE

1. Name: Address:

2. We will post you more information about SENAC if you wish. Do you want this information?

3 (a). Do you have research publications where the numerical work was done, or could easily be rearranged to be done, using the NAG library?

3 (b). Would you be prepared to re-work this and to write it up as a SENAC Case Study, with the Case Study being arranged as an example to help future users?

4. For Universities and Polytechnics. Does your institution have staff or students, either in Computer Science or in Mathematics, who can program in LISP and who would like to assist in the development of aspects of SENAC? (SENAC could, for example, be arranged as a front-end to other libraries, for example ELLPACK, or the NAG Finite Element Library, etc.. Some tasks are suitable for Honours or Postgraduate student projects.)

5. A "workshop on symbolic/numeric computation" (to be held at Waikato prior to the February 1991 Australian Applied Maths meeting near Christchurch) is under consideration. What items would attract your attendance?

Grant Keady
University of Waikato
(On leave from University of Western Australia)

BOOK REVIEWS

Topological and Uniform Spaces, by I. M. James; Springer-Verlag, 1987; ix + 163pp.

If you teach an introductory course on general topology to the non-specialist you will probably find this book very useful. It provides an outline of both the theory of topological spaces and the theory of uniform spaces. The relation between the two is well emphasised. The elements of the theory of topological groups are also skillfully incorporated in the text. Many related topics are developed in the exercises which occur at the end of the twelve chapters.

The author acknowledges in the Introduction that he purposely did not include many well known examples and counter-examples which are usually encountered in standard textbooks on General Topology, being of the opinion that they are not of first importance for the non-specialist. In our opinion, on the contrary, more examples would have been of greater value to non-specialists.

The book is well written and includes many illustrations. New concepts are always introduced with a proper motivation. In defining compactness the author uses a relatively unusual approach. (Definition 5.1 : The topological space X is compact if the second projection $\pi : X \times T \to T$ is closed for all topological spaces T). This is an arguable point of disagreement with the writer of this review who would prefer the standard approach in terms of open covers. However, this well-organised book is a useful addition to the literature on this subject.

Dragan Jankovic
University of Auckland

Geometry I and II, by Marcel Berger. Translated from the French by M. Cole and S. Levy. Universitext, Springer-Verlag, Berlin, Heidelberg 1987.

It is a pleasure to review this book, partly because I get to keep it when I am finished. It is a great source of geometrical knowledge.

Some books, such as almost any text on linear algebra, seem to have authors with only a passing knowledge of what they are writing about. Others, of which the pre-eminent example must be *Geometry and the Imagination* by D. Hilbert and S. Cohn-Vossen, are rich with the authors' insights. This book is in the second category and it steers a happy course between something like *Linear Algebra and Geometry* by J. Dieudonné which concentrates on the foundations of the subject and an intuitive book like Hilbert and Cohn-Vossen's.

Let me illustrate his approach with his treatment of the regular polytopes in 4 dimensions found in the first chapter of Volume 2. First, he has the revealing pictures of the 5-cell and 8-cell from *Geometry and the Imagination* but not those of the 16-cell and 24-cell. But he does have some of the projections found in H.S.M. Coxeter's books of the more complicated ones. Then he has Schläfli's Theorem describing the possible regular polytopes in all dimensions. His proof is sketchy, but not unacceptable because of that. The connection of all this to group theory is only hinted at, partly in what is called "A Cultural Remark". He also has "A Heuristic Remark" which is about a "principle, due to Thom: Rich structures are more numerous in low dimensions, and poor structures are more numerous in high dimensions." You can look on page 40 of Volume 2 to see what he means. Then he has a number of Notes detailing history and other facts about the subject and where they might be followed up.

The volumes are published in the Universitext series, but how they could be used as a textbook, I don't know, for most chapters contain enough to fill a course. He does suggest Chapters 8 and 9 for a freshman course on Euclidean geometry, Chapters 18 and 19 for a higher-level course on the sphere and hyperbolic geometry and Chapters 11 and 12 for a higher-level course on convexity from the geometric point of view. The origin of the book is a course given by the author at the University of Paris and "fifteen years of experience in preparing the geometry part of the orals in the Agrégation de Mathématiques, a competition to select the best high school teachers in France."

There are lots of figures, not very well labelled, but it is worth spending time browsing through them, even though you may never find what some are about—see Figure 9.11.1.2 (Pithecanthropus Geometricus) or Figure 12.5.6.2.3. What a numbering system!

Peter Lorimer
University of Auckland

Hamiltonian Methods in the Theory of Solitons, by LD Faddeer and LA Takhtajan; Translated from the Russian by AG Reyman; (Springer Series in Soviet Mathematics); Springer-Verlag, Berlin-Heidelberg-New York, 1987; ix + 592pp; DM 198; ISBN 3-540-15579-1

This book is a treatise on the application of Hamiltonian methods to integerable equations in one spatial dimension treated as classical field equations. The subject of solitons and their occurrence has been well covered in recent years. Equations exhibiting soliton solutions fall into the class of integrable equations. This book is divided into two parts. The first part deals with a thorough study of the non linear Schrodinger equation. This is at variance when a lot of introductory treatments proceed via the examination of the Korteweg deVries equation. Interesting features of the treatment of the non linear Schrodinger equation are:

(i) The use of the zero curvature representation instead of the usual Lax pair representation.

(ii) The treatment of the inverse problem based on the matrix Riemann problem of analytic factorisation of matrix valued functions rather than the traditional Gelfand Levitan Marchenkno equation.

(iii) The introduction of a Hamiltonian structure in terms of the so called r-matrix.

Among the arguments for examining the non linear Schrodinger equation are that in many respects it is simpler and more fundamental than the Korteweg deVries equation. The Hamiltonian formalism for the non-linear equation is more straightforward and simple. Also the non-linear Schrodinger equation has a natural quantum analogue. The second part of the book deals with the general theory of integrable evolution equations. This part of the text contains a study of further examples such as the N-wave model, the chiral field and the Laundau Lifshitz model. The Heisenberg ferromagnet equation, the Sine Gordon equation and the Toda Lattice equation are discussed in some detail. In the final chapter a Lie algebraic approach to the classification and analysis of integrable models is given. This is based on the concept of the r-matrix. These notions are also extended to lattice models. There are detailed notes and references at the end of each chapter. The references given are particularly useful as they provide a comprehensive bibliography of the Soviet literature.

The book uses classical analysis and avoids delving into full mathematical rigour as the authors believe this approach obscures the main development in the theory and its interrelation with other branches of mathematics such as the theory of the Lie groups. A second volume on the quantum r-method is promised.

This is a well-written book and I look forward to the second volume.

E.G. Kalnins
University of Waikato

Introduction to Analysis of the Infinite, Book 1, by Leonard Euler, translated from Latin by John D. Blanton, xvi + 327 pages, Springer-Verlag, Berlin, 1988. ISBN 3-540-96824-5.

Euler created analysis as a branch of mathematics with his great text *Introductio in Analysin Infinitorum*, published (in 2 volumes) at Lausanne in 1748. He set the style for modern mathematics, so that this is the earliest book on infinite series and products which can be read by modern mathematicians, without having to learn unfamiliar notation. The work had been translated from Latin into French, German and Russian, and now we have an English translation of Book 1.

Euler presented an enormous quantity of new material in this text, written with his customary clarity, but also with his customary standards of rigour concerning infinity, which are often alarming to a modern reader. Much of the book is devoted to infinite series and infinite products and to transformations between them. Euler occasionally acknowledged that some series diverged, but usually he blithely disregarded any considerations of convergence. However, he did explain that some series converged so slowly as to be unsuitable for computation.

The text treats functions mapping one or more real (or complex) variables onto one or more real (or complex) variables. The factorization of real polynomials into real linear and quadratic factors is treated, without anything resembling a proof of the Fundamental Theorem of Algebra. Continued fractions are treated in great detail, including consideration of multiple factors (linear and quadratic) in the denominator. Rational functions

are converted to infinite power series using the Binomial Theorem, which is asserted for general (rational) exponent without any proof. Applications are made to linear difference equations and to Daniel Bernoulli's method for numerical solution of polynomial equations.

Logarithmic and exponential functions are treated at length, including the computation of logarithms by the method of Briggs and Vlacq, using binary section with repeated extraction of square roots. Also, Euler showed how to use the power series for $\log(1+x)$ and for $\log((1+x)/(1-x))$ to compute natural logarithms of integers, and thence their decimal logarithms. A variety of series are developed, leading to the fundamental relation

$$e^{iv} = \cos v + i \sin v.$$

(Actually, Euler standardised the notation i for $\sqrt{-1}$ after publishing this book.)

His blithe usage of infinitely large and infinitely small quantities looks alarming to modern readers. For instance (in §125):

$$e^z = \left(1 + {}^{z}/_{j}\right)^{j}, \qquad \log(1+z) = j\left((1+z)^{1/j} - 1\right),$$

where j is infinitely large, so that (in §116) $(j-1)/j = 1$!

Euler extended the factorization of polynomials to factorization of infinite power series, producing his classic infinite products for various trigonometric, inverse trigonometric, exponential and logarithmic functions; and he then proceeded to apply Vieta's relations (for coefficients of polynomials) to those infinite series. With breathtaking audacity he inferred that, if n is even, then

$$1/1^n + 1/2^n + 1/3^n + 1/4^n + \ \ldots = A_n \pi^n,$$

where A_n is rational! (In Riemann's notation, $\zeta(n) = A_n \pi^n$.) Even Euler was not able to find out anything for odd n : indeed, it was not until 1978 that Apéry created a sensation by proving that $\zeta(3)$ is irrational. In a dazzling display of virtuosity, Euler converted $\zeta(n)$ from the infinite series over the positive integers to a product over the primes:

$$1/1^n + 1/2^n + 1/3^n + 1/4^n + \ \ldots = \left[(1-2^{-n})\,(1-3^{-n})\,(1-5^{-n})\,(1-7^{-n})\ldots\right]^{-1},$$

and he inferred that the sum of the reciprocals of the primes is divergent. (It follows that infinitely many primes exist. After Euclid's classical proof, Euler's was the second proof of that very deep theorem.)

Euler created the theory of partitioning of integers, based on the theorem that the coefficient of x^n in the power series expansion of

$$((1-x)\,(1-x^2)\,(1-x^3)\,(1-x^4)\ldots)^{-1}$$

equals the number of different ways in which n can be expressed as a sum of positive integers. He derived some profound results on partitions, for instance: "The number of different ways in which n can be expressed as the sum of m different numbers is the same as the number of different ways in which $n-m(m+1)/2$ can be expressed as the sum of the numbers $1, 2, 3, 4, \ldots m$".

This Book 1 ends with a chapter on continued fractions, including Euler's noteworthy continued fraction:

$$(e-1)/2 = \{0;1,6,10,14,18,22,\ldots\}$$

In §126 Euler asserted without proof that "it is clear enough" that π ®cannot be expressed exactly as a rational number", and there are some similar unjustified assertions in §105 concerning logarithms and exponentials. Euler occasionally cited the names of the earlier mathematicians Briggs, Vlacq, Wallis, Leibniz, Brouncker, deMoivre and Daniel Bernoulli—but he did not cite Roger Cotes (1682-1716) who had found many important results in analysis. In particular, Cotes invented the radian, and in 1714 he published (without proof) the fundamental formula:

$$\log(\cos\theta + i \sin\theta) = i\theta.$$

Euler's casual usage of infinity is displayed in his evaluation of some finite series as the difference between two infinite series, rather than evaluating the finite series and considering its limit as the number of

terms increases to get the sum of the infinite series. Euler's approach can be validated (but hardly justified) in some cases where the series can be shown to converge, as in §232. But, §258 purports to give the sum of the infinite series $s = \sin(a) + \sin(a+b) + \sin(a+2b) + \sin(a+3b) + \ldots$, which does *not* converge! The finite series $\sin(a) + \sin(a+b) + \sin(a+2b) + \ldots + \sin(a+nb)$, which is considered in §259, had effectively been found by Archimedes (in geometric form); but Euler found its sum by using his spurious sum for the infinite series and then subtracting from it the *equally* spurious sum of the infinite remainder series $\sin(a+(n+1)b) + \sin(a+(n+2)b) + \ldots$! Nonetheless, Euler presented such a profusion of riches that his contemporaries were understandably dazzled by his achievement, and they did not feel any need to look closely into questions involving infinity.

This English translation reads clearly, but there are some details which should be emended, as follows:

p.26: "$-a + b + 2c + d$" should be "$-2a + b + 2c + d$".
p.38: Euler has erroneously repeated the section number §46.
p.59: Omit the word "Since" (and likewise on pages 169 and 223).
p.67: "a quadratic in one variable" should be "a square of one variable"
p.79: "Vlasc" should be "Vlacq".
p.98: In log 7, the 21st-25th decimal places should be corrected from 54639 to 53527.
p.101: In π to 127 places, the 113th decimal place should be corrected from 7 to 8.
p.126: "a constant of the same form" should be "a constant of such form".
p.127: The four factors $((1 + 4x^2)/\pi^2)$ *etc.* should be $(1 + (4x^2/\pi^2))$ *etc.*
p.133: $[1 + v/(3\pi+g)]$ should be $[1 - v/(3\pi+g)]$.
p.135: $[1 + 2z/(2\pi+g)]$ should be $[1 - 2z/(2\pi+g)]$.
p.146: Insert the series: $5\pi^5/1536 = 1 - 1/3^5 + 1/5^5 - 1/7^5 + \ldots$
"equal exponents" should be "even exponents".
p.153: "cos yi - 1" should be "cos yi".
p.162: "ro" should be "ρ".
p.166: "a right angle" should be "half a right angle" (twice).
p.173: $[-{}^{8z}/_5 + z^2]$ should be $[1 - {}^{8z}/_5 + z^2]$.
p.233: "$P = 1/2^n +$" should be "$P = 1 + 1/2^n +$".
p.278: "up to 1024 lb." should be "less than 1024 lb.".
"up to 2048 lb." should be "less than 2048 lb.".
p.288: "$x = {}^1/_{2y}$" should be "$x = {}^y/_2$".
p.308: The continued fraction in line 4 should be:

$$x = \cfrac{\alpha}{b + \cfrac{\beta}{c + \cfrac{\gamma}{d + \cfrac{\delta}{e + \cfrac{\varepsilon}{f + \ldots}}}}}$$

p.315: The series in line 3 should be:
$$1 - 1/2 + 1/(2\times12) - 1/(2\times12\times30) + 1/(2\times12\times30\times56) - \ldots$$
p.319: "error in the hundred thousandth place" (!) should be "error in the 5th place".
p.325: "geometric progression" should be "arithmetic progression (after the first term)".
p.326: "*Archemedian*" should be "*Archimedian*".
Also, there are minor misprints on pages *x*, 19, 45, 52, 54, 79, 132, 155, 160 and 233.

There is no index to this Book 1 : it is to be hoped that Book 2 will be published with an index to both books.

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Recursively Enumerable Sets and Degrees, by R.I. Soare, Springer-Verlag Perspectives in Mathematical Logic, Berlin, Heidelberg, New York, 1987 ISBN 3-540-15299-7 and ISBN 0-387-15299-7.

Recursive function theory grew out of the deep investigations of Gödel, Kleene, Church and others. These investigations were concerned with essentially the analysis of the algorithmic content of various fragments of mathematics. For example, given that mathematicians prove theorems, it is natural to ask if there is a machine that, once turned on, would eventually print out all of the theorems of (for example) arithmetic. Gödel's famous incompleteness theorem of the thirties says that no such machine can exist. Encapsulated in the proof of this result are the key ideas that eventually led to the mathematical clarification of the intuitive notion of computability (as recursive) by many authors, but in particular Church and Turing (cf [1, 19]). This is surely one of the major intellectual achievements of the twentieth century.

