THE NEW ZEALAND
MATHEMATICAL SOCIETY (INC.)

NEWSLETTER

CONTENTS

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PUBLISHER'S NOTICE

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NZMS COUNCIL AND OFFICERS

NEWSLETTER CORRESPONDENTS

EDITORIAL

Winds of Change

I frequently hear complaints about the "rate of change", "change for change's sake" and various other appeals to conservatism. Indeed our politicians seem to be restructuring everything under their control, and these changes are affecting us both at a professional and a personal level. However we are well placed as mathematicians to quantify change and perhaps to offer critical comment where appropriate. Indeed to react to the claim that the unemployment situation is "improving" because of a change of sign in the second derivative of the number of unemployed in our country (as a function of time), requires a little deep thought. A contemporary of mine at Victoria University, Jan Whitwell, achieved the dubious honour of being publicly criticised by a previous Prime Minister when she published her analysis of the then economic policies. Jan's career was one of change. After some years as a lecturer in mathematics at Massey University, she took her mathematical skills into the discipline of Economics. She maintained contact with us however, having attended many of our colloquia. Jan, whose recent death we mourn, is commemorated in the feature "centrefold" article of this issue.

Other changes appear in our Society. After 7 years of editorship, David Smith has passed his editor's red pen to me. I have little intention of changing the nature of this newsletter, although I welcome critical comment, and I will try to maintain the high quality that David achieved. We welcome also Mark McGuinness, who replaces Kee Teo (hopefully with a black pen), as Treasurer of the Society. Our Society is a cooperative of and for its members, and I appeal to you to consider the roles that you might play in our endeavours. Within this issue there is a call for nominations for three new members, to replace those retiring on the Council.

Michael Hendy

Correction

In error, the Centrefold in Issue 58 on Roy Kerr, was attributed to Brian Davis. It was in fact written by Brian Woods.

LOCAL NEWS

AgResearch

The New Zealand Pastoral Agriculture Research Institute Limited (AgResearch) is the largest of the CRIs, formed in 1992 from MAF Technology and the Grasslands division of DSIR. It has major sites at Ruakura (Hamilton), Grasslands (Massey), Wallaceville (Upper Hutt), Lincoln and Invermay (Mosgiel).

New appointments to AgResearch are Simon Woodward and Ken Louie. Simon has joined us at Whatawhata after completing a Ph.D. in mathematics at Massey. He will continue to work on models for grazing systems management, the subject of his thesis. Ken has made the short trip from Massey to Grasslands, but is moving from research on the spatial dynamics of possum populations to models for wool growth.

Participants from AgResearch at the Statistics in Ecology and Environmental Monitoring conference at Otago University in December included Graeme Bourdot, Peter Espie, Stephan Halloy, Peter Johnstone, Dave Leathwick, Roger Littlejohn, Mick Roberts and Dave Saville. Smaller numbers made it across the Tasman to ANZIAM in the Hunter Valley: Ken Louie and Simon Woodward presented papers on work carried out in their former incarnations at Massey, and Mick Roberts spoke on joint work with Hans Heesterbeek from the Netherlands on threshold quantities in parasite population dynamics.

Mick Roberts

UNIVERSITY OF AUCKLAND
School of Mathematical and Information Sciences

The School opened on 1993-2-1, with Ivan Reilly as Interim Director and Jill Reid as the School Registrar. Five applicants for the post of Director were interviewed in January 1994, and Ivan Reilly has been appointed as Director. Jill Reid has now been appointed as Faculty Registrar for the School of Engineering.

The Department of Mathematics and Statistics had grown to unwieldy size, and on 1994-2-1 it dissolved into the Department of Mathematics (headed by David Gauld) and the Department of Statistics (headed by Alastair Scott).

Department of Computer Science

Dr Robert Uzgalis and Dr Christian Colburg are now Lecturers.

Professor Solomon Marcus, of Bucharest University, is visiting for the first half of the year and teaching a course.

Professor Arto Salomaa (University of Turku, Finland), a leader in theoretical computer science, has this year been awarded the title "Professor of Finland". He visited from February 18 to March 6, and a 2-day seminar of "Salodays at Auckland" was held in his honour, with contributions from Chris Calude, Herman Maurer, John Butcher, Solomon Marcus and others.

Professor Salomaa is renowned as an enthusiast for that Finnish institution, the sauna. One week before the "Salodays at Auckland", it occurred to Mike Lennon that what happens to people in a sauna is rather like what happens to pork and kumara in a hangi. Accordingly he arranged for a hangi in honour of Professor Salomaa. About 50 people attended that hangi, at a farm near Helensville, which proved to be a most convivial occasion. When Mike Lennon visits Turku, perhaps he may expect a ceremonial sauna to be arranged in his honour.

Kevin Burrage was a foundation member of the Computer Science Department in 1980, and in 1989 he returned (with John Butcher and Garry Tee) to the Department of Mathematics and Statistics. In 1990 he became Professor of Computer Science at the University of Queensland. The University of Queensland has issued the following announcement:

> The Centre for Industrial and Applied Mathematics and Parallel Computing (Director, Professor Burrage) in collaboration with the Queensland Department of Primary Industries has just won the Gold Award within the 1994 Government Technology Productivity Awards. This is for their interactive visualization software tool kit ADVISE, which runs in a high performance computing environment.