Since the thirties there has been an explosive growth of recursion theoretic techniques into many branches of mathematics and computer science together with a similar growth of various subareas of recursion theory.

The concern of Soare's book is one of the major subareas of modern recursion theory: recursively enumerable (r.e.) sets and degrees. Here a set of natural numbers A is r.e. if $A = \emptyset$ or there is a computable function f that enumerates the elements of A. For example, if φ is a programme and A is the set of x such that φ halts on input x, then A is r.e. Note the inherent asymmetry here: if φ halts on x then eventually we will see it by waiting, but we may apparently never know if φ does not halt on x.

This area saw its beginnings with a famous address to the American Mathematical Society by Post [12] who in Soare's words "stripped away the formalism associated with the development of recursive functions in the 1930's and revealed in a clear informal style the essential properties of r.e. sets and their role in Gödel's incompleteness theorem". That is, Post showed that such undecidability proofs mainly involved a set construction that was later coded into the relevant structure. In this paper Post introduced various notions of reducibility between such problems (i.e., between their representations as sets) and observed that all natural problems seemed to be either decidable or "complete" (that is, as complicated as deciding "if a programme will halt on some input"). For the computer scientist, the situation is rather like P vs NP where all natural problems initially seemed to be either P-time or NP-hard. (Of course these very notions were inspired from classical recursion theory.) At this stage, Post posed his famous problem of whether there is an "intermediate" problem. We make this precise as follows. The notion of reducibility gives rise to a partial ordering: $A \leq_T B$ iff "$x \in A$" can be computed from a finite number of questions to B. The equivalence classes are called "degrees of unsolvability", and Post's problem asks if there are any r.e. degrees between $\mathbf{0}$ (the decidable sets) and $\mathbf{0}'$ (the halting problem). (We will return to this problem later.)

In a beautiful and justifiably well-known book, Rogers [13] essentially summarized all that was known in the areas of r.e. sets and degrees (and much of the rest of recursion theory) up to the early 60's. Rogers' book has recently been reprinted with essentially no changes, and it thus omits a huge number of important technical and conceptual advances from the last twenty years.

The first five chapters of Soare's book are concerned with the "hard core" of recursion theory, at a fairly informal level. These include notions of reducibility, the jump operator, s-m-n and recursion theorems, the arithmetical hierarchy and the solution to Post's problem. It is fair to say that these notions and results would be at the centre of any advanced undergraduate or fourth year course in "theory of computation". From there one could either go into more advanced recursion theoretic concepts, applications into model theory or algebra (such as Hilbert's tenth problem) or into topics in theoretical computer science (such as complexity theory). In my experience, fourth year Victoria University students tend to find the pace of Soare's book a little fast and in this section would tend to prefer Rogers' more leisurely approach.

From the point of view of using this as a textbook for a first course what is also missing is an account of the various models of computation such as λ-definability, μ-recursion, register machines and proofs of their equivalences. In the reviewers opinion, the best book here is the recent one of Odifreddi [10], which would seem destined to be a classic. For one planning a course, the best idea is to use Soare (or Rogers or perhaps Davis and Weyuker [2]) and the others as references, to be expanded by the teacher.

For a graduate course/second course in r.e. sets and degrees Soare's book is ideal in many respects. To elaborate, we return to Post's problem and the main thread of the book, the priority method. To solve Post's problem Friedberg [3] and Muchnik [8] invented a new proof technique called the priority method. (The method is a technique in the same way that other mathematical techniques such as generating functions or differential equations are. One has a general framework but needs great ingenuity for specific problems.) I will try to give a flavour of this technique (although this may be an error). In general the technique may be construed as a game played between us and the universe. We will have a number of goals we wish to satisfy at the end of the construction. The construction will proceed in stages 0, 1, ... We win if our goals are met. Unfortunately the goals are usually so complex we cannot meet them at any finite stage and so we decompose them into many

subgoals. To make matters worse, our goals are usually very non-computable but the construction must be computable. This will inevitably mean that we never have complete information at any finite stage about that part of the universe to which the goals pertain, but constantly work with partial information. For example, a typical type of subgoal might say if some particular r.e. set W is infinite do (A) if it is not infinite do (not A). Our strategy must be to act in such a way as to win no matter whether $|W| = \infty$ or not. Note we cannot know in general if $|W| = \infty$ (as this would solve the halting problem) but what we do is plan a strategy that will first try to do (not A) and whenever |W| "appears infinite" (as it will do infinitely often when a new element appears) we switch to trying to do (A). Conflicts clearly occur since achieving (A) plainly disagrees violently with achieving not (A). Matters must be arranged so that the correct outcome happens according to the correct premise (which we never really know).

Conflicts also occur between the various subgoals and one defines a priority ordering so that we give one goal higher priority than others. The trick is to get the strategies corresponding to all the "real" outcomes (that only the universe knows) to cohere and not be affected by the "false" outcomes.

The technique has many "levels" which measure how hard the game is. The early arguments (called "finite injury") are quite well understood but it was not until the mid 70's that the next level—corresponding to arguments of the early 60's—was really understood, due to the sheer technical difficulties. The first really comprehensible account of these was the lovely paper of Soare [17]. As a student, I recall learning much of my recursion theory from this now-classic paper. The contents of this paper—which gives an account of the early infinite injury papers of Sacks, Lachlan and others—are found in Soare's book (and at a rather more leisurely pace).

The really complex arguments of the 70's employ "tree of strategy" arguments (that use trees to decide how to play the game) or pinball techniques, and again our understanding of these arguments has gone through a gradual evolution which has by no means finished. Since their introduction by Lachlan [5], the power of the "$0'''$ arguments" (the most difficult technique) is witnessed by their ability to solve many of the major questions in recursion theory which had previously seemed intractable.

The areas treated by Soare's book cover most of the major themes in r.e. sets and their Turing degrees. For the degrees under other reducibilities or subrecursive reducibilities (such as poly-time) the reader would need to go to Odifreddi [10, 11] or Wagner and Wechung [20], and for the Turing degrees of non-r.e. sets one needs to go to Lerman [6] (or Shoenfield [15] which is unfortunately now out of print). Another feature in this book is its lack of treatment of applications to other areas of mathematics. Here this would seem to fall beyond the author's defined scope of his book and the reader would need to go elsewhere. A final (small) limitation of Soare's book is the failure to treat a couple of the fundamental results such as Lachlan's decision procedure for the $\overrightarrow{\mathrm{AE}}$ theory of the lattice of r.e. sets, and the technique of embedding nondistributive lattices into the r.e. degrees. Here I only mention the areas of recursion theory and its applications not covered by Soare's book but closest in spirit to it. I therefore apologise to those devotees of the many other related disciplines (such as higher type recursion, descriptive set theory, E-recursion etc) whose favourites missed out being mentioned as not being included in Soare's book.)

Nevertheless, despite these little drawbacks, for its intended scope the book is an instant classic and is a must for all workers in the area. The author covers most major basic results since the 50's, together with a wide selection of advanced topics. It gives a number of important previously unpublished results, together with a wide range of related research results (in the guise of exercises with long hints). The author is "the" noted expositor of the area, and the text shows the care and dedication to excellence that caused the book to have undergone a decade of revisions until its final published form.

It is particularly noteworthy for the first really comprehensible account of the $0'''$-method via ideas of Soare, Slaman and Harrington. (This method was seen as so complex when Lachlan introduced it in [5] that virtually nobody "really" understood it (including Lachlan!), and it became known as the "monster" method.) This book also gives a really nice account of Soare's automorphism machinery (of [16]) using ideas of Maass [7] and Stob.

In summary, this is a superbly written book devoted to one of the core areas of recursion theory and is essential to any worker in the area of r.e. sets and degrees. I think it is one of the few books that the mathematically mature reader can learn all the basic techniques of an area (via highly motivated proofs). As a text for New Zealand universities it would seem to be appropriate for a second course or a graduate course. I also think that it would be an extremely valuable reference for anybody in mathematics or computer science whose work or teaching deals with issues of computability.

One final positive note is that the author has typeset this book via the TEX system and negotiated with Springer-Verlag so that the price has been kept quite low for a book in such a prestigious series as the "Perspectives in Mathematical Logic".

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ISSUES/OPINIONS

A CONVERSATION BETWEEN SAUNDERS MAC LANE AND JOHN RAYNER AT DUNEDIN ON 27 APRIL 1989

Saunders Mac Lane is the author of numerous articles and five books. His interests include algebra, topology, algebraic topology, logic and category theory. He has held positions at Harvard, Cornell and Chicago, and served the greater mathematical community in innumerable ways. Saunders visited the University of Otago in 1987 and returned this year as William Evans visiting professor.

The conversation was seeded by the questions that follow.

Question 1 *In the salaries for university academic staff (dated 1/4/1989), a Lecturer starting at the bottom of the scale has a bar in the lecturer's scale, and a substantive barrier before promotion to Senior Lecturer. Seniority then takes that person to a so-called career barrier. The high fliers then have a bar in the Senior Lecturer range before proceeding through to Associate Professor and possibly to Professor. Steps within these higher grades can take five years. Some hard working staff in my department have been held five to ten years, and are still waiting for promotion to Senior Lecturer. Progression is certainly becoming tougher. How does this compare with your experience, and what effects do you predict for such a policy?*

Question 2 *At Otago University we have recently changed our structure from being faculty-based to "divisions". This has had considerable implications for our organization and funding, and just what an academic's job is now. Yet the debate was minimal and almost inconsequential, for change in some form was clearly going to be imposed. Now we are told to frame a "mission", "goals" and "objectives". It is rumoured that a form of staff assessment is also being contemplated and may well be imposed. Would you please comment both on the style with which change is being brought about, and the changes both implemented and proposed?*

Question 3. *You gave a talk here about "great mathematics departments." From your experience of the Otago department, could we aspire to being "great"? What would be the cost? Is that a realistic and reasonable aim for New Zealand society?*

Rayner: Is there any background you want to give before you discuss the first question?

Mac Lane: Well, this arrangement about salaries and ranks of staff is very different from what I am used to in the United States and other countries. The difference is probably that universities in the United States are much more competitive with each other, so that if a professor gets unhappy at University X he lets it be known and gets himself a job at university Y. The other difference is that in many universities in the United States nearly everybody is a full professor. So the ranks are instructor, Assistant Professor, Associate Professor, Professor. But at least in major universities where the faculty is good, they get so many offers from outside that most able people are likely to become professors in their early thirties. So it is a very different situation in the United States. There are scales of pay, but I'm a little bit surprised by the barriers that exist here. Can you explain those?

Rayner: Not well. I think that it is a salary saving measure by the Vice-Chancellors and the government who lobbied, I believe, for this sort of thing. The effect is of course that you can hold people at these barriers and there will be delays before they get to the more highly paid positions and this saves the universities and therefore the government money. To be fair to the powers that be, it is perhaps also performance related. Maybe the idea is that you should earn the money and therefore to get over the barriers you've got to perform. But the barriers are discriminating in favour of the older staff who didn't have these barriers to go through. Whereas younger staff are being held and they perform more highly, some of them.

Mac Lane: Than the older staff?

Rayner: Than some of the older staff who are getting more money. So there must be some feeling about that amongst the younger staff.

Mac Lane: I should think there would be. Of course any university tries to hold costs down. So in the universities in the United States, a department chairman will recommend salary increases for his faculty members, and a Dean or a Provost will block some of those increases or make some of them smaller. Inevitably there are bound to be controls, but an absolute barrier is a pretty strong control.

Rayner: The other thing that is interesting, is that our university system as a whole is controlled rather than the individual university. So that the rules encompass all six universities. Now going back to something that you said before, you were saying how competitive things were in the States. We have an aging academic population within New Zealand. At one stage many years ago I think movement was very free. In many faculties and departments that has slowed down. So that people are getting into clusters at the career grades. Of course that's adding to the expense, presumably, and maybe this is some reason why we have these barriers to hold the younger people back, because you cannot do anything about the older staff who have reached their career barriers. Certainly, I think, movement between and within the universities in New Zealand has decreased considerably.

Mac Lane: It's hardly comparable to the United States because there are only six universities here and they are all more or less supposed to be on the same level of quality. Whereas in the United States we have hundreds of

universities and among them there are supposed to be 50 or 60 first class research universities, whatever that means. The fancy universities call themselves research universities, and there are universities of different kinds. There are State universities and private universities and different states have different rules, and I'm sure this situation makes for more competition. This is quite aside from the fact that the whole system is very much bigger.

Rayner: I think we can touch upon the different aims of the universities under the second question. That raises interesting points: should New Zealand universities be attempting to be something different from each other, rather than all being the same?

Mac Lane: I don't know, I'm not wise enough to know, and since they're all essentially universities run and financed by the state, that would be very difficult to do. So in the United States because of the start being very different, because some universities long ago became better than others, it is quite different. So consider for example Chicago. Chicago alone has as big a population or bigger than New Zealand, and there are perhaps seven universities in the immediate Chicago neighbourhood. You can rank them quite precisely in order of merit. The best is the University of Chicago, then there's Northwestern University, which is right near by, then there's a branch of the University of Illinois, called Circle Campus, and then there's Illinois Institute of Technology, then there's Roosevelt University which is sort of a public university started by the YWCA, then there's DePaul and Loyola, which are Catholic universities, then there are two or three colleges run by the city. So that there is a great variety.

Rayner: Do these different institutions have written into their charters that they shall aim to be different?

Mac Lane: No! No! This is just the sort of thing that has developed informally.

Rayner: Okay. Well, given that it has happened, do staff have it written into their contracts that they will aim to do different things depending what university they are at?

Mac Lane: I have been at the University of Chicago for 35 years and I've never looked at my contract.

Rayner: I see!!! To your knowledge though, do younger staff have specific things written into their contracts—you shall do research, you shall not do research?

Mac Lane: No. Such expectations are in the atmosphere as far as I know. So that a university that claims to be a research university thereby wants its staff to do research, and the universities that aren't research universities may aspire to this, and may more or less want the staff to do research.

Rayner: Do they move people on if they are not fulfilling the undefined aims?

Mac Lane: Oh, there are certainly barriers, there must be barriers in any system, in the American universities the typical barrier is what is called tenure. So that young people who are instructors or assistant professors do not have tenure, and there is usually a severe examination as to whether or not they get promoted to tenure. I suppose there is a similar situation here.

Rayner: Initially an appointment is made for a period of three years here, and at the end of the second year you'll be told whether you're going to succeed, and most people do get tenure. But I think the interesting question is that given that you have got tenure and you have performed well in order to get that, what happens later? What if you stop performing? You just don't get salary increases?

Mac Lane: There are a few people who are at major universities who stop performing and never get promoted above associate professor. But that is relatively rare.

Rayner: So okay, what is going to be the effect of our system compared to the American system? Is it better or is it worse?

Mac Lane: Oh, it is simply different, and I certainly have the impression that the system here at Otago University emphasizes teaching more than it is emphasized at great research universities in the United States.

Rayner: I think that the New Zealand system as I understand it would make people feel more secure.

Mac Lane: Yes. The American system with all this competition makes for perhaps too great uncertainty or insecurity.

Rayner: But maybe the changes that are happening here are going to affect the younger staff, and its going to try to drive the younger staff to perform more. Unfortunately the way I see it, older staff are not have to perform in the same way.

Mac Lane: Well, what it is that gets people to perform well is for me a mystery. So that in doing mathematics it is partly just the plain curiosity or the desire to get new theorems, understand things better, or, as a teacher the desire to influence more students, make things clearer to students. I'm not sure what gets people to do these things. Some part salary, some part competition, but some part internal drive.

Rayner: Yes. I think that is true, I think that's what disappoints some university staff with some of the things that have been happening in the last year or so. So a time and motion study may eventually be foisted upon us, when the integrity, which is usually the reason why people do perform, is being ignored.

Mac Lane: Yes. That is curious. Now the recent changes from faculties to divisions which comes up in question two is something that more or less mystifies me. I guess when I was here two years ago there were faculties and there were faculty meetings. I went around to one of the faculty meetings, and when I was appointed a William Evans visiting professor they told me that included the right to go to faculty meetings, but I haven't gone to any. So it may be that the divisions have lost a little participation that way, at least they have lost my participation.

Rayner: The point of the divisions, I think, was to take away a lot of the administrative problems from the staff, and to give that administration to administrators while the academic staff were supposed to do more research. I imagine that was most of the goal.

Mac Lane: That has happened in all sorts of places. In American universities, partly because the funding by government for research, the administrative staff has grown enormously, compared to the faculty. So that when I first was at the University of Chicago in 1930 there was a president, and the president had a secretary, and there were a couple of deans, that was the administrative staff. Now Chicago has a six story building that is not enough to contain the administrative staff. So the fascination of modern civilization with management or the impositions by accountants, has resulted in a proliferation of administrators in the US.

Rayner: I would have expected the reverse though. I would have expected if somebody came in and looked at the academic structure and the organizational structure, that they would have tried to prune the organizational structure.

Mac Lane: Well, I don't understand these people. They have not pruned the structure. As for the new divisions, the only thing I have really seen is the statement of "Missions, Goals and Objectives," and I am blessed if I know what these things mean. They have to be updated every year or so, and when I look at the current draft of the goals and objectives for the Division of Sciences, I see wonderful words. Goals are statements of broad general direction, and such statements are, as far as I'm concerned, a brass dime a dozen. Down under Objectives, which I can't distinguish from Goals, it turns out that attainment of Objectives should be measurable. It seems to me that most of the real objectives such as the effect of teaching and the effect of original research are things that are not measurable, at least not measurable by any numbers, so that stating that objectives should be measurable is a way of constraining the objectives to the things that you don't really want. What you really want is to have research which makes breakthroughs or better understanding, and you can't measure that by citation counts or any other thing. You can get judgements on it from other people in the field, but that is all. As for teaching, you have to wait for 20 years to see what has happened to your students.

Rayner: Certainly the research thing, Einstein might have had trouble holding favour with some university criteria.

Mac Lane: Yes. Then I've heard a rumour of what staff assessment might be like. The rumour is full of management lingo and a long lists of platitudes. About monitoring, appraisal is a difficult interpersonal process. I don't think it can be reduced to filling out forms. So I am mystified as to why it is imagined that filling out assessment forms is going to lead to any effective appraisal of what goes on.

Rayner: I must admit I haven't found any staff that I have spoken to who can see merit in such a proposal. I know it is a feature of some non-academic institutions. For example I'm aware of CSIRO, where they have six monthly reports and forward planning and things like that, and I dare say in some factories they do this sort of thing. It seems to me that something that has come from a factory-type workplace has permeated back towards institutions for which it is less and less appropriate to do so. I can see some point in some sort of forward work plan. I can see some point in some form of gentle appraisal, but a formal appraisal by time and motion study sheets, I can't see how it can work. Actually, I think it will create a lot of ill will.

Mac Lane: Yes. Any real appraisal would be done by thoughtful people who consult others who know about what the individual has done. It seems to me it cannot be reduced to forms like this.

Rayner: Certainly! It is surely not likely to influence somebody in the right way if that person is given three out of ten for their annual assessment. Academic staff surely would respond better to the Head of Department or some significant person gently cajoling them in a more effective direction.

Mac Lane: Yes. It seems to me that ordinarily the Head of Department will have some effective notions about what the members of his department are doing, and would do some of this cajoling irrespective of having an assessment thing. Of course the thing that I don't understand very well is the relation of this to the political situation in New Zealand. So at some point it is observed that these documents are related to a report called "Learning for Life," which has been issued by the Ministry of Education. This pamphlet on learning for life I had occasion to look at, and it managed to lump all universities and technical schools and other things under something called "Post Secondary Education," and it displays no particular understanding as to how universities might be different from other institutions. In fact I wrote a letter to the Associate Minister of Education explaining why I was troubled by "Learning for Life", and got a very polite answer back from him.

Rayner: The Secondary school teachers are today striking because of this very issue I believe. Effective and reasonable staff assessment is difficult to define at that level and even more so at university level, where I feel it is even less appropriate than it is at high school. Maybe there is a very small proportion of high school teachers who aren't performing effectively .

Mac Lane: It certainly must be. At least in most countries that is the case, but I have the impression that that is better in New Zealand than in the United States.

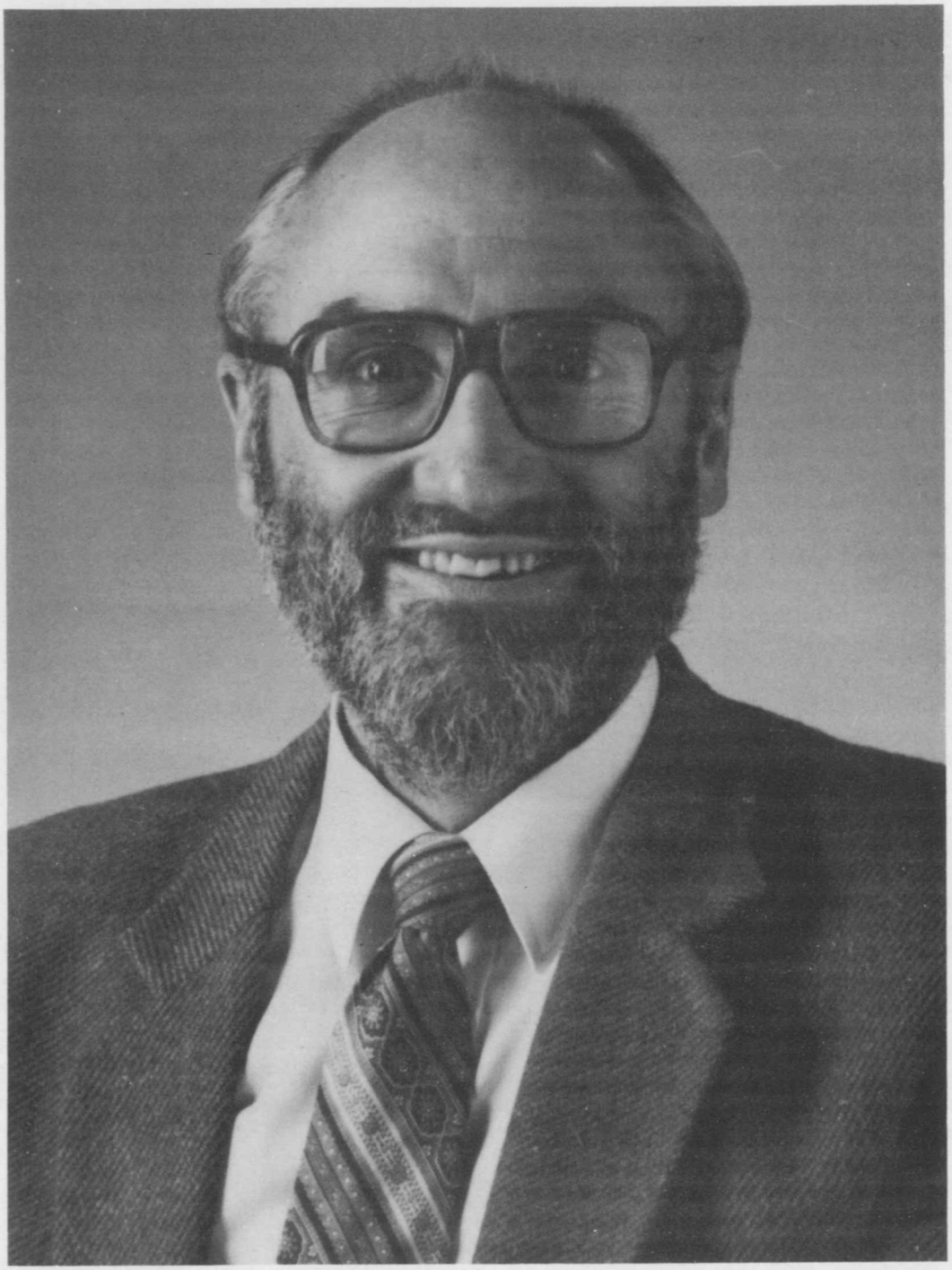
Rayner: Well yes, I don't know how to measure that, I haven't seen any studies.

Mac Lane: Last time I talked to one or two of the high schools, and this time I went down to Invercargill and talked to some of the secondary school teachers there, and I was most impressed with their interest and devotion. I don't know much about the corresponding situation in the US, but it is generally reputed to be not very good.

Rayner: As far as the universities are concerned I've known of one place where they had a person with a persecution complex from the second world war, and he was described as a supernumerary—somebody who wasn't performing effectively—and they had extreme difficulty in moving this person on. For many years he was drawing a salary and not doing anything. I could see that there may be some point in having a means of effectively moving such people on, but again I am unaware of there being such people in New Zealand universities. May be there are one or two, but it seems rather pointless to disturb the entire academic community to get out one or two. The quality of what is going on with the rest of the well performed academics is going to go down because of this.

Mac Lane: As far as I know there certainly are occasional cases like that of faculty members who have ceased being effective in any sense, who do teaching only in a routine fashion, and have stopped doing research. Or, and I've know two or three such cases in Chicago, one case where the faculty member essentially had a nervous breakdown and was unable to be effective at all. But as far as I know, each of these cases was handled in an individual sort of fashion. I've know of cases where such people have been eased out or given early retirement with some financial arrangement. I've know of others who have found the atmosphere of their own universities too demanding, so got themselves jobs at easier universities.

(Continued on p 30)



Dr Brent Wilson

WILLIAM BRENT WILSON

by Murray Smith

When Brent Wilson died suddenly on 21 June in Sussex, England, the University community lost a very lively and talented colleague and friend.

Many members of the University, and most of the science faculty in particular would have had contacts with him, for Brent Wilson was a mathematician who was also intensely interested in the application of his subject to a wide variety of disciplines. Nothing pleased him more than when the solution of a problem involved an elegant piece of mathematics. It was perhaps this pursuit of the elegant, even grand, result that led him to such a variety of interests.

Brent Wilson spent most of his life in Christchurch. He was born there in 1941 and attended Christchurch Boys' High School where he was Dux in his final year. From school he went to the University of Canterbury from which he graduated Bachelor of Science with First Class Honours in Mathematics in 1962. He won the Lord Rutherford Memorial Fellowship, studied at Emmanuel College, Cambridge and received his Doctorate in 1968 for his thesis on co-operative instabilities in stellar systems. A short time later he joined the staff of the Mathematics Department at Canterbury where he remained until his untimely death.

After his return to Canterbury his interests broadened to include relativity where he tackled the very difficult problem of quaternion spinors in gravitation theory. He also worked on mathematical models in biology and on the geometry of statistical models while still pursuing his active research in stellar dynamics and astronomy. But it is perhaps in the theory for which he coined the term "Thermoeconomics" which most typifies the nature of Brent Wilson's special talents. Here he formulated a theory of economics using the equations which occur in the branch of physics known as thermodynamics.

Brent Wilson will also be remembered for his enthusiasm, his inventiveness and his wit. These qualities contributed to his excellent teaching reputation and to his being sought as a popular speaker on topics mathematical. He was often asked to deliver the address at the prize giving for the BNZ Mathematics Competition for high school students, and on one such occasion he chose to speak on the mathematics of Rubik's cube, then at its height of popularity. To make the talk more interesting he devised a method whereby he would (almost) solve the cube behind his back at the same time as he was giving his talk. The specially prepared but random looking cube was given to the audience to make two moves. After executing the 36 or so special moves behind his back without faltering in the delivery of his lecture Brent took the cube from behind his back expecting it to be just a few moves away from complete. However, on this occasion a miracle happened and much to the surprise of the audience and the even greater surprise of the speaker the cube emerged completely solved.

It could never be said that Brent Wilson avoided publicity. He and a few of this colleagues decided that the University should honour the Centenary of the birth of Albert Einstein. On 14 March, 1979 the lights in selected offices in the Chemistry-Physics building were switched on so that, when viewed from Ilam Road, the building displayed the famous formula $E = mc^2$ in gigantic characters. Brent Wilson was also well known as the leader of the "Maths Team" which, on the nights of the 78, 81, 84 and 87 general elections, made successful predictions on Radio NZ of the election results using early returns. In 1978 a series of six television programmes which he made with Dr John Hearnshaw (Physics) on "the Astronomers' Universe" were broadcast.

Out of the limelight, too, Brent Wilson happily took on many professional responsibilities. He was NZMS Secretary from 1976-7, Council Member from 1976-9 and Editor of this Newsletter from 1980-1. He in fact originated the idea of using the Centrefold as a regular feature of the Newsletter with his first issue in August 1980 (featuring John Butcher). As a representative of the Royal Society of NZ he was on the National Committee for Astronomy, and on the Carter Observatory Board. He was also a former chairman of the local Mathematics and Physics Section of the Society.

Brent was friendly, yet forthright. He was always keen to argue a point, often in a very direct manner, but never bore any malice. He had many interests outside his professional life, including a great love of classical music, art and literature. He was immensely practical and deservedly had the reputation of being able to fix anything from the former Head of Department's grandfather clock to a complex piece of modern electronic equipment. Brent Wilson was one of the real characters in the University. He will be remembered with great affection and sadly missed by all who knew him.

He is survived by his wife Anna and daughter Charlotte.

(This photograph and article first appeared, in slightly different form, in the University of Canterbury Chronicle, Vol 24 No 12, and is used with permission.)

(Continued from page 27)

Rayner: So in other words there are other ways of handling this.

Mac Lane: There are ways in which such a situation arises, and it is recognized without any sort of formal assessment because it is pretty clear, and then it probably has to be handled individually.

Rayner: Of Course, this document, doesn't say anything about how it is to be handled. If there is going to be assessment, then you identify the problems, or you identify what you think of as problems. Staff who get two out of ten I guess for their annual assessment three years in a row. It doesn't say what to do with those.

Mac Lane: We haven't talked about question three. Earlier on when I first came here I did give a talk about "Great Mathematics Departments I Have Known," and in that talk I was discussing chiefly departments which had had a major influence in research, either by virtue of the standing of their faculty or the amazing PhD students whom they trained, and in their graduate work. So I discussed on some universities in Germany, and some of the newer universities in the United States that have been outstanding in that regard, because I thought it was interesting to analyse the common things that they do. That was explicitly directed at the universities in older civilizations like Europe, and a little bit like the United States, and it isn't really easily applicable to New Zealand.

Rayner: One part of that that is applicable, is that our Vice-Chancellor has said that one of the things that makes a good year at Otago University is research papers produced, and there definitely has been a push from that direction to get staff to perform. Is this the way to become great? I suspect not, I suspect the quality of what is done is more important.