This is a very prestigious award and will be presented at Parliament house in Canberra on 22 February. The Vice Chancellor and Deputy Vice Chancellor will accompany Professor Burrage to the award ceremony.

Department of Mathematics

David Gauld, who was Head of the Department of Mathematics and Statistics, is Head of the new Department of Mathematics.

At the end of enrolment week (February 25), the total undergraduate EFTSs in Mathematics for the City Campus only are given in the following table, together with the corresponding numbers for 1993, March 31:

	1994-2-25	1993-3-31
Stage 1:	494.85	501.86
Stage 2:	169.52	198.53
Stage 3:	70.65	59.85
Total:	735.02	760.24

At Tamaki campus, there are 773 enrolments for Stage 1 Mathematics courses and 235 enrolments for Stage 2 courses; in 1993 there were c600 and c100 enrolments respectively.

Maxine Pfannkuch, from Auckland College of Education, is now Lecturing in the Mathematics Education Unit.

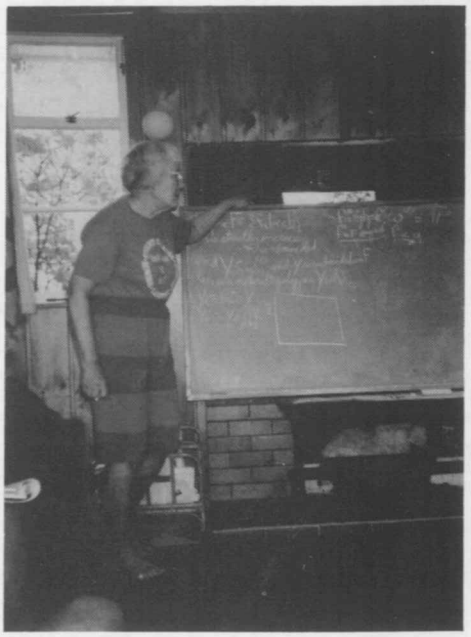
Professor Boris Pavlov has arrived from St Petersburg, taking up his Personal Chair. Dr Paul Bonnington (graduate of Massey) and Dr Stephen Taylor (graduate of Auckland) are now lecturing at the Tamaki Campus. Stuart Laird (from Rangitoto College) is the 1994 Teaching Fellow. Pamela Hurst has now joined Moira Statham in the Wellesley Programme, preparing students for university study.

Vivien Kirk has returned from short leave at the University of Chicago and at Logan, Utah. Margaret Morton has returned from the University of North Texas. Colin Fox has returned from University of Virginia, Clarkson University, UCSB, University of Washington and Universite du Maine. Arkadii Slin'ko was on the Scientific Committee for the conference on Non-Associative Algebra and its Applications held at Oviedo (Spain) in July 1993, and he attended the Algebraic Victoria Conference in September 1993. Norm Levenburg gave an Invited Address on the Plurisubharmonic Theorem, at the December 1993 meeting of the Canadian Mathematical Society at Ottawa, and a Colloquium Talk at the University of Illinois in February.

The Department now has many visitors. Prof. Colin MacLachlan (Aberdeen University) is the NZMS Visiting Lecturer for 1994. He is working with Marston Conder on discrete groups and low-dimensional topology, and teaching a graduate course. He is an Invited Speaker for the Conference on Groups and Geometry, to be held here in May.

Prof. Glen Anderson (University of Michigan) is working with Vamanamurthy on harmonic analysis and is teaching a graduate course and part of Stage 3 Analysis. Michalis Diamantakis (Imperial College) came in January to work with John Butcher for 3 weeks. Prof. George Micula (University of Cluj-Napoca) is working with John Butcher on numerical methods for ordinary differential equations. Prof. Fred Gehring (University of Michigan) is working with Gaven Martin. Prof. Donald James (Pennsylvania State University) is teaching a graduate course and working with the algebraists. Dr Zorana Lazarevic (University of Wisconsin) is here as a temporary lecturer, and working with the topologists. Dr Steve Watson (York University, Ontario) is working with the topologists. Profs Mary Ellen Rudin and Walter Rudin (University of Wisconsin) led an informal symposium on topology held in some baches at Piha during February.

Mrs Slinko, Arkadii Slinko and Walter Rudin



Mary Ellen Rudin

Photographs by Ivan Reilly, Piha Lodge, 1994-12-2

In the November 1993 list of promotions, Jianbe An was promoted 2 levels in the Lecturer scale, Robert Chan was promoted 2 levels over the Lecturer bar (and soon after that he was promoted to Senior Lecturer), Horst Gerlach was promoted to Senior Tutor, Norm Levenberg was promoted to Senior Lecturer, and Margaret Morton was promoted above the Lecturer bar.

Dr Sergey Fedorov has accompanied Boris Pavlov here from St Petersburg as a Post-doctoral Fellow. There are now 9 people working for Ph.D. in the Department, and in addition Chaun Chao and Nava Langmeyer are Ph.D. students of Fred Gehring who have accompanied him here from Michigan. Kecheng Liao has completed his Ph.D. in analysis, on "The AP integral".