Mac Lane: I don't think this can be judged by paper count, because counting papers counts the insignificant ones with the significant ones, and obviously the number doesn't matter, and if it gets around that what's counted is the number then staff is likely to write the same idea up in three papers so that it counts threefold. Or to take one paper and split it into four different parts. Clearly the paper count doesn't matter. For example, I gave a lecture here on the subject of graph theory because of the interest here. I suddenly remembered that 50 years ago I had written four or five papers on graph theory, and looking back on those papers of 50 years ago, I came to the recognition that out of those four or five papers only one of them really mattered; that the others had been forgotten, probably rightly forgotten. Perhaps what matters are the significant papers, so it isn't the count of papers. Some people in the United States like to use citation indices. There is an outfit in Philadelphia, whose name I have forgotten, who uses a list of how many times each scientific paper was cited in the bibliographies of other papers. Again this doesn't seem to me to measure anything about the real quality of the papers.

Rayner: Oh no, you can get a large number or citations by having gross inaccuracies in your papers, and people write saying what rubbish it is.

Mac Lane: Or you can get a large number of citations by writing good expositions. So I looked at one of these citation counts, and I was in it fairly high up. Why? Not because of any research I'd done, but because of a book I once wrote on Homological Algebra, which had the good luck to be a clear exposition and so was used by lots of people when they wanted to cite well know results which weren't due to me. So the citation counts don't count. Encouraging staff to do research is indeed useful. So in the United States, from the time we had a revolution against England, it took a hundred years before there was really effective research being done at universities. J. W. Gibbs at Yale was the first internationally famous mathematician—a mathematical physicist. So then at the beginning there were just a few universities that stood out. But recently many more have begun to be anxious to contribute to research. So I think that this could certainly happen in New Zealand.

Rayner: Yes, maybe it's the first step, maybe what the vice-Chancellor is keen to have, is University of Otago in learned journals.

Mac Lane: Yes, and it certainly is important to encourage this, because if the staff at the University of Otago are busy thinking about research on this and that, then their teaching is likely to have a greater edge to it, a greater excitement.

Rayner: I think you are right, that is the argument that is used here. The importance of research is that it

improves teaching, and of course, some people who are mainly interested in teaching, are disappointed by that point of view. They claim that they can do effective teaching without doing very much research.

Mac Lane: Yes, well, I can certainly agree that there are people who don't do research or who stop doing research, and who are nevertheless very effective teachers. The famous example in mathematics is of Emil Artin who had done magnificent research when he was younger, and who somehow stopped doing research but was very effective in teaching, and in training graduate students. So there are cases like that, but still, an atmosphere in which getting or doing new investigations is encouraged seems to me to help people.

Rayner: I think excitement when work is being done and you are getting new results, gives a certain liveliness to what is going on. Delivering a lecture with good oratory, a well prepared lecture, is a reasonable thing to do, but it does lack some sort of excitement, of where you are going and why this is important background is missing.

Mac Lane: There is something about being able to tell your class something new. Something new and significant if you can. So I think if the current turmoil here in the universities of New Zealand is directed to encourage, especially in younger staff, more actively encourage research, then it is the right thing to do. Now of course in the United States much of this is encouraged by extensive graduate work. There are many PhD students at the bigger universities, and some faculty members spend a lot of their time guiding their PhD students' research. As yet this isn't so extensive in New Zealand for obvious reasons. But some beginning on that would also probably help.

Rayner: Yes, I think that is a political decision New Zealand universities have to make. Certainly in this department five years ago, the norm was that somebody who got a good first class honours here would move on to the States or to Europe. Whereas now I think you put the question to the student first. Would you like to stay here and work with X and Y? I think that question should be put fairly early on in the piece. We have had some success here in encouraging people from overseas to come, and I think that make for a more vibrant department.

Mac Lane: Getting a vibrant department depends on so many subtle things that can't really be measured: a Chairman who looks to the future, faculty members who stimulate each other, and having good students. When I was thinking about great universities, it struck me that one of the things that represented their effectiveness was that they indeed had a lot of bright students. If it hadn't been for the students to somewhat press the staff it would be much less lively . That certainly can happen, that the student seems to get there faster than the teacher does and that keeps the teacher on his toes.

Rayner: I agree. Okay, we don't have that many really good students, but certainly at Otago recently I think the atmosphere has built up. For example, over summer, there were lots of staff in here doing lots of work. Five years ago that was less so. I am at a loss to explain that. I don't know whether the Vice-Chancellor can take credit for that, because he said publish or perish. Or whether it is the age of the staff; because we are an ageing department, like most of the New Zealand universities. I think you have a little perspective, can you think of any reason why?

Mac Lane: I was here '87. There was some element of excitement around then. I can't tell what it was like before. I do have a definite impression that the interest in research is greater here now than it has been, but that is just by what people tell me about how it used to be.

Rayner: Certainly if you can see activity then something is going on, but what I am looking for is the underlying reasons for that activity. What were the conditions that forced us into this mould?

Mac Lane: I think that activity is stimulated by contact with other mathematicians and statisticians.

Rayner: Certainly that is something that is measurable. Since we've had the new Chairman we've had very many more visitors.

Mac Lane: Visitors make a difference, and the possibility of sabbatical years, seems to me to make a real difference. But it depends a little on what people do with their sabbatical years. If they go off to England, the United States or Canada and get new input, that helps.

Rayner: Certainly there was a political decision about that. Now when staff apply for sabbatical, the administration look back on what happened after their previous sabbatical. If activity wasn't apparent from their previous sabbatical, then they are less likely to get the next one. So there is a push. It is claimed that the community wants to see value for money.

Mac Lane: Of course another aspect of assessment of staff that goes differently in the United States, is that assessment of research accomplishments isn't made just by counting papers. When a person is going to be promoted, or perhaps to get a bigger salary, the Chairman often writes to experts in the field and asks for letters about the person. Or it can happen that people considered for appointment or promotion have six or seven letters from experts about them on file. The system of many letters is overdone in the United States but I think that is one way of assessment that at least goes back to people who really know what their field is about.

Rayner: I think that only happens to the upper echelon here.

Mac Lane: I suppose when somebody applies to be promoted to Associate Professor?

Rayner: It certainly happens then. I think that is a good point if somebody wants a promotion from lecturer to senior lecturer, a method like that might enhance their case considerably.

Mac Lane: Of course that does tend to emphasize the research aspect of things, because people writing from outside will know more about the research accomplishments, than about the teaching of the individual.

Rayner: True, but there are other aspects of performance other than teaching and research, such as you may have made a significant contribution to the community by writing some piece of software, and that doesn't show in the publication count, but you have certainly done something of benefit to the community and that ought to be noted. Outside experts at lower levels could be very positive.

Mac Lane: I think we have covered just about all that we wanted to talk about. I think that we end on this notion that things indeed seem to be in general improving here. With greater attention that is only moderated by the somewhat mysterious notions of measuring objectives. If the interest can be concentrated on improving teaching, and improving research and not on formalities of assessment, things should go well.

Rayner: Yes, but the point is that things are improving because of reasons that are difficult to identify, but maybe it is the visitors programme, yourself included of course. There could be a turn around of course if these other forms of assessment were imposed. Then maybe things will start to decline.

Mac Lane: I would hope that the other forms of assessment would be formulated in more reasonable and less bureaucratic ways.

Rayner: Thank you very much Saunders.

SECRETARIAL

MINUTES OF THE TWENTY-FIFTH COUNCIL MEETING 14th May 1989

The meeting was held in room 711 of the Social Sciences Tower at Massey University and began at 10.00 a.m.

PRESENT: Brian Woods (in the Chair), Derrick Breach, John Butcher, Marston Conder, Robert Goldblatt, John Shanks, Alfred Sneyd, Gillian Thornley, Rae Sullivan-Barnes (for NZAMT), Chris Triggs (afternoon session).
In attendance John Giffin, Kee Teo (morning session).
There were no apologies.

1. MINUTES: It was **moved** from the Chair that: *the minutes of the previous meeting be received.* It was pointed out that in item 7 (ii) (b) of those minutes "4500" should be "$500". With this amendment the motion was **carried.**

2. MATTERS ARISING FROM THE MINUTES:

(i) B. Woods reported that he had had discussions with the Vice-Chancellor of the University of Canterbury about the investment of funds. The Society's funds are not large enough to warrant the hiring of an investment manager and therefore it will have to rely on its own resources.

(ii) In the matter of supporting the nomination of a certain person for a Fields Medal, J. Butcher reported that the nomination has been made by the Royal Society of New Zealand through its President.

(iii) With reference to section 12 of the previous minutes concerning the appointment of an Officer for Maths Education, G. Thornley reported that Gordon Knight is interested but wants more information about the duties involved. After some discussion it was decided to refer the matter to the AGM.

(iv) M. Conder reported that he had written to the organisers of the IBM Mathematica display, currently in Australia. There is the possibility that it could tour New Zealand.

(v) In the matter of a pre-doctoral thesis competition the Secretary reported that he had no success in persuading someone to undertake the organisation of such a competition. He volunteered to do it himself with winners to be announced at the 1990 Colloquium. He asked for ideas for getting the prizes sponsored by individuals or businesses.

(vi) M. Conder asked if nominations had been made to the National Committee on Mathematics of the RSNZ. The Secretary replied that on behalf of NZMS as a member body of the RSNZ he had nominated Derek Holton and Mike Carter. He had left the third nomination to J. Butcher as a Fellow of the RSNZ and Peter Lorimer had been nominated this way. It is expected that these three nominations will be accepted to fill the three vacancies on the National Committee.

3. CORRESPONDENCE:

(i) A letter from Gloria Olive accepting her honorary membership was read.

(ii) The Secretary said that a letter from Professor J.T. Campbell with a donation of $500 had been received. It is Professor Campbell's wish that this be a contribution to the publication fund. The Secretary said that he had written a note of thanks to Professor Campbell. It was **moved** from the Chair that: *the Council of the New Zealand Mathematical Society expressed on behalf of all its members gratitude to Professor Campbell for this, and other, generous donations.* The motion was **carried** with applause.

B. Woods undertook to write to Professor Campbell conveying these sentiments.

(iii) The Secretary reported that he had written to Gillian Heald congratulating her on being appointed Principal of Rangi Ruru School.

(iv) From time to time the Joint Policy Board for Mathematics in the U.S.A. sends material such as posters, postcards, reports etc. The Secretary said he had passed some of this on for display at the Colloquium.

4. TREASURER'S REPORT: [It is appended to these minutes.]

(i) In presenting his report J. Shanks said that the accounts were now in a much better form. However shortage of time had prevented the Auditor from making his report. Nevertheless the figures had been seen by the Auditor and any adjustments needed would be minor ones. It is hoped the final version would be available for publication in the August Newsletter. [The Auditor's report is appended.] The Society's assets amount to some $110,000 but not all in cash; there is $20,000 under debtors and $25,000 under book-stocks. In the past the funds have had to be administered with certain caution but the time has now come to make forward-looking approach to the management of the Society's finances. The closing of holding accounts has ensured that all business goes through one account with a predicted simplification in the reporting of GST returns. It was

moved from the Chair that: *the Treasurer's Report be accepted.* The motion was **carried.**

(ii) M. Conder presented a financial plan for the NZMS. There was much discussion of this. It was agreed that for the meantime this paper be kept confidential to the Council. It was **moved** from the Chair that: *the M. Conder's draft financial plan be adopted in principle.* The motion was **carried.** It was **moved** by J. Shanks (seconded by J. Butcher) that: *the Council recommend to the AGM that the annual subscription be raised to $30.00 not including GST.* The motion was **carried.**

5. PUBLICATIONS:

(i) G. Thornley presented a report on publications [appended to these minutes]. It was **moved** from the Chair that: *the report be accepted.* The motion was **carried.**

In her report G. Thornley expressed gratitude to J. Shanks for the considerable work and time he has put into keeping the publication accounts in order.

(ii) There was a general discussion of ways of recognising the 1990 sesqui-centenary and the centenary of the birth of A.C. Aitken. The possibility of developing links with the Edinburgh Mathematical Society was mentioned.

6. APPLICATIONS FOR FINANCIAL ASSISTANCE:

(i) The Secretary reported that in mid-December an application had been made for a travel grant to attend a conference in Australia in January 1989. He and the President after consultation had declined the request.

(ii) The Secretary reported that he had given $180 (one hundred and eighty dollars) to Raymond Scurr, a student, towards the costs of attending the Colloquium. This money came from the amount set aside by the Council for the Secretary's use in making such internal student travel grants.

(iii) As a result of the Secretary's correspondence with Council members in which they had all concurred without coercion it had been decided to give $500 (five hundred dollars) from the South Pacific fund to Associate Professor Ahuja of the University of Papua New Guinea to help with his expenses while attending the Colloquium. It was **moved** from the Chair that: *the grant of $500 (five hundred dollars) to Professor Ahuja from the South Pacific fund be confirmed.* The motion was **carried.**

(iv) It was **moved** by J. Butcher (seconded by D. Breach) that: *Associate Professor Vamanamurthy receive a grant of $500 (five hundred dollars) towards the cost of a visit by Professor Anderson to continue their collaborative research.* The motion was **carried.**

(v) It was **moved** by B. Woods (seconded by R. Goldblatt) that: *the NZMS give $1000 (one thousand dollars) to the Colloquium organisers to support the NZMS lecturer at the Colloquium.* It was **moved** as an **amendment** by M. Conder (seconded by J. Butcher that: *the amount be increased to $1500 (fifteen hundred dollars).* The amendment was **carried.** The amended motion was then put and **carried.**

(vi) It was **moved** by M. Conder (seconded by A. Sneyd) that: *Dr. Charles Little be invited to re-submit his application to the next Council meeting and that he be asked to report on his research with Franz Rendl during the latter's visit to NZ.* The motion was **carried.**

(vii) It was **moved** by M. Conder (seconded by J. Shanks) that: *Dr. H.V. Henderson be given $500 (five hundred dollars) towards the costs of his trip to the United States.* The motion was **carried.**

(viii) It was **moved** by R. Goldblatt (seconded by J. Butcher) that: *the NZ Mathematics Olympiad Committee be given $1000 (one thousand dollars) towards the cost of sending a team to West Germany in 1989.* It was **moved** as **amendment** by J. Shanks (seconded by D. Breach): *that: the amount be $2000 (two thousand dollars).* The amendment was **lost** on a show of hands, 3 for, 6 against. The **original motion** was then put and **carried.**

The Secretary was instructed to convey to the NZ Mathematics Olympiad Committee the Council's feelings and reservations in this matter.

The meeting adjourned for lunch at 12.30pm and resumed at 1.30.

(ix) It was **moved** by G. Thornley (seconded by R. Sullivan-Barnes) that: *the NZMS make available ICOTS 3 $5000 (five thousand dollars) of this year's funds to assist in a scheme whereby travel grants can be made to teachers of statistics to attend the conference. The ICOTS 3 organising committee is invited to approach the NZMS again when further details of the scheme are available.* The motion was **carried.**

ICOTS 3 is an acronym for the Third International Conference on the Teaching of Statistics to be held in Dunedin in 1990. It is envisaged that the scheme will be administered by a committee consisting mainly of NZMS and NZAMT representatives.

(x) One application for financial assistance was declined.

7. FORDER LECTURESHIP:

(i) It was **moved** from the Chair that: *the report of Sir Michael Atiyah on his tour of NZ as the second Forder Lecturer be received and that a letter of thanks be written to Sir Michael.* The motion was **carried.** [The report is appended.]

(ii) It was **moved** from the Chair that: *the Council of the NZMS adopt the conditions and rules governing the selection of the Forder Lecturer as proposed by the London Mathematical Society.* The motion was **carried.** [The conditions and rules are appended].

(iii) It was moved from the Chair that: *the Secretary write to the London Mathematical Society giving Professor Peter Whittle as their first choice as the Third Forder Lecturer with the names of Professor Roger Penrose and Sir James Lighthill to be held in reserve.* The motion was **carried.**

8. CONFERENCES:

A letter was received from Professor David Gauld declining with regret the suggestion that there be an Australasian Mathematics Convention in July 1992 in Auckland. The Secretary was instructed to write to the Australian Mathematical Society accordingly.

9. THESIS PRIZE AND OTHER AWARDS:

(i) (The pre-doctoral thesis prize is dealt with in Section 2(v) of these minutes).

(ii) The Council noted with interest, for future reference, a suggestion from Professor Peter Lorimer that the NZMS award a medal annually for achievement in mathematics.

(iii) J. Butcher suggested that the NZMS award prizes to students in mathematics classes at the NZ Universities. He was invited to follow up this idea.

(iv) G. Thornley drew attention to the Mathematics Week to be promoted by NZAMT and wondered about a contribution in the form of a prize or some such. Without further details the Council was not well placed to pursue the matter.

10. FELLOWSHIP OF THE RSNZ:

(i) J. Butcher reminded the Council of the importance of keeping the supporting material of current nominees up to date.

(ii) J. Butcher spoke of the desirability of having the present selection panel for Mathematics and Physics split into two panels. The President undertook to write to the President of the RSNZ about this matter.

(iii) After some general remarks on the selection and processing for nomination to Fellowship of the RSNZ the Council went into committee to discuss names.

11. OTHER BUSINESS:

(i) M. Conder reminded the Council of a forthcoming significant birthday. He and D. Breach were charged with finding a suitable present.

(ii) M. Conder drew attention to the need for the NZMS and the NZSA to make submissions on the funding of mathematics. It was also pointed out that there was to be a meeting of heads of mathematics departments on the following Wednesday. M. Conder tabled the report of the President of the Australian Mathematical Society covering the main features of that Society's submissions to the Senate Enquiry into Higher Education and to the Smith Committee on Research Policies.

(iii) J. Butcher is preparing a new list for inclusion in the World Dictionary of Mathematicians and asked for names of likely entrants who were not members of University departments.

(iv) It was **moved** by R. Goldblatt (seconded by G. Thornley) that: *the NZMS lecturer for 1990 be associated with ICOTS.* The motion was **carried.**

(v) It was **moved** from the Chair that: *the Council of the NZMS record its appreciation of the services given by David Smith as Editor of the Newsletter.* The motion was **carried.**

(vi) It was **moved from** the Chair (seconded by D. Breach) that: *the Council heartily thank the long-suffering Treasurer, John Shanks, for his devoted and time-consuming services to the Society in keeping its books in good order.* In speaking to his motion the President pointed out that John Shanks' long term as Treasurer had been preceded by one as Secretary. The motion was **carried** with noisy acclamation.

(vii) The President also expressed thanks to the retiring Secretary, Derrick Breach. His sentiments were acoustically supported by other Council Members.

(viii) The Incoming President, Gillian Thornley, proposed a motion of thanks to the outgoing President, Brian Woods, and this motion was also received with acclaim.

The meeting ended at 3.35pm.

TREASURER'S REPORT FOR 1988

Accompanying this report are the balance sheet and accounts of the Society for 1988, audited by Peat Marwick, Chartered Accountants

Assets The assets of the NZMS continued to grow in 1988 as they have in the last few years, once again due mainly to another profitable year from the Society's publishing endeavours, but also aided by a healthy return on investments.

It may be interesting to note the growth of assets over the past five years:

1984	$ 22000
1985	$ 33000
1986	$ 54000
1987	$ 94000
1988	$110000

I believe the Society can now regard its sound financial standing as a solid foundation on which to plan for the financing of its varied range of activities, there being more than sufficient funds to act as seed finance for new publications.

Accrual basis Except in some minor detail we have completed the move from what was essentially a cash basis to an accrual system of accounting. In this final "catching up" year some of the 1988 figures are distorted by

including transactions not fully accounted for in 1987.

Holding accounts I am pleased to report that after the end of 1988 the holding accounts have been closed so that all transactions can now be handled through the Society's main account. I am confident that this move will vastly simplify the task of reporting GST returns and the summarising of accounts at the end of the year.

Notes I have provided the following notes to explain items on the accounts:

1. Subscriptions received is up slightly on 1987 due to collection of some arrears and a small increase in numbers. As at 12/5/89 the Society has 220 members made up as follows:

161	ordinary
15	reciprocal
17	student
9	honorary
1	life
6	free ordinary
11	free student

2. Interest The much increased interest on bank deposits reflects the healthier state of the Society's cash assets.

3. Newsletter The increased expense here is due to higher printing costs.

4. Travel/Council Expenses Almost all of this item is from air-travel.

5. Travel and Research Six grants each of $500 were made during 1988, two of which were designated as travel grants and four as research grants.

6. Donations $500 to Analysis/Topology Conference, $2500 to NZ International Mathematics Olympiad, $1000 for NZMS Colloquium Lecturer.

7. Miscellaneous Stationery, photocopying, postage, auditing, RSNZ fee.

8. NZAMT share Because the profits on publications are way down this year (see below) the amount owing to NZAMT is far smaller than the $25000+ from each of 1986 and 1987. The amount is 50% of the profits on jointly published books less an auditing/administration fee.

9. Publications The breakdown of publications income and expenditure for each of the 5 books is shown on page two of the accounts. A few points are worth noting:

   a) Maths with Stats The profit here was small. Some costs associated with 1987 are included here as they were not fully accounted for in the 1987 figures; that is, the 1987 profit was overstated and the 1988 profit is understated. A more realistic picture is gained if the figures are taken together.

   b) Secondary School Maths The loss on this set of books is due to a bad debt of $1820 which has been written off and the writing down of stock by 33 1/3% as it is likely that not all stock will be sold.

   c) Overall a reasonable profit of around 15% was attained.

10. As reported last year, problems exists with correct reporting of GST but the situation is now less critical than previously. It is hoped that all problems will vanish when movements are made through the one account.

New Treasurer My term of office is closing and I wish the new Treasurer every success in his task ahead.

John A Shanks
Hon Treasurer
31 May 1989

NEW ZEALAND MATHEMATICAL SOCIETY
FINANCIAL STATEMENTS
FOR THE YEAR ENDED 31 DECEMBER 1988

INCOME AND EXPENDITURE ACCOUNT		1988 $	1987 $
Income			
Subscriptions	3,588		3,229
Interest	15,719		7,025
Donations	-		854
Publications (Note 2)	100.458		163.014
		119,765	174,122
Expenditure			
Newsletter	2,066		1,110
NZMS Visiting Lecturer	700		500
Forder Lecturer	-		1,103
Travel/Council Expenses	2,667		2,267
Travel and Research Grants	3,000		3,810
Donations	4,500		2,400
Miscellaneous	1,782		306
NZAMT share of Publications Profits	2,964		26,880
Publications (Note 2)	87.020		95.475
		104.699	133.851
EXCESS INCOME OVER EXPENDITURE		$ 15,066	$ 40,271

BALANCE SHEET
AS AT 31 DECEMBER 1988

Accumulated Funds			
Balance Brought Forward		93,833	53,562
Excess of Income over Expenditure		15.066	40.271
		$108,899	$93,833
REPRESENTED BY:			
Assets			
Bank •General Account	16,608		34,202
•Massey	9,242		5,080
•Canterbury	12,211		839
•Auckland	94		22
•Wellington	4,804		2,691
•Aitken Memorial Trust	354		324
•General Autocall Account	39,770		-
•Massey Autocall Account	5,100		-
Debtors	20,093		4,935
Book Stocks on Hand	25,376		27,313
Term Deposit	-		70.690
		133,652	166,096

Less Liabilities			
Owing to NZAMT	2,964		54,409
Creditors	21,298		16,183
Owing for GST	491		1,671
		24,753	72,263
		$108,899	$ 93,833

NOTES TO THE ACCOUNTS

NOTE 1: STATEMENT OF ACCOUNTING POLICIES

General Accounting Policies The following general accounting policies as recommended by the New Zealand Society of Accountants have been adopted in the preparation of the financial statements.

i) The measurement base adopted is that of historical cost.

ii) The matching of revenue earned and expenses incurred using accrual accounting concepts except that interest and subscriptions are accounted for on a cash basis.

Stock Stocks of books are valued at cost except that Volume 1 and Volume 2 of Secondary School Maths have been written down by 33 1/3% as it is unlikely that all books will be sold.

NOTE 2: PUBLICATIONS

	Income	Expenditure
Maths/Calc	47,023	33,497
Maths/Stats	23,873	23,859
Calculus	23,878	18,451
Sec School Maths	1,249	7,860
Linear Algebra	4,435	3,353
	$100,458	$87,020

AUDITOR'S REPORT

" We have examined the accompanying Balance Sheet and Income and Expenditure Account of the Society and have obtained all the information and explanations we have required.

Stocks of Books have been accepted as advised by the Treasurer.

Subject to the matter referred to in the above paragraph in our opinion, the Balance Sheet and Income and Expenditure Account respectively give a true and fair view of the financial position of the Society at 31 December 1988 and of the results for the year ended on that date.

Peat Marwick
Chartered Accountants
Dunedin, 16 May 1989"

PUBLICATIONS REPORT TO NZMS COUNCIL May 1989

Textbooks

Linear Algebra by Smith and Teo was published in December and is now out of print! In the end we only printed 500 and will be able to make corrections for next year. A print run of 1000 to sell over a 2-3 year

period may help keep the price down.

The market for *Calculus* has fallen this year as Auckland classes adopted another text. Massey also plans to drop this text next year.

Joint projects with NZAMT

Modelling Activities by Russell Dear is almost ready for printing. It will be printed and distributed from Palmerston North. We propose a print run of 500 and estimate that the price to schools will need to be about $33-$35 (including GST)/ This would require sales of 370-400 to break even. We have orders for 130 and plan to launch it at the NZAMT Conference in August.

Mathematics with Statistics and *Mathematics with Calculus* have each sold over 1500 copies in the past year and have recently reprinted similar quantities.

Secondary School Mathematics is selling quite slowly and has not needed another printing.

I have recently had a request to update our listing in *School Supplies Textbook Catalogue*. The two seventh form books were listed already although I have not been approached before about this. It is probably a mixed blessing, making our books more prominent but diverting more orders through bookshops and so increasing the cost to schools.

Other Publications

Postgraduate Topics in Mathematics continues to be updated and distributed annually by Rod Downey who is also investigating the support for a monograph series (see latest Newsletter). During this Colloquium we hope to establish a group to work on the revision of *Employment Opportunities in Mathematics.*

I would like to thank the convenors of writing groups who continue to handle orders and accounts for their books year after year.

We are especially grateful to John Shanks who, as honorary treasurer, has managed our finances through an exceptionally busy period of publishing. He has coordinated the accounts from four different projects operating simultaneously in different parts of the country, mastered the intricacies of GST, patiently sorted out payments and accounts and made it all balance each year. He even kept on doing it for a year after he resigned! Thank you, John.

Gillian Thornley
Publications Convenor

REPORT OF THE FORDER LECTURER 1989
Sir Micahel Atiyah

General. As the second Forder Lecturer, following in the steps of Christopher Zeeman, I found the ground well prepared. My programme was very similar to his in that I visited all six universities and gave a total of 15 lectures. These were all well attended by both staff and students and some lectures attracted a more general scientific audience. I also had discussions with a number of the mathematicians (particularly of the younger generation).

There was extensive publicity concerning my visit and I had 5 or 6 interviews with local journalists which resulted in a similar number of newspaper articles. I also met 5 of the 6 vice-chancellors so that I was, by the end, well briefed on the current problems of the New Zealand universities (essentially too many students and not enough money).

Administrative Arrangements. All arrangements in New Zealand were coordinated by Professor Graeme Wake of Massey University. He was extremely helpful and efficient so that everything went off very smoothly. Each university looked after us well and provided generous hospitality. We made many friends.

Travel. Before going to New Zealand we spent one month at the MSRI in Berkeley, California and then several weeks in Australia, mainly at the ANU in Canberra. We continued westward, stopping 3 days in Singapore where I also gave some lectures. Inside New Zealand we rented a car and drove throughout our stay. Car hire is expensive in New Zealand but easily the best and most convenient way of seeing the country, especially given the number of universities we were visiting.

Finance. Travel to New Zealand was supported by the British Council and the London Mathematical Society, while local expenses in New Zealand were the responsibility of the New Zealand Mathematical Society and the

various universities.

Comments. In his report on the first Forder Lectures Christopher Zeeman indicated that 16 lectures over 3 weeks was rather a hectic schedule and that a longer visit might be preferable. As a result we allowed 4 weeks for our stay in New Zealand. In the end this did nothing to decrease the lecturing pressure but it did provide a week in which to recuperate at the end.

One small problem emerged which might be examined for the next Forder Lecturer. Because of the intense pressure on lecture rooms in most universities, my lectures were frequently sandwiched between two undergraduate classes. This meant that the time for the lecture was limited to a maximum of 50 minutes and effectively precluded any questions or discussion. If this remains a problem I would suggest either that the Forder lecturer is asked to prepare shorter lectures (30-40 minutes) or else that rooms are booked for a double period and the lecture extended accordingly.

Concerning the choice of future Forder Lecturers, it should be borne in mind that, in the New Zealand university mathematics departments, there are many applied mathematicians and statisticians. Some rotation of subject area is therefore reasonable, although lecturers will no doubt be selected on an individual basis with particular regard to their lecturing ability. The mathematical audiences in New Zealand are inevitably very varied, covering a wide range of interests, and the Forder Lecturer has to keep technicalities to a minimum if he is not to lose his listeners.

Conclusion. I would like finally to express my thanks to the London Mathematical Society for appointing me as Forder Lecturer, to the British Council for its financial assistance (and hospitality in New Zealand), to Graeme Wake for his efficient organisation and to all his New Zealand colleagues for their generous hospitality. My wife and I enjoyed our time in New Zealand and, on the mathematical side, I was particularly pleased that the exciting recent work of Vaughan Jones (an Auckland graduate) figured prominently in my lectures.

Michael Atiyah
14 April 1989.

LONDON MATHEMATICAL SOCIETY AND NZMS FORDER LECTURESHIP Conditions and Rules

I. General

1. In 1986, the Council of the London Mathematical Society, in consultation with Officers of the New Zealand Mathematical Society, decided to institute a Lectureship to New Zealand, bearing the name of the late Professor H.G. Forder, formerly of the University of Auckland and a benefactor of the London Mathematical Society.

2. The award of the Lectureship shall be considered biennially by the two Societies, and the Lectureship shall be taken up in odd-numbered years.

3. No person shall be awarded the Lectureship more than once.

4. The Lecturer shall be a Member of the London Mathematical Society who is normally resident in the United Kingdom of Great Britain and Northern Ireland on the 1st January of the year of the award.

5. Grounds for award of the Lectureship shall include: (i) work in and influence on and general service to mathematics; (ii) lecturing gift; (iii) breadth of mathematical interest.

6. The award is not restricted to mathematicians working in any specified field or area of mathematics.

7. The regulations may be varied from time to time by agreement between the two Societies. The agreement to award the Lectureship may be cancelled by the London Mathematical Society at any time on the expiry of a period of three years' notice.