Dr Nick Wormald, formerly a Lecturer here, has been promoted to Reader at Melbourne University.

The Department is facing severe accommodation problems, with insufficient offices for the increasing number of permanent staff and the Ph.D. students, let alone for the many visitors. Five offices have been relinquished by the Physics Department, but several further offices are urgently required. Serious consideration was given to converting our Common Room and Seminar Room into offices; but it now seems that that sacrifice might not be necessary.

Seminars

Numerous internal seminars have been given by members of the Department of Mathematics and Statistics, in algebra, analysis, numerical analysis, topology, statistics etcetera. Seminars have been given by the following visitors:

Prof. Ken Gross (University of Vermont), "Ramanujan's master theorem for symmetric cones", and "Totally positive functions, unitary matrices, and finite reflection groups".
Dr Alan Graham (Open University), "Statistics education".
Prof. Rudolph Vyborny (University of Queensland), "Some applications of Henstock-Kurzweil integration".
Dr Rod Gover (University of Adelaide), "Integral transforms, twistor theory and representation theory".
Dr Maurice Dodson (University of York), "Diophantine approximation, Hausdorff dimension and applications".
Dr John Knopfmacher (Witwatersrand University), "A connected topology with arithmetical implications for special principal ideal domains".
Prof. Hyam Rubinstein (University of Melbourne), "Recognising the 3-dimensional sphere".
Prof. Steve Watson (York University, Ontario), "A new method of constructing topological spaces".
Prof. George Micula (University of Cluj-Napoca, Romania), "An introduction to splines", and "Application of spline functions to the numerical solution of neutral delay differential equations".
Prof. Mary Ellen Rudin (University of Wisconsin), "The rationals and the irrationals".
Dr.Daniel H. Huson (University of Bielefeld), (joint seminar with the Department of Electrical Engineering),"RepTiles and the combinatorics of periodic tilings".

Department of Statistics

Alastair Scott is the first Head of the new Department of Statistics.

Dr Karla Ballman (from Macalester College, Minnesota) is now a Lecturer at the Tamaki Campus.

Chris Wild has returned from leave at Waterloo, during which he was promoted here to Associate Professor. Wiremu Solomon has returned from 2 years leave, at Armidale and Wagga Wagga. Ilse Zeidins has gone on short leave to the Institute for Mathematics and its Applications (the one at Minnesota, not the original IMA at Southend-on-Sea). Robert Gentleman has been promoted over the Lecturer bar, and Alan Lee has been promoted above the Senior Lecturer bar.

Thomas Yee has completed his Ph.D. on "The analysis of binary data in quantitative plant ecology", and he is now working on a statistical project in the Department of Medicine. Dr Patricia Metcalf has returned from her Post-Doctoral Fellowship at the University of North Carolina. She has an HRC Fellowship and will split her time between the Departments of Statistics and of Community Health.

Peter Danaher, who was a Lecturer in the former Statistics Unit, is now an Associate-Professor in Marketing and International Business.

The new Department urgently requires additional accommodation, especially more staff offices and student laboratories.

G. J. Tee

UNIVERSITY OF CANTERBURY
Mathematics and Statistics

Dr Mike Steel, and Dr James Sneyd, UCLA, have been appointed to the vacant lectureships. Mike has already taken up his appointment, and James will arrive later in the year. A further lectureship, in Statistics, is currently being advertised.

In December we held a farewell dinner for Frank Gair and Brian Woods who were retiring, and Graham Wood who was off to his new position in Queensland. A most enjoyable evening was had by all.

There are currently two long term visitors in the department. Dr Burkhard Polster, from the University of Erlangen is supported by a grant from the von Humbolt Foundation, and works in geometry. Angele Hamel, from the University of Waterloo, works in algebraic combinatorics.

Seminars
Dr Brailey Sims, Newcastle, Fixed point theory for non-expansive maps.
Dr Werner Ricker, New South Wales, Functional calculi and local spectral properties.
Prof Douglas Bridges, Waikato, Computability in analysis and economics.
Prof Mary Ellen Rudin, Wisconsin, Rationals and Irrationals.
Prof Walter Rudin, Wisconsin, Mean Value properties of harmonic functions.
Dr Daniel Huson, Bielefeld, Periodic Tilings.
Prof Bob Smyth, George Washington University, Statistics of Bioassay.
Dr Peter Renaud, Matrix formulations of some classical inequalities.