II. Procedure for award of the Lectureship in year X

1. At the January meeting of LMS Council in year X-2, there shall be a preliminary discussion of the Lectureship, in the course of which Members of LMS Council may put forward candidates for the Lectureship.

2. In the months of February and March, year X–2, the LMS President shall consult with the NZMS President concerning the Lectureship. In these consultations, both may suggest candidates for the Lectureship and make comments on the other's proposals.

3. At its Annual Meeting in May, year X–2, the NZMS Council shall approve an ordered list of recommended names for the Lectureship and this list shall be communicated to the LMS Meetings Secretary no later than 31st May.

4. At its meeting in June, year X–2, LMS Council shall receive the recommendations of the NZMS Council. LMS Council shall then select the Lecturer and approve an ordered list of reserve Lecturers. An invitation to the selected Lecturer shall be issued by the LMS President and in the event of this invitation being declined, the reserve Lecturers shall be approached in turn. The name of the Forder Lecturer for year X shall be communicated to the NZMS Secretary by the LMS Meetings Secretary and shall be announced in the LMS Newsletter.

III. Duties of the Lecturer and Reimbursement of Expenses

1. The Forder Lecturer shall be appointed for a period of about four weeks, normally in the period from March to June. The Lecturer shall visit and give lectures in most New Zealand universities.

2. The Lecturer's provisional itinerary shall be agreed by the LMS Meetings Secretary and the NZMS Secretary in consultation with the Lecturer, and then approved by the LMS and NZMS Councils.

3. It is hoped that in some years, the Lecturer may receive grants from outside bodies towards travelling expenses. If, for procedural reasons, it is appropriate that applications for such assistance should originate in New Zealand, then the NZMS Secretary shall arrange that such applications are submitted.

4. LMS Council shall agree by 31st January in year X–2 a sum of money which shall be guaranteed to the Forder Lecturer in year X, which shall represent the cost of two air tickets to and from New Zealand at advanced purchase fares by scheduled airlines. The amount paid by the LMS to the Lecturer shall be the difference between the amount guaranteed and the amount received by way of grants towards travelling expenses outside New Zealand.

5. Full living expenses and travelling expenses of the Lecturer in New Zealand during the tenure of the Lectureship shall be arranged by the NZMS, bearing in mind that the Lecturer may be accompanied by a spouse.

MINUTES OF THE FIFTEENTH ANNUAL GENERAL MEETING
16 May, 1989

The meeting was held in Room AH1 of the Agricultural-Horticultural Lecture Block at Massey University and began at 4.35 pm.

PRESENT: B. Woods (in the Chair), J. Ansell, D. Breach, J. Burnell, J. Butcher, M. Carter, M. Conder, G. Dixit, M. Doherty, S. Forbes, D. Gauld, J. Giffin, R. Goldblatt, A. Gomez, D. Halford, A. Hall, J. Harper, M. Henderson, D. Holton, M. Jorgensen, P. Kelly, M. McGuiness, B. Neumann, I. Reilly, I. Rinsma, A. Sneyd, G. Tee, K. Teo, G. Thornley, C. Triggs, J. Turner, G. Wake.

1. APOLOGIES: Apologies were received from M. Hendy, J. Liddell, and D. Smith. It was **moved** from the Chair that: *the apologies be accepted.* The motion was **carried.**

2. MINUTES OF THE FOURTEENTH AGM: It was **moved** by D. Gauld (seconded by M. Jorgensen) that: *the Minutes of the Fourteenth AGM be accepted.* The motion was **carried.**

3. MATTERS ARISING FROM THE MINUTES:

(i) Referring to item 4, J. Harper asked if there had been any further communication from the Minister of Education to which the answer was "No".

(ii) With reference to item 9, J. Harper asked the Council if it had considered the matter of appointing an education officer. The President said that the Council had discussed the matter and wanted clarification of such an officer's duties. S. Forbes said that appointees would make the job their own but would provide a focus for submissions and queries on mathematical education problems which fell outside the normal attention of Council. G. Thornley said a particular person was being approached. [Dr Gordon Knight has been appointed.]

4. PRESIDENT'S REPORT:

(i) The President presented his report to the meeting. [The report is appended to these minutes.] In the general discussion following the report R. Goldblatt said that, in view of the likely contestability of science funding, it was important to have a working group near to the sources of finance. In the past mathematicians in New Zealand had been relatively invisible; they form about one percent of the RSNZ membership. J. Butcher also spoke of the under-representation of mathematics in the RSNZ and said that the President of the RSNZ had finally come to believe in the case for better representation.

(ii) It was **moved** from the Chair that: *the retiring Treasurer, John Shanks, be given the heartfelt gratitude of the NZMS in recognition of his long and faithful service in a most difficult and time-consuming office.* The motion was **carried** with acclamation.

(iii) Professor B. Neumann expressed pleasure on hearing of Dr Gloria Olive's honorary membership.

(iv) G. Wake said he had received a letter from Sir Michael Atiyah expressing pleasure about his trip to New Zealand as the second Forder Lecturer. The President remarked that a report from Sir Michael would be published in the Newsletter. [It is appended.] It was **moved** from the Chair that: *the President's report for 1988-89 be accepted.* The motion was **carried.** [The report is appended.]

5. TREASURER'S REPORT: As there had not been time for the auditors to complete their report an interim financial statement was circulated. It is expected that the final report signed by the auditors will differ only in minor detail. It was **moved** from the Chair that: *the Treasurer's report be accepted.* The motion was **carried.**

6. ANNUAL SUBSCRIPTION: It was moved by B. Woods (seconded by D. Breach) that: *the annual subscription be raised to $30 (thirty dollars) not including GST with an abatement for prompt payment.* The motion was carried.

7. ELECTION OF COUNCIL MEMBERS: With the elected term of the Treasurer coming to an end and he not wishing to continue, and with the Secretary resigning, there were two vacancies to be filled on the Council. Two nominations had been received:

> **Dr Kee Teo** nominated by G. Thornley (seconded by P. Kelly). and
> **Dr John Giffin** nominated by P. Kelly (seconded by M.R.Carter).

Both candidates had accepted nomination. The President asked if there were any further nominations. After some discussion of the structure of the Council and the Constitution it was **moved** by J. Ansell (seconded by D. Gauld) that: *nominations be closed.* The motion was **carried.** K. Teo and J. Giffin were then declared duly elected to the Council.

8. OTHER BUSINESS:

(i) J. Turner asked about publishing plans and policies and suggested that the Society support publication of projects and texts even though they would be unprofitable. In particular the publications funds were not being

used to produce advanced mathematics texts; even small amounts would help. J. Ansell said that very little of the profits has gone into producing monographs and people should be invited to submit such works. S. Forbes said there was some level of dissatisfaction from authors about how the money was being used. M. Conder pointed out that it was only in the last two years that the profits have accumulated. J. Harper said as an author of a previous publication of the NZMS he was happy with the Council's use of the profits.

(ii) It was moved by M. Conder (seconded by J. Harper) that: *the NZMS get together with Heads of Mathematics Departments, the National Committee for Mathematics, and sister societies to make a concerted case that mathematics teaching be funded as a science subject and not as an arts subject and to achieve representation on bodies handling research funding.* The motion was **carried.**

(iii) It was **moved** from the Chair that: *the Society show its thanks to the retiring Secretary for his services over the past two and a half years.* The motion was **carried** with applause.

(iv) The incoming President, G. Thornley, thanked the outgoing President, B. Woods for the work he had done for the Society.

The Secretary's ball-point ceased functioning and the meeting ended at 5.40 pm.

D.R. Breach
Hon Sec, NZMS

PRESIDENT'S REPORT 1988-9

I shall report briefly on some of the activities of the Society undertaken since the last AGM, and on some of the issues facing it.

The Council has met once during this period, on 28 October 1988, and will have met again, on Sunday May 14, before this report is circulated.

Financial support for mathematical activities.

At the meeting of 28 October, grants towards the conference expenses of one society member and three post-graduate students were approved. We will be considering further applications at the meeting on May 14, and I shall report on these verbally at the AGM.

The Second Forder Lecturer.

Professor Sir Michael Atiyah visited this country as the second Forder lecturer during February and March of this year, and his visit was successful in every way we could hope for. The Society is indebted to Graeme Wake for his organization of Professor Atiyah's itinerary. Negotiations are in train for the selection of the third Forder Lecturer.

"Learning For Life", "A New Deal for Science" Etc

Members will I suspect be somewhat shell-shocked by the rapidity with which proposals to reform higher education and research have been unveiled and launched in the past year. It is far from clear what the implications are for mathematics. I have received a number of communications from STAC. These included an invitation to a meeting in January of this year, to discuss their report "A New Deal for Science". Professor Rob Goldblatt agreed to attend this, and I hope to persuade him to give us an account of what came out of it. In a written comment on the report, which I hope many of you have read, I made these points: (i) The dominant strain in the report is the identification of science with technology, and of science and technology with (industrial) R and D. Notwithstanding the great importance of this aspect of science, there are other aspects which we must be careful to defend in a time of rampant utilitarianism, and these have to do with the support of "basic" or even "pure" research. (ii) Mathematics is scandalously under-resourced in this country, and proposals (as in the Hawke Report, and in an attenuated form, in "A New Deal...") that some of the funding on which we depend should become in some sense "contestable" would be analogous to withholding food from a famine victim, while offering him a chance to compete for it in a beauty contest. (I did not use these exact words). (iii) I expressed the wish that the Society be given the opportunity to make nominations to the two Boards of Management (in Physical Sciences and Technology, and in Social Sciences) of the Science and Technology Advisory Committee.

Farewell and Thanks

Our colleague John Shanks will, at this meeting, stand down from the Treasurership, which he has held since June 1984. (He was Secretary for two years before that). During his tenure, the work of the Treasurer has markedly increased, particularly by the quite large movements of money generated by our publishing ventures. The Society owes him considerable gratitude for his labours in office, and I wish to record my own thanks here. I should also like to record my thanks to our colleague Derrick Breach, who has run the Society as its Secretary for the past two years.

B.A. Woods
12 May 1989

MATHEMATICAL VISITORS TO NEW ZEALAND

LIST NO.23 : 1 JULY 1989

The information for each item is arranged as follows:
Name of visitor; home institution; whether accompanied; principal field of interest; dates of visit; principal host institution; principal contact person; comments.

One of the main purposes of this list is to enable other institutions to invite visitors to spend time with them. Anyone wishing to issue such an invitation should do so through the principal contact person.

Professor Brian Alspach; Simon Fraser University, B.C., Canada; graph theory; 17–19 July 1989; Massey University; Dr. Charles Little.

Professor Wim Blok; University of Illinois at Chicago; wife (Mary); logic, universal algebra; February–November 1989; University of Canterbury; Dr. Robert Bull.
Professor Blok is an Erskine Visitor for 1989.

Professor Stavros Busenberg; Harvey Mudd College, Claremont, California; wife & 2 teenage sons; differential equations and mathematical modelling (especially in biology); 1 June–31 August 1989; Massey University; Prof. Graeme Wake.
Professor Busenberg is visiting Massey University under the Fullbright Award Scheme.

Professor George Duff; University of Toronto, Canada; partial differential equations, fluid mechanics; 1–15 July 1989; Massey University; Prof. Graeme Wake.

Professor Katherine Heinrich; Simon Fraser University, B.C., Canada; graph theory; 17–19 July 1989; Massey University; Dr. Charles Little.

Professor R.N. Horne; Stanford University, California; petroleum engineering; November 1989; University of Auckland; Prof. Ian Collins.

Dr. Grant Keady; University of Western Australia; wife & daughter; symbol manipulative computation, differential equations; 1 July 1989–30 June 1991; University of Waikato; Dr. Kevin Broughan.

Professor S. Koonce; Vassar College, New York; spouse (D. Armstrong); algebraic topology; 10 June–10 July 1989; University of Auckland; Dr. Gaven Martin.

Professor E. Palm; University of Oslo; fluid mechanics; October–December 1989; University of Auckland; Prof. Ian Collins.

Dr. Ahmad Parsian; Shiraz University, Iran; multivariate statistics; January–December 1989; Victoria University of Wellington; Prof. David Vere-Jones.

Professor M.J.D. Powell; University of Cambridge; wife; optimization & approximation, numerical analysis; 10 September–2 December 1989; University of Canterbury; Dr. Ian Coope. Professor Powell is an Erskine Visitor for 1989.

Dr. A.T. Richardson; University of Bristol; wife & daughter; fluid dynamics, magnetohydro-dynamics, stability theory; July–September 1989; University of Auckland; Prof. Ian Collins.

Professor Gerhard Rosenberger; Universität Dortmund, West Germany; wife & daughter; group theory; 10–24 September 1989; University of Auckland; Dr. Marston Conder.

Professor Shayle R. Searle; Cornell University, U.S.A.; wife; statistics–linear models, components of variance; 26 February–4 May 1990; University of Auckland; Prof. George Seber.

Dr. Günter Steinke; Christian-Albrechts Universität zu Kiel, West Germany; wife; topological projective planes; from 27 August 1989, indefinitely; University of Auckland; Prof. Peter Lorimer.

Professor Tom Shively; University of Texas at Austin, U.S.A.; time series regression models, hypothesis testing, extreme value theory; 29 May–5 August 1989; University of Auckland; Prof. Craig Ansley.

Professor Robert Sulanke; Boise State University, Idaho; combinatorics, graph theory; February–August 1989; University of Canterbury; Dr. Derrick Breach.

CONFERENCES

**** 1989 ****

October 2-4 (Kyoto, Japan) **Topics in Univalent Functions and Their Applications**
Contact Shigeyoshi Owa, Dept. of Mathematics, Faculty of Science and Technology, Kinki University, Higashiosaka, Osaka 577, Japan.

October 2-5 (Basel, Switzerland) **IMACS-GAMM International Symposium on Computer Arithmetic and Self-Validating Numerical Methods**
Contact C. Ullrich, Institut für Informatik, Universität Basel, Mittlere Strasse 142, CH-4056 Basel, Switzerland.

October 2-6 (Kaiserslautern, West Germany) **Third Workshop on Computer Science Logic**
Contact M.M. Tichter, Fachbereich Informatik, Universität Kaiserslautern, Postfach 30 49, 6750 Kaiserlautern, West Germany.

October 2-6 (Venice) **Symposium on Applied and Industrial Mathematics**
Contact R. Spigler, Chairman, The Organising Committee of Symposium Venice - 1, Universitá di Padova, Dipartimento di Metodi e Modeli Matematici per le Scienze Applicate, Via Belzoni, 7-35131 Padova, Italy.

October 4-6 (Knoxville, Tennesses) **Geometry and Mathematical Physics: John H. Barrett Memorial Lectures**
Contact H. Simpson, Department of Mathematics, University of Tennessee, Knoxville, Tennessee 37996-1300, U.S.A.

October 6-7 (Oxford, Ohio) **Conference on Issues in the Teaching of Calculus**
Contact F. Gass, Department of Mathematics and Statistics, Miama University, Oxford, Ohio 45046, U.S.A.

October, 9-13 (Ithaca, New York) **Workshop on Geometric Phases in Mechanics**
Contact MSI, 201 Caldwell Hall, Cornell University, Ithaca, New York 14853-2602, U.S.A.

October 9-13 (Ibadan, Nigeria) **International Conference on Contemporary Problems in Stochastic Analysis and its Applications**
Contact G.O.S. Ekhaguere, Department of Mathematics, University of Ibadan, Ibadan, Nigeria.

October 12-14 (Tallahassee, Florida) **Second Interdisciplinary Conference on Natural Resource Modeling and Analysis**
Contact M. Mesterton-Gibbons, Department of Mathematics, Florida State University, Tallahassee, Florida 32306-3027, U.S.A.

October 16-20 (Minneapolis, Minnesota) **Workshop on Patterns and Dynamics in Reactive Media**
Contact IMA: see (3) below.

October 16-20 (Beijing, China) **Sixth World Congress on Medical Informatics**
Contact Ms Shan Huiquin, Medinfo 89, Office of the Secretariat, China Computer Technical Service Corp, 29 Xueynan Nanlu, Haidian District, Beijing, China.

October 17-20 (Kyoto, Japan) **Hyperfunctions and Differential Equations**
Contact Kiyomi Kataoka, Faculty of Science, University of Tokyo, Bunkyo-ku, Tokyo 113, Japan.

October 19-20 (Ithaca, New York) **Workshop on Large-Scale Numerical Optimization**
Contact T. Coleman, Department of Computer Science, Cornell University, Ithaca, New York 14853, U.S.A.

October 20-26 (Montréal) **Hamiltonian Systems, Transformation Groups and Special Transform Methods**
Contact F.H. Clarke, Director CRM, Université de Montréal, C.P. 6128-A, Montréal, Québec H3C 3J7, Canada.

October 22-28 (Linz and Vienna, Austria) **Österreichisches Symposium Zur Geschichte Der Mathematik**
Contact Dr Christa Binder, Institut für Mathematik, Technische Universität Wien Wiedner Hauptstrasse 8-10, A-1040 Vienna, Austria.

October 23-26 (Beijing, China) **Beijing International Conference on System Simulation and Scientific Computing**
Copntact BICSC Sonfrence Secretary Group, Automatic Control Department, Beijing Institute of Aeronautics and Astronautics, Beijing 100083, China.

October 25-27 (Kyoto, Japan) **Evolution Equations and Applications to Nonlinear Problems**
Contact Nobuyuki Kenmochi, Faculty of Education, Chiba University, Chiba 260, Japan.

October 25-28 (Espoo, Finland) **Workshop on Numerical Methods for Elliptic Systems**
Copntact J. Pitkäranta, Helsinki University of Technology, Institute of Mathematics, 02150 Espoo, Finland.

October 26-28 (Como, Italy) **The Riccati Equation in Control, Systems and Signals**
Contact Centro di Cultura Scientifica A. Volta, Villa Olmo, Via Cantoni 1, 22100 Como, Italy.

October 29-November 4 (Oberwolfach, West Germany) **Computational Methods in Solid Mechanics**
Contact MFOG: see (1) below.

Oct 30-November 2 (Berkeley, California) **Workshop on Homotopy Theory**
Contact MSRI: see (2) below.

October 30-November 2 (Kyoto, Japan) **Differential Analysis and Differential Topology**
Contact Shuzo Izumi, Faculty of Technology and Science, Kinki University, Higashiosaka, Osaka 577, Japan.

October 30-December 1 (Trieste, Italy) **College on Differential Geometry**
Contact ICTP: see (5) below.

November 2-4 (Columbus, Ohio) **Second Annual Conference on Technology in Collegiate Mathematics**
Contact F. Demana, 1989 Technology Conference, Ohio State University, Department of Mathematics, 231 W. 18th Avenue, Columbus, Ohio 43210, U.S.A.

November 2-5 (Florence, Italy) **Third International Conference on Expert Systems in Law**
Contact Secretary of the Congress, ENIC, via S. Caterina d'Alessandra 12, 50129 Florence, Italy.

November 4-8 (Ithaca, New York) **Workshop on Geometric and Algebraic Integration Algorithms**
Contact R. Grossman, Department of Mathematics, M/C 249, Box 4348, University of Illinois at Chicago, Chicago, Illinois 60680, U.S.A.

November 6-8 (Kyoto, Japan) **On the Structure of Solutions to Partial Differential Equations**
Contact RIMS: see (4) below)

November 6-10 (Tempe, Arizona) **SIAM Conference on Applied Geometry**
Contact SIAM Conference Co-ordinator, Suite 1400, Architects Building, 117 S.17th Street, Philadelphia, Pennsylvania 19103-5052, U.S.A.

November 10-11 (Carbondale, Illinois) **Eighteenth Midwest Differential Equations Conference**
Contact T.A. Burton, Conference on Differential Equations, Southern Illinois University, Carbondale, Illinois 62901-4408, U.S.A.

November 13-17 (Berkeley, California) **Workshop on Logic Related to Computer Science and Programming Language Theory**
Contact MSRI: see (2) below.

November 13-17 (Minneapolis, Minnesota) **Workshop on Dynamical Issues in Combustion Theory**
Contact IMA: see (3) below.

November 15-17 (Kyoto, Japan) **Geometry of Manifolds**
Contact Katsuo Kawakubo, Faculty of Science, Osaka University, Toyonaka, Osaka 560, Japan.

November 17-20 (Ithaca, New York) **Workshop on Classical and Quantum Transport in Hamiltonian Systems**
Contact G.S. Ezra, Department of Chemistry, Baker Laboratory, Cornell University, Ithaca, New York 14853, U.S.A.

November 27-29 (Kyoto, Japan) **Computer Algebra and its Application to Investigations in Mathematics**
Contact Shunro Watanabe, Mathematics Department, Tsuda College, Kodaira, Tokyo 187, Japan.

November 27-29 (Kyoto, Japan) **Recent Developments in High Technology and Mathematical Science**
Contact Hideo Kawarada, Faculty of Engineering, Chiba University, Chiba 260, Japan.

November 29-December 1 (Kyoto, Japan) **Numerical Analysis and Scientific Computing**
Contact Makoto Natori, Institute of Information Science and Electronics, University of Tsukuba, Niihari-gun, Ibaragi 305, Japan.

December 4-6 (Kyoto, Japan) **Decision Theory and Related Topics**
Contact Toru Nakai, College of Liberal Arts, Kobe University, Nada-ku, Kobe 657, Japan.

December 4-6 (Washington, DC) **1989 Winter Simulation Conference**
Contact P. Heidelberger, Program Chair, WSC '89, IBM Research Division, T.J. Watson Research Center, Hawthorne, P.O.Box 704, Yorktown Heights, New York 10598, U.S.A.

December 4-7 (Kyoto, Japan) **Complex Analytic Geometry and Related Topics**
Contact RIMS: see (4) below.

December 6-9 (Kyoto, Japan) **Algebraic Number Theory**
Contact Kazuya Kato, Faculty of Science, University of Tokyo, Bunkyo-ku, Tokyo 113, Japan.

December 10-16 (Oberwolfach, West Germany) **Asymptotic Methods for Computer-Intensive Procedures in Statistics**
Contact MFOG: see (1) below.

December 11-13 (Chicago) **Fourth SIAM Conference on Parallel Processing for Scientific Computing**
Contact SIAM Conference Co-ordinator, Suite 1400, Architects Building, 117 S.17th Street, Philadelphia, Pennsylvania 19103-5052, U.S.A.

December 12-14 (Kyoto, Japan) **Number Theory—Studies Related to Automorphic Forms**
Contact Tadashi Yamazaki, Department of Mathematics, Faculty of Science, Kyushu University, Higashi-ku, Fukuoka 812, Japan.

December 12-14 (Wollongong) **Second Australian Supercomputer Conference**
Contact Jerard Barry, Australian Nuclear Science and Technology Organisation, Private Mail Bag 1, Menai, NSW 2234, Australia.

December 17-23 (Oberwolfach, West Germany) **Theory and Numerical Methods for Initial-Boundary Value Problems**
Contact MFOG: see (1) below.

December 18-20 (Cirencester, England) **Cryptography and Coding**
(Leeds, England) **Waves and Turbulence in Stably Stratified Flows**
Contact Conference Officer, The Institute of Mathematics and its Applications, Maitland House, Warrior Square, Southend-on-Sea, Essex, SS1 2JY, England.

** 1990 **

January 1-6 (Oberwolfach, West Germany) **Zeitreihenanalyse**
Contact MGOG: see (1) below.

January 7-13 (Oberwolfach, West Germany) **Mathematische Optrimierung**
Contact MFOG: see (1) below.

January 14-20 (Oberwolfach, West Germany) **Nonlinear Evolution Equations, Solitons and the Inverse Scattering Transform**
Contact MFOG: see (1) below.

January 15-26 (Trieste, Italy) **Workshop on Composite Media and Homogenization Theory**
Contact ICIP: see (5) below.

January 21-27 (Oberwolfach, West Germany) **Modelltheorie**
Contact MFOG: see (1) below.

January 22-26 (Berkeley, California) **Workshop on Applications of Algebraic Topology to Geometry and Analysis**
Contact MSRI: see (2) below.

Jan. 28-Feb. 3 (Oberwolfach, West Germany) **Regelungstheorie**
Contact MFOG: see (1) below.

Jan. 29-Feb. 16 (Trieste, Italy) **Second College on Variational Problems in Analysis**
Contact ICTP: see (5) below.

February 4-10 (Oberwolfach, West Germany) **Funktiontheoretische Methoden Bei Partiellen Differential Und Integralgleichungen**
Contact MFOG: see (1) below.

February 4-10 (Oberwolfach, West Germany) **Nukleare Frechet-Räume**
Contact MFOG: see (1) below.

February 11-15 (Coolangatta, Queensland) **26th Australian Applied Mathematics Conference**
Contact Dr V.G. Hart, Department of Mathematics, University of Queensland, St Lucia, Queensland 4067, Australia.

February 11-17 (Oberwolfach, West Germany) **Funktiontheorie**
Contact MFOG: see (1) below.

February 18-24 (Oberwolfach, West Germany) **Mathematische Modelle in der Biologie**
Contact MFOG: see (1) below.

Feb. 25-March 3 (Oberwolfach, West Germany) **Eigenwertaufgaben In Natur Und Ingenieurwissenschaften Und Ihre Numerische Behandlung**
Contact MFOG: see (1) below.

March 4-10 (Oberwolfach, West Germany) **Interval Methods for Numerical Computation**
Contact MFOG: see (1) below.

March 5-7 (New Orleans) **SIAM Conference on Applied Probability in Science and Engineering**
Contact SIAM Conference Co-ordinator, Suite 1400, Architects Building, 117 S.17th Street, Philadelphia, Pennsylvania 19103-5052, U.S.A.

March 11-17 (Oberwolfach, West Germany) **Mathematische Stochastik**
Contact MFOG: see (1) below.

March 12-16 (Minneapolis, Minnesota) **Workshop on Twist Mappings and their Applications**
Contact IMA: see (3) below.

March 14-19 (Predela, Bulgaria) **East European Category Seminar**
Contact K.G. Preeva, Sofia 1000, POB 384, Institute of Applied Mathematics and Computer Science, VMEI "V.I. Lenin", Bulgaria.

March 18-24 (Oberwolfach, West Germany) **Masstheorie**
Contact MFOG: see (1) below.

March 18-24 (Hamburg, Germany) **Third Centenary Celebration of the Mathematische Gesellschaft in Hamburg**
Contact Mathematische Gesellschaft in Hamburg, Geschäftsstelle, Bundesstrasse 55, D-2000 Hamburg 13, Federal Republic of Germany.

March 19-April 3 (Minneapolis, Minnesota) **Workshop on Mathematical Physiology**
Contact IMA: see (3) below.

March 20-23 (Auburn, Alabama) **Directions in Matrix Theory**
Contact F. Uhlig, Department of Mathematics - ACA, Auburn University, AL 36849-5307, U.S.A.

March 25-31 (Oberwolfach, West Germany) **Kontinuumsmechanik der Festen Körper**
Contact MFOG: see (1) below.

March 26-April 6 (Trieste, Italy) **Workshop on Group Theory from a Geometrical Viewpoint**
Contact ICTP: see (5) below.

April 4-7 (Rome) **Symposium on Distributions with Given Marginals**
Contact Dipartimento di Statistica, Piazzale Aldo Moro 5, I-00185 Rome, Italy.

May 7-June 1 (Trieste, Italy) **College on Recent Developments and Applications in Mathematics and Computer Science**
Contact ICTP: see (5) below.

May 21-25 (Tucson, Arizona) **Eleventh United States National Congress of Applied Mechanics**
Contact C.F. Chen, Department of Aerospace and Mechanical Engineering, University of Arizona, Tucson, Arizona 85721, U.S.A.

May 23-25 (Charlotte, N. Carolina) **1990 International Symposium on Multiple-Valued Logic**
Contact G. Epstein, Computer Science Department, University of North Crolina at Charlotte, Charlotte, North Carolina 28223, U.S.A.

May 25-31 (Atlantic City, New Jersey) **Tenth International Conference on Pattern Recognition**
Contact H. Freeman, CAIP Center, 605 Hill, Rutgers University, New Brunswick, New Jersey 08903, U.S.A.

May 29-30 (Boulder, Colorado) **Algebraic Logic Conference in Honour of Professor Don Monk**
Contact Walter Taylor, Department of Mathematics, Campus Box 426, Boulder, Colorado 80309-0426, U.S.A.

May 29-June 2 (Minneapolis, Minnesota) **Workshop on Dunamical Systems in Fluid Mechanics**
Contact IMA: see (3) below.

June 4-8 (Minneapolis, Minnesota) **Workshop on Nonlinear Phenomena in Atmospheric and Oceanic Sciences**
Contact IMA: see (3) below.

June 6-9 (Lahti, Finland) **Fifth Annual Conference of the European Consortium for Mathematics in Industry**
Contact S. Vaskelainen, University of Helsinki, Lahti Research and Training Centre, Kirkkokatu 16, SF-15140 Lahti, Finland.

June 6-12 (Barcelona) **1990 Barcelona Conference on Algebraic Topology**
Contact M. Castellet, Director, Centre de Recerca Matematica, Institut D'Estudis Catalans, Apartat 50-08193 Bellaterra, Barcelona, Spain.

June 11-14 (Helsinki) **Fourteenth Rolf Nevanlinna Colloquium**
Contact S. Rickman, University of Helsinki, Department of Mathematics, SF-00100, Helsinki, Finland.

June 11-14 (New York) **8th International Conference of Systems and Cybernetics**
Contact Professor C.V. Negoita, Department of Computer Science, Hunter College, City University of New York, 695 Park Avenue, New York, N.Y. 10021, U.S.A.

June 11-15 (Uppsala, Sweden) **Third International Conference on Hyperbolic Problems**
Contact Professor Dr B. Gustafason, Department of Computer Sciences, University of Uppsala, Sturegatan 4B 2TR, Uppsala, Sweden.

June 11-15 (Minneapolis, Minnesota) **Workshop on Chaotic Processes in Geophysical Phenomena**
Contact IMA: see (3) below.

June 11-15 (Liblice Castle, Czechoslovakia) **Rigorous Results in Quantum Dynamics**
Contact J. Dittrich, Theoretical Department, Institute of Nuclear Physics, 250 68 Rez, Czechoslovakia.

June 27-30 (Xanthi, Greece) **Fourth International Congress on Algebraic Hyperstructures and Applications**
Contact L. Konguetsof, Democritus University of Thrace, 67100 Xanthi, Greece.

July (Sydney) **10th Australian Statistical Conference and 2nd Pacific Statistical Congress**
Contact Dr. S.H. Huxham, School of Mathematical Sciences, University of Technology, Sydney, P.O. Box 123, Broadway, New South Wales, Australia.