Rick Beatson

IRL APPLIED MATHEMATICS.
Over the summer months we had 5 students working at Applied Maths. Paula Meyer from Victoria worked with the statisticians, Andrew Kerr, Canterbury, and Graeme Basire, Victoria, worked with the operations researchers, and Matthew Cole, Massey, and Kim Rutherford, Victoria, worked with the math modelling team. Last year we welcomed a new staff member. Russ Boyles joined us from the United States. Russ completed his Ph.D. in Statistics at the University of California, Davis. Since then he has worked in various industries, most recently as a Statistical Quality Process Manager at Precision Castings and Parts. Since his arrival, he has been working on the Statistical Methods for Decision Making project, developing some ideas he has formed on statistical quality process control, and working on improving estimates of distribution functions. In November Rona Bailey, Bruce Benseman and John Burnell attended the International Institute of Refrigeration Conference at Massey. This conference was relevant to a project in which we are developing a simulation model of coolstore management practices. Bruce presented a paper outlining the current state of the project. In January, David Rhoades and Roger Young attended the 1994 meeting of the International Association of Seismology and Physics of the Earth's Interior, that was held at Victoria University. This was attended by over 500 researchers in the Earth Sciences and provided valuable contacts for the work being undertaken by Applied Maths. David presented a paper on his work on earthquake studies. Graham Weir attended the ANZIAM conference in Pokolbin, NSW, where he presented a paper outlining some of the industrial problems that are being done at Applied Maths. In early February, Warwick Kissling, Stephen White and Roger Young attended the Taupo Volcanic Zone Heat Transfer Workshop, at Wairakei. A major aim of the workshop was to develop a model of the Taupo Volcanic Zone which unified the work that has been carried out over the years in a number of separate disciplines. We have recently been given approval to advertise for a new staff member in the operations research area. Anyone requiring further information should contact David Rhoades (+4 569 0000, e-mail d.rhoades@irl.cri.nz)

John Burnell

MASSEY UNIVERSITY
Mathematics

We take pride in the award of a personal chair to Mike Hendy, who is now Professor of Mathematical Biology within the Department of Mathematics.

Gordon Knight has transferred to Massey's Albany campus on Auckland's North Shore to begin the Department's teaching in the BSc(MathInf) programme starting this year, as well as taking the role of Associate Head of School for SMIS at Albany. Dr Robert McLachlan, with interests in computational mathematics and dynamical systems, will arrive during April to take up a lectureship as replacement for Gordon at the Palmerston North campus. Robert is originally from the University of Canterbury, and has completed postgraduate work at CalTech in the USA. Ken Louie, NZVCC Postdoctoral Fellow, has left to take up a research position at AgResearch, just over the road. Visiting Research Fellows at present include Professor Bob Chapman, Director of the Maths-Stats Clinic at the University of Guelph, whose area of interest is industrial mathematics, and Dr Chew Seng from the University of Singapore, with interests in integration theory.

Koryn Grant and Nicholas Allsop worked in the Department as summer research scholars. Mary Day, Catherine Rivers, Chris Palliser and Kelvin Watson won Massey University Postgraduate Scholarships for Ph.D. study starting this year; we now have 12 Ph.D. students in Mathematics. New Graduate Assistants this year include Ms Catherine Rivers (Ph.D. studies in Combustion theory), Ms Mary Day (Gender issues in Mathematics), Ms Fiona Taylor (Coordination in problem-solving) and Mr Kelvin Watson (Facilities layout).

Mike Hendy visited the University of Alberta, the FSP group at the University of Bielefeld (led by Andreas Dress), the Mathematische Forschungsinstitut at Oberwolfach, and the University of Munich during a period of leave in November. Robert McKibbin and Alex McNabb presented papers on the mathematical modelling of deep, hot brine systems at the NZ Geothermal Workshop in Auckland during November.

Graeme Wake, Robert McKibbin, Ken Louie, Simon Woodward and Easwaran Balakrishnan, comprising one half of the NZ contingent, attended the Australian Mathematical Society's applied mathematics conference, ANZIAM 94, at Pokolbin in the Hunter Valley, NSW, during February. Graeme organised the judging of the 49 student presentations; the others delivered papers on, respectively, geothermal modelling, population dynamics, pasture dynamics under grazing, and path-following problems. Simon Woodward won a place in the list of the six best student paper presentations for the T. M. Cherry Prize competition with his talk on "A differential-delay model of pasture dynamics under grazing." The weather: fine, hot and humid; the wine: fine, cold and wet!

Graeme Wake has been elected as the first NZ-based President of ANZIAM (a division of AMS) and will hold office 1995-1997. The NZ branch of ANZIAM will host the 32nd meeting in 1996 at Solway Park in Masterton.

Wolfgang Vogel visited three universities in Vietnam during February by invitation of UNESCO, and met again with former Ph.D. students. The focus of his activity there is to build a strong relationship with universities in Hanoi, Hue and Ho Chi Minh City. Wolfgang says "Vietnam is a very poor country with great potential. I believe that our university, with a strong vocational and applied orientation, is in a good position to contribute to Vietnam's development."

The School of Mathematical and Information Sciences has inaugurated a new pre-print series to enable rapid publication of new research results; copies will be sent to appropriate departments as the reports become available.

Seminars

Dr Rod Gover (University of Adelaide) "Invariant theory for conformal Cauchy, Riemann and similar parabolic geometries" .

Prof. Wolfgang Vogel (Massey) "Intersection theory" (3 sessions).

John Knopfmacher (University of Witwatersrand) "A connected topology with arithmetical implications for special principal ideal domains".

Dr Chew Seng (Massey) "Henstock-Kurzweil integrals and differential equations".
Prof. G. R. (Bob) Chapman (University of Guelph) "Operation of the Maths-Stats Clinic at the University of Guelph", "Global optimisation and the geometry of chemical and phase equilibrium problems".
Dr Paul Bonnington (University of Auckland) "Separating paths in infinite almost-transitive graphs".
Dr Philip Laird (University of Wollongong) "Land freight transport energy evaluation".
Dr Henri Schurz (Institute of Applied Analysis and Stochastics, Berlin) "Introduction to numerical analysis of stochastic differential equations".