July 1-7 (Oberwolfach, West Germany) **Modulfunktionen In Mehreren Variablen**
Contact MFOG: see (1) below.

July 1-18 (Saint-Flour, France) **Twentieth Summer Session on Probability Theory**
Contact P.L. Hennequin, Mathématiques Appliquées, F63177 Aubiere Cedex, France.

July 2-6 (Budapest) **XVth International Biometric Conference**
Contact Ms Eva Sos, Computer and Automation Institute, Hungarian Academy of Sciences, H-1502 Budapest, P.O. Box 63, Hungary.

July 2-6 (Townsville) **34th Annual Meeting of the Australian Mathematical Society**
Contact Professor R.J. Hosking, Department of Mathematics, James Cook University, Townsville, Queensland 4811, Australia.

July 8-14 (Oberwolfach, West Germany) **Variationsrechnung**
Contact MFOG: see (1) below.

July 9-20 (Hamilton, Ontario) **Geometry and Topology of Four-Manifolds**
Contact I. Hambleton, Department of Mathematics, McMaster University, Hamilton, Ontario, Canada L85 4K1.

July 15-21 (Oberwolfach, West Germany) **Stochastic Image Models and Algorithms**
Contact MFOG: see (1) below.

July 15-23 (Luminy, France) **Colloquium in Honour of Roland Fraisse**
Contact R. Bonnet, Department of Mathematics and Mechanics, Case Postale 322, Université Aix Marseille III, 13 397 Marseilles Cedex 13, France.

July 22-28 (Oberwolfach, West Germany) **Konvexgeometrie**
Contact MFOG: see (1) below.

July 29-Aug. 4 (Oberwolfach, West Germany) **Mechanik Und Algebraische Geometrie**
Contact MFOG: see (1) below.

July 30-Aug. 3 (Winston-Salem, North Carolina) **Fourth International Conference on Fibonacci Numbers and their Applications**
Contact Dr John Turner, Dept of Mathematics and Statistics, University of Waikato, Private Bag, Hamilton, New Zealand.

July 31-Aug. 2 (Bristol, England) **Dynamics of Numerics and the Numerics of Dynamics**
Contact Conference Officer, The Institute of Mathematics and its Applications, Maitland House, Warrior Square, Southend-on-Sea, Essex, SS1 2JY, England.

August (Uppsala, Sweden) **53rd Annual Meeting of the Institute of Mathematical Statistics and 2nd World Congress of the Bernoulli Society**
Contact Lynne Billard, Department of Statistics, University of Georgia, Athens, Georgia 30602, U.S.A.

August 5-11 (Oberwolfach, West Germany) **Mathematical Methods in Tomography**
Contact MFOG: see (1) below.

August 12-18 (Oberwolfach, West Germany) **Algebraische Zahlentheorie**
Contact MFOG: see (1) below.

August 12-18 (Honolulu) **Pre-Congress Topology Conference**
Contact K.H. Dovermann, Department of Mathematics, University of Hawaii, Honolulu, Hawaii 96822, U.S.A.

August 15-19 (Osaka, Japan) **International Conference on Knot Theory and Related Topics**
Contact A. Kawauchi, Department of Mathematics, Osaka City University, Osaka 558, Japan.

August 19-24 (Dunedin, N.Z.) **Third International Conference on the Teaching of Statistics**
Contact the Secretary, ICOTS 3, Department of Mathematics and Statistics, University of Otago, P.O. Box 56, Dunedin, New Zealand.

August 19-25 (Oberwolfach, West Germany) **Mathematische Methoden Des VLSI-Entwurfs Und Des Distributed Computings**
Contact MFOG: see (1) below.

August 21-29 (Kyoto, Japan) **International Congress of Mathematicians**
Contact ICM-90 Secretariat, RIMS: see (4) below.

Augg. 26-Sept. 1 (Oberwolfach, West Germany) **Komplexe Analysis**
Contact MFOG: see (1) below.

August 28-30 (Esztergom, Hungary) **IMACS European Simulation Meeting on Problem Solving by Simulation**
Contact A. Javor, Central Research Institute for Physics of the Hungarian Academy of Sciences, H-1525 Budapest 114, P.O. Box 49, Hungary.

Aug. 30-Sept. 4 (Nagoya, Japan) **International Conference on Potential Theory**
Contact M. Kishi, Office of the Organizing Committee of International Conference on Potential Theory, Department of Mathematics, College of General Education, Nagoya University, Nagoya 464-01, Japan.

September 2-8 (Oberwolfach,West Germany) **Topologie**
Contact MFOG: see (1) below.

September 3-6 (Tokyo) **Fourth Asian Logic Conference**
Contact K. Kakahi, Department of Mathematics, Waseda University, 3-4-1 Okubo, Shinjuku-ku, Tokyo 169, Japan.

September 3-7 (Brussels) **IMACS Symnposium on Intelligent Models in Systems Simulation**
Contact S. Tzafestas, National Technical University of Athens, Division of Computer Science, Department of Electrical Engineering, 157 73 Zographou, Athens, Greece.

September 9-15 (Obersolfach, West Germany) **Surgery and L-Theory**
Contact MFOG: see (1) below.

September 10-14 (Dresden) **Mathematiker-Kongress**
Contact Professor G. Burosch, Sektion Mathematik, Wilhelm-Pieck-Universität, Universitätsplatz 1, Rostock 1, 2500 German Democratic Republic.

Sept. 10-Oct. 5 (Trieste, Italy) **School on Qualitative Aspects and Applications of Nonlinear Evolution Equations**
Contact ICTP: see (5) below.

September 16-22 (Oberwolfach, West Germany) **Risikotheorie**
Contact MFOG: see (1) below.

September 23-29 (Oberwolfach, West Germany) **Random Graphs and Combinatorial Structures**
Contact MFOG: see (1) below.

Sept. 30-Oct. 6 (Oberwolfach, West Germany) **Diophantische Approximationen**
Contact MFOG: see (1) below.

October 14-20 (Oberwolfach, West Germany) **Geometrie**
Contact MFPG: see (1) below.

October 21-27 (Oberwolfach, West Germany) **Mathematische Methoden in der Robotik**
Contact MFOG: see (1) below.

Oct. 28-Nov. 32 (Oberwolfach, West Germany) **Mathematical Economics**
Contact MFOG: see (1) below.

November 18-24 (Oberwolfach, West Germany) **Komplexitätstheorie**
Contact MFOG: see (1) below.

Nov. 25-Dec. 1 (Oberwolfach, West Germany) **Stochastische Approximation und Optimierungsprobleme In Der Statistik**
Contact MFOG: see (1) below.

December 2-8 (Oberwolfach, West Germany) **Multigrid Methods**
Contact MFOG: see (1) below.

December 3-7 (Palmerston North, N.Z.) **1990 Australasian Conference on Combinatorial Mathematics and Computing**
Contact Dr C.H.C. Little, Department of Mathematics and Statistics, Massey University, Palmerston North, New Zealand.

December 9-15 (Oberwolfach, West Germany) **Allgemeine Ungleichungen**
Contact MFOG: see (1) below.

December 16-22 (Oberwolfach, West Germany) **Mathematische Logik**
Contact MFOG: see (1) below.

Dec. 25-Jan. 1 (Oberwolfach, West Germany) **Lineare Modelle Und Multivariate Statistische Verfahren**
Contact MFOG: see (1) below.

** 1991 **

July 8-12 (Washington D.C.) **Second International Conference on Industrial and Applied Mathematics**
Contact Conference Officer, The Institute of Mathematics and its Applications, Maitland House, Warrior Square, Southend-on-Sea, Essex SS1 2JY, England.

July 22-26 (Dublin) **Thirteenth IMACS World Congress on Computing and Applied Mathematics**
Contact J.H. Miller, University of Dublin, School of Mathematics, 39 Trinity College, Dublin 2, Ireland.

Special Contact Addresses:

(1) **MFOG:** Mathematisches Forschungsinstitut Oberwolfach Geschäftstelle, Alberstrasse 24, D-7800 Freiburg in Breisgau, Federal Republic of Germany.

(2) **MSRI:** I. Kaplansky, Director, MSRI, 1000 Centennial Drive, Berkeley, California 94720, U.S.A.

(3) **IMA:** Willard Miller, Jr., Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street S.E., Minneapolis, Minnesota 55455, U.S.A.

(4) **RIMS:** Research Institute for Mathematical Sciences, Kyoto University, Kitashirakawa, Sakyo-ku, Kyoto 606, Japan.

(5) **ICTP:** International Centre for Theoretical Physics, P.O. Box 586, 34100 Trieste, Italy.

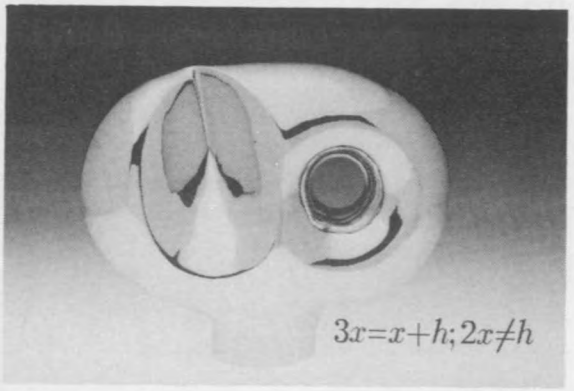
PROBLEMS AND QUERIES

Again the editors have received no new problems or solutions to previous problems. David Gauld's intriguing homonymous quotient group problem **P12** should have provoked a lot of curiosity. We publish below David's solution which, as you will see, asks additional questions. If you can trivialise v , then you can trivialise G .

Also outstanding are problems:

P4 (Dimensionless ratios) December 1986
P7 (Bowling) April 1987
P8 (Squares in triangles) December 1987
P10 (Paper trimming) April 1988
P13 (Random sample maxima) August 1988

At the 1989 New Zealand Mathematics Colloquium two posters and two postcards were displayed. The two postcards are reproduced here.



P14 To the topologically naive editors, the sculptures on the postcards accompanying the expressions $\pi_1(S^3 - S^2) \neq \pi_1(S^3 - S^2)$; and $3x = x+h$; $2x \neq h$ were puzzling. Hence as our next problem we ask for a satisfying explanation of these inequations.

One of the posters was a sculpture of a torus whose ring has triangular section with the triangle being rotated uniformly through $2\pi/3$ radians in one revolution of the ring. This toroidal figure appears to be a mirror image of the recently commissioned swept up Massey University logo reproduced below. This provoked the next problem.

MASSEY
UNIVERSITY

P15 Consider a torus T of circular section with internal radius a , and sectional radius b . Inscribed in this torus is a ring with equilateral triangular section, such that the vertices of the triangle are on the surface of the torus. If, on rotation θ around the torus, the triangular section rotates $\theta/3$, find the volume of the triangular ring.

P12 Homonymous quotient group

Let G be the group with generators a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u,v,w,x,y,z and relations of the form: two words w_1 and w_2 are deemed to be equal if w_1 and w_2 are both words in the English language and the English words w_1 and w_2 are homonyms of each other (i.e. they are pronounced the same but are not just alternative spellings of the same word). For example, tide = tied and dew = due. **Prove that G is abelian.** (This group is not very well defined, because it depends upon how you speak. For example, I would not admit the relation do = dew , at least directly, but some people would. Maybe you should rely on your own pronunciation. There must be many variants of this problem; try inventing your own.)

Solution (from David Gauld) While tide = tied implies that de = ed , this sort of thing seems to be too tedious a way of proceeding. Instead, we show that the group needs at most one generator, from which it follows immediately that it is abelian.

I list 4 sets of words. In the first set the underlined letter is optional in the sense that if it is deleted then we get a homonym and hence the underlined letter is trivial. The second set consists of pairs of homonyms. For each pair, after cancellations and deleting the trivial letters obtained from the first list from the resulting relation, one deduces that the underlined letter is trivial. The third set is like the second, but now we also use known trivia from the second list. Similarly for the fourth list.

(1) oar, jamb, scent, ore, reign, bailed, knot, damn, too, iron, butt, buy, two.
(2) ducked = duct, right = rite, jeans = genes, hall = haul, dammed = damned, queue = cue, lax = lacks, you = ewe, seize = seas.
(3) wrapped = rapt.
(4) faze = phase.

Thus the only letter which might not be trivial is v. Q.E.D.

Some questions

(1) Is G trivial?
(2) Can we make the lists more efficient, i.e. move letters from one list to an earlier list?

Edited by Mike Hendy and Graeme Wake
Massey University

ANECDOTE ABOUT BRENT WILSON

Several years ago, Brent proudly told me how he had saved the life of the eminent cosmologist Stephen Hawking.

Brent was on leave at Cambridge in about 1978, and he was working there with Stephen Hawking on cosmology. Stephen Hawking was then still able to walk with crutches, and his tiny figure, shuffling around Cambridge on crutches, became a familiar sight to many of the residents of the town. At 5 pm one day, Brent and Hawking were walking along a narrow twisting street in Cambridge, absorbed in cosmological discussion. They started to cross the street when a rush-hour bus sped around a nearby corner and rushed towards them, without time for the driver to stop the bus or space to steer around them on the narrow lane.

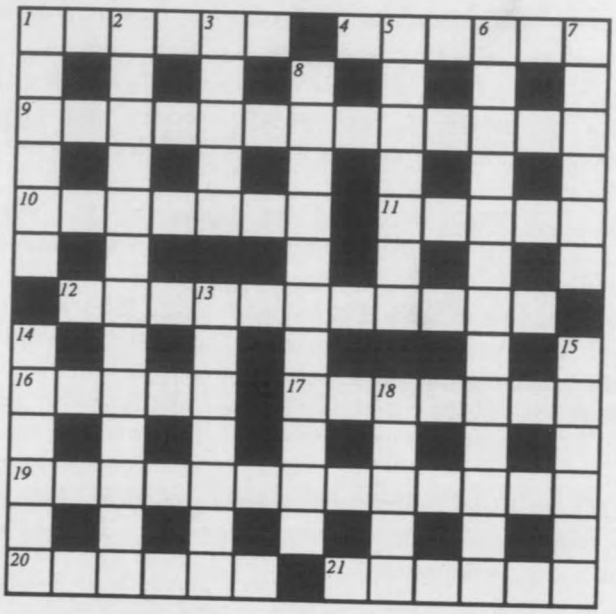
Brent was short in stature, but muscular. Without hesitating, he scooped Hawking into his arms and leaped onto the pavement, scattering Hawking's crutches, as the bus sped over the spot where they had stood one second previously.

Garry J. Tee

CROSSWORD

No 28

by Matt Varnish



Across

1. Change the direction with irritation (6)
4. Place at the halfway point (6)

9. Sail the small quantities (13)
10. Unparts to retain the warmth (7)
11. Sail east overturned between the seats (5)
12. In the mid-morning a turn at one on reduction in force (11)
16. Overturn {u, p} (5)
17. Sleeping room with hard water for little creatures (7)
19. Act silently to plot about nothing (could be the spirit) for copying (13)
20. Puts down again and transmits (6)
21. Young bird from tangency without a direction (6)

Down

1. One who hurts the poor winner (6)
2. Vanishingly small I am the little cake burner with largess (13)
3. Erase the input (is obvious) (5)
5. Take out from the pamphlet (7)
6. Changing places across the location (13)
7. Season does not go west (6)

8. Guns old notes, or the demolition team? (3-8).
13. Physical measure not pyre nor type (7)

14. Time for adder (6)

15. Eighth over the dimension (6)
16. Pearly without a muddled answer (5)

Crossword No. 27 Solution