Robert McKibbin

UNIVERSITY OF OTAGO
Mathematics and Statistics

The turmoil of enrolment and the hectic start of the new year will have to be reported in the next issue as I am writing this report from Vanderbilt University, far away from the hue and cry of such events.

The summer has ben a busy one for Otago people. In December John Harraway, John Shanks and Dennis McCaughan supervised the marking of Bursary Mathematics and Statistics papers; a mammoth task well done.

Various programs for hands on Science were provided by members of the department and much work put into the new computer lab, particularly by Mark Borrie.

John Selfridge from Illinois and John Stillwell from Australia visited Derek Holton and there was a healthy seminar program maintained.

The details in this report are rather scarce as I am working remotely with little access to particular information. Nevertheless, you may rest assured that there has been constant, productive activity both in the department at Otago and by those of us who have travelled abroad for research over the summer. I will include more in my next report.

Robert Aldred.

STATISTICS, NEW ZEALAND

Your correspondent has been lax in reporting, so there are a variety of movements by mathematical statisticians to catch up with. Helen Stott and Alistair Gray now have a son, Finnian Padraig. Debra Taylor has now followed Helen's example, and has left on maternity leave. Martin Hamilton has left to work in Sydney, and Sarah Crichton is leaving to be a Biostatistician at the Wellington Medical school. Last year we were joined by Tracey Savage, Tracey Gilmour, and Diane Craig, and re-joined by Max Wigbout, Mike Keall and Judith Archibald. Over the Christmas vacation Susan Reedy, the first winner of the scholarship the Department is offering to Maori students, worked in our Division. Harry Smith won first prize in last year's Evening Post "Mind of Wellington" competition. This year, the Department hosted a successful International Conference on the Marketing of Statistics. Joe Duncan, who was attending that conference, gave a talk to the Wellington local group of the Statistics Association on "Statistics into the 21st Century". Wouter Keller, who also attended, had a number of other discussions in the Department. Last month we were visited by Adele Furie from Statistics Canada, who built up and runs the surveys they have immediately after and piggybacking on the Census. (Their last Census they ran post-censal surveys on disability, and on aboriginal populations).

Mike Doherty

VICTORIA UNIVERSITY
Mathematics

Rod Downey went to Schloss Dagstuhl (the computer science version of Oberwolfach) during the long vacation and spoke on the density problem for paramaterized polynomial time. He also spent a week in Canada visiting Mike Fellows at the University of Victoria, British Columbia.

We have four new MSc students: John Bowmar (from VUW), Felix Geiringer (Otago), Charles Semple (Massey, with a VUW Masters Scholarship) and Alister Wilson(VUW).

John Harper

WAIKATO UNIVERSITY
Department of Mathematics

A symposium and farewell was held for John Turner, who retired at the end of 1993, on the afternoon and early evening of Thursday 9th December. The speakers were David Gauld ("How to draw a nice Seifert surface"), Ernie Kalnins ("Non Linear Fourier Analysis"), Bill Rogers ("Pen Based user Interfaces in Symbolic Computation"), Mark Schroder ("History in Mathematics or the History of Mathematics"), Garry Tee ("The saga of the meccano computer"), Graeme Wake ("Pentagonal Cells") and John Turner ("On models of the modular group and some of its geometric and number sequence properties"). The occasion was singularly successful and one of the most enjoyable that have taken place in the department. Ray Littler contributed the symposium bell.

The number of post-graduate students in the department continues to increase. Two recent additions are Wang Yuchuan working with Douglas Bridges and Mark Schroder, and Zhu Nan with Kevin Broughan and David Whitaker. The total number of undergraduates in the department is still being assessed by the School of Computing and Mathematical Sciences division. It appears to be on upward climb again.

Block R, housing support personnel and new laboratories for computing, was opened by Simon Upton in late October. A fine celebration was held for members of the School.

Two applications have been made to the Foundation for Research Science and Technology from the Department of Mathematics and Statistics; at least one will be sent on from the University, we believe, in spite of there being no mathematical or computational expertise on the University selection committee.

Kevin Broughan, with Peter Gill (Chemistry, Massey) represented NZ at a steering committee meeting, in Taiwan in February, for the formation of an annual series of conferences on High Performance Computing in the Asia-Pacific region.

The University is supporting a change to the FRST and MOSRT act wherein "science" is defined to include "the physical, mathematical and information sciences, as well as the social sciences" replacing the same definition with the central phrase omitted.

Heather Rae has returned from sick leave and is feeling much better. Mark Schroder has recovered from his second hip replacement operation. He was up and about after only three days. Fay Sharples is unwell and has been on sick leave for some time now, I regret to advise. We are all hoping for a speedy recovery.

Our congratulations to Ingrid and Matt on the birth of their child Nicholas in January and to Stephen and Sue for Kerrianne in February.

Richard Littin won the highest award for his BCMS Report on an Investigation presentation "Pen Input of Mathematical Expressions" supervised by Kevin Broughan and Bill Rogers.

Graham French attended the Australian Bridging Mathematics Network and the Mathematics Education Research Group of Australia Conferences in Brisbane in July. Bill Bolstad attended the

American Statistical Association conference in San Francisco in August. Douglas Bridges has returned from leave and is proposing changes to reduce the amount of teaching and number of courses. Nye John has returned from leave spent mostly at the University of Queensland.

Ray Littler is soon to be formally appointed as Pro-Dean for Undergraduate Students in the School of Computing and Mathematical Sciences. He has been carrying out the functions of this role for some time now, as well as continuing as Director of the Centre for Applied Statistics.

Two new appointments took up their positions in February: Jocelyn Dale in Statistics and Ian Hawthorne in Pure Mathematics. Further details concerning the background and interests of these staff members will be given in a future Newsletter.

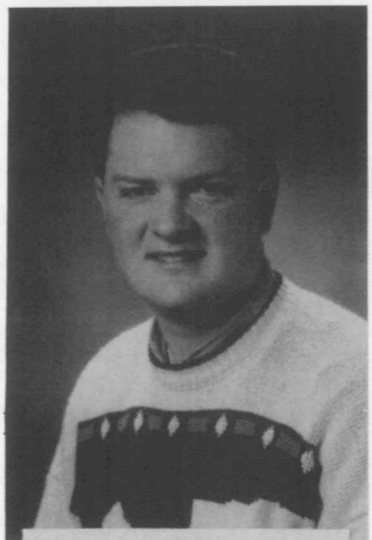
Preparations for the Colloquium as well underway and the submission of papers is warmly encouraged. Invited speakers include Mark Gould, Ian Sloan, Wolfgang Vogel, Mitchel Taibleson and Vivien Kirk. Please send requests for information to nzmc94@hoiho.math.waikato.ac.nz.

Seminars

Turner Symposium: see above.
Peter Hilton and Jan Pedersen (New York and Santa Clara), "Paper-folding and number theory".
H Edgar, (San Jose State University), "Arithmetic, Geometric and Harmonic Numbers".
Robert F. Churchouse CBE, (University of Wales at Cardiff), "Computers and Mathematics"; "The Achilles Heel of the Enigma Machine and some of its consequences"; "Simulation of natural fractals by IFS, DLA and L-string systems".
Richard Fabling (University of Waikato), "Energy Release in Coronal Magnetic Flares".
Kathryn Sanders (University of Waikato), "Auckland International Airport Passenger Arrivals Processing".
Richard Littin (University of Waikato), "The Pen Input of Mathematical Expressions".
Mark Schroder, (University of Waikato), "Permutation Groups and Galois Theory".
Ian Hawthorn (University of Waikato), "Classes of Finite Groups"
Craig Lynch-Blosse, (University of Waikato), "Computer Services on the Internet"
Thomas Forster (University of Cambridge), "Constructive Set Theory with a Universal Set"
Walter Rudin (University of Wisconsin), "Calculus Proofs in Topology"

Kevin Broughan

NEW COLLEAGUES



Dr. Paul Bonnington

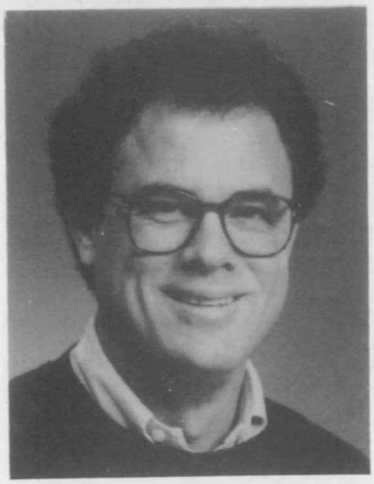
Dr Paul Bonnington was recently appointed to a lectureship in mathematics at the Tamaki campus division of science and technology, Auckland University.

A Massey University graduate, Dr Bonnington has a BSc(Hons) in Pure Mathematics and a Ph.D.; his doctoral thesis entitled "Combinatorial Maps and the Foundations of Topological Graph Theory".

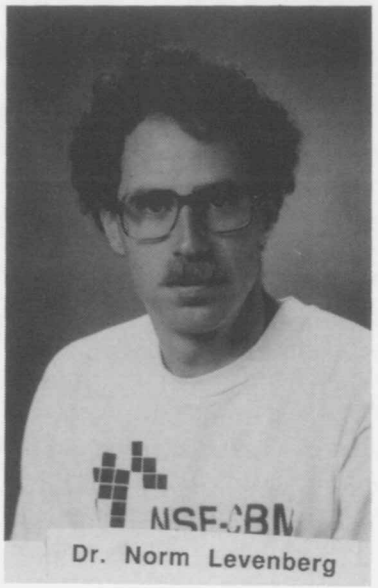
After tutoring at University of Waikato for a year, he joined the Department of Mathematics and Statistics at Auckland as a temporary tutor in 1992. From late 1992, Dr Bonnington spent a year at the Montanuniversitaet Leoben in Austria working in a research project on infinite graphs and groups. This was followed by a semester researching and teaching at the University of Vermont.

His research interests lie mainly in combinatorics with a particular emphasis on infinite graphs and their automorphism groups, computational graph theory, topological graph theory, and design theory.

For information on Russ Boyles please see IRL news.

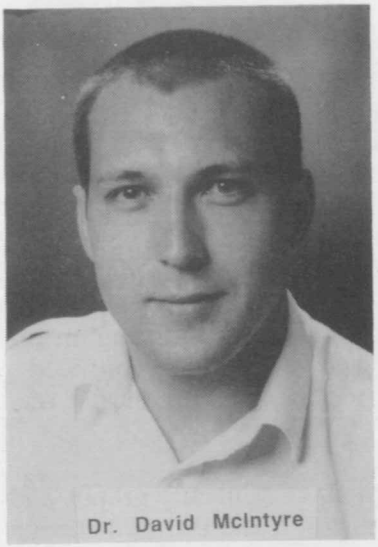


Dr Russ Boyles



Dr. Norm Levenberg

Norm Levenberg became a Lecturer at the University of Auckland in 1992. He received his Ph.D. in Mathematics from the University of Michigan in 1984. His main research interests lie in several complex variables (SCV), in particular, potential theory in SCV and applications to approximation theory. In one complex variable, potential theory may be loosely defined as the study of *subharmonic* functions and the (linear) Laplace operator. There is an intimate relationship with the study of holomorphic functions, since log |f| is subharmonic whenever f is holomorphic. In SCV, we call a function u defined on a domain $\subset \mathbf{C}^n$ *plurisubharmonic* (psh) if u is uppersemicontinuous and its restriction to any complex line is subharmonic; the associated potential theory is *non--linear*. The analogue of the Laplacian is the non-linear *complex Monge--Ampere operator*.



Dr. David McIntyre

David McIntyre has been appointed to a lectureship in the Department of Mathematics at Auckland University. His research interests include set theory, general topology and the theory of ordered structures.

Born in Bristol, UK, David graduated from Oxford University with a BA (Hons.) in Mathematics in 1987, and a DPhil in 1990; his thesis title was "Chain conditions in linearly ordered and regular first countable spaces". He spent the next two years working as a lecturer in the Mathematics Department at Reading University, before the lure of sun, sea and an active topology group brought him to Auckland.

David's current research focuses on the structure of the lattice of topologies on a set. His teaching centres on discrete mathematics, set theory and logic.

Arden Miller has been appointed to a lectureship in the Department of Statistics at the University of Auckland. His research interests include industrial statistics, experimental design and robust parameter design.

Born in Canada, Arden graduated from the University of Victoria (B.C.) with a B.Sc. in chemistry and mathematics. He received a M.Math. and a Ph.D. in statistics from the University of Waterloo.

Dr Arden Miller

GRANTEE REPORTS

Workshop

This November I attended the 15th New Zealand Geothermal Workshop with the help of a student travel grant from the New Zealand Mathematical Society.

The New Zealand Geothermal Workshop is one of the main international geothermal conferences, which runs annually. It is hosted by the Geothermal Institute of the University of Auckland.

The Workshop ran for three days (10-12 November), with participants from 15 countries. The keynote speakers were:

Mr B.Carey, Electricity Corporation of NZ Ltd, Wairakei; Mr J.Hotson, Tasman Pulp and Paper Company Ltd, Kawerau; Mr S.Javellana, Philippine National Oil Company, Manila; and Mr T.Powell, Unocal Geothermal, Santa Rosa. The talks covered topics on Exploration, Use, Policy and Planning. There were talks on Geothermal Modelling, Geophysics, Geochemistry, Geology and Reservoir Engineering.

In this regard the conference was extremely interesting from the point of view of the possibility of the mathematical applications. All papers presented at the workshop are in the Proceedings of the 15th New Zealand Geothermal Workshop 1993. I gave a talk myself on mathematical modelling of geothermal flow.

The atmosphere of the conference was friendly and inspiring. For me it was a great opportunity to meet the most advanced scientists, who work on different aspects (including environmental) of the exploration and development of geothermal resources.

The 16th New Zealand Geothermal Workshop will be on 9-11 November 1994. It can be useful for mathematicians interested in applications.

I am very grateful to the council of the New Zealand Mathematical Society for supporting my participation at this conference.

Irene Pestov, Ph.D. student, Victoria University.

Earlier this year I attended the Mathematics-in-Industry Study Group (MISG 94) held at the University of Newcastle and the Australian Applied Mathematics Conference (ANZIAM 94) held at Pokolbin, Hunter Valley, NSW. The valuable grant of $250 received from NZMS and also the

generous support of CSIRO and the Department of Mathematics, Victoria University, made my trip possible, which fact I gratefully appreciate.

Both conferences were extremely interesting. The first was the Mathematics-in-Industry Study Group, organised by the Department of Mathematics, University of Melbourne. The main goal of MISG is to establish better contacts between industry and academic mathematicians by presenting fresh research problems for mathematicians. At this meeting eight problems covering a wide range of mathematical topics (namely Operations Research, Heat Transfer, Elasticity, Fluid Mechanics) were presented and, as was stressed by some of the participants, nine of them were actually solved!

The second conference was the annual meeting of applied mathematicians, organised by the Australian Mathematical Society. It was held at the Hunter Valley Resort, which is known as a wine-producing area and the origin of the best Australian wines. Unfortunately it was too hot in the Hunter Valley for wine-tasting (38^{o} C) and also very humid. This conference was remarkable by a large number of student talks presented. I myself gave a talk on dimensional analysis and linear stability of geothermal flow. I had many interesting meetings and enlightening discussions at both places.

Between these two conferences I visited Sydney. I was very grateful for that opportunity too. My thanks also go to my husband Vladimir for looking after our two children while I was overseas.

Irene Pestov, Ph.D. student, Victoria University

Report on International Commission on Mathematics Instruction Study on Gender and Mathematics Education Sweden, 7-12 October 1993

With the aid of a grant from the NZMS I was able to attend this study with about eighty other participants. The study was an intensive one with plenary sessions, paper presentations, panel discussions and workshops and was of considerable value to me. It was very fruitful to have all the leading experts in Gender and Mathematics: Fennema, Leder and Burton together with curriculum authorities, Keitel and Kilpatrick.

A major theme was the persistence of media and social perceptions of considerable differences in mathematics achievement by males and females despite the fact that such differences, where they exist at all, are minimal (and not necessarily in favour of males).

Contentious assessment problems were very much discussed particularly by countries which rely on such trivial instruments as multichoice questions. An alarming development in Britain, was the use of more investigative, non-timed methods of assessment which lead to improved female performance, and have subsequently been cut back. There was consensus on the need for a greater internal component to assessment in order to have more authentic measures of various mathematical abilities.

The greatest concern, with regard to gender and mathematics, is still the extent of participation of women in mathematics particularly at higher levels and most particularly in university mathematics departments. Strategies to improve this situation were outlined by Mary Gray (past Vice-President, AMS) - most involved money, mentoring and the expenditure of enormous energy on the part of the few women in these positions. Particular barriers to tenure are the desire, by many women, to publish joint papers (rather than individual ones) and the lack of recognition given to high quality non-quantitative research in disciplines such as psychology. There was a strong feeling that high level mismanagement of human resources did not seem to be held accountable in universities in the western countries.

It was useful to be reminded that the situation in Britain, New Zealand and the United States is not a logical necessity. In Portugal, for example, most mathematics teachers and university mathematicians are women.

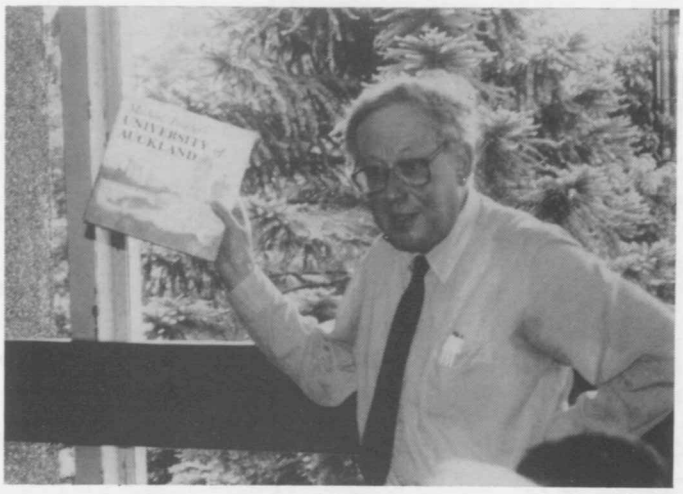
I found this conference/study group very stimulating and extremely worthwhile and expect that it will provide many fruitful directions for future research. I am very grateful to the NZMS for this opportunity.

Megan Clark, Victoria University

MISCELLANEA

John Kalman's 65th Birthday

John Kalman's 65th birthday on 1993-11-19 was celebrated by a Symposium, at which 13 short lectures were given by colleagues, friends and former students of John, and many others spoke brief tributes to him. He was presented with "The Times Atlas of the World", Michael Fowler's sketchbook of "The University of Auckland" and Ron Keam's definitive history of the eruption of "Tarawera". John will teach a graduate course this year, after his retirement.



John Kalman, 65th Birthday, 19-11-93

Garry Tee

Honorary Degree

The University of Wales celebrated its centenary on 1993 November 30, with a ceremony at Cardiff at which 8 eminent people were awarded honorary degrees by its Chancellor, the Prince of Wales. The Honorary Graduands included Mrs Mary Robinson (Ll.D.), the Aga Khan (Ll.D.) - and Professor Vaughan Jones (D.Sc.).

Vaughan was presented to the Chancellor by Professor Sir John Meurig Thomas FRS, with the following oration:

In 1926, an elderly widow named Mary Butler, mother of eleven children, living in the Gwendraeth Valley bid farewell to two of her daughters. One left for Canada, the other, Bessie, took her son Jimmy and his brother and sister to join their father Freddie Jones, who had left Burry Port a few years earlier to seek a better life in New Zealand. Mary Butler never saw her daughters again. The forty year old grandson of Bessie and Freddie Jones stands before you today, a former undergraduate and now honorary graduate of the University of Auckland, Professor of Mathematics

at the University of California at Berkeley since 1985, the first recipient of the Rutherford Gold Medal awarded by the New Zealand Government, Fellow of the Royal Society, Honorary Fellow of the American Academy of Arts and Sciences and, most significant of all, winner in 1990 of the Fields Medal, awarded every four years, the mathematical equivalent of the Nobel Prize - an intellectual as well as a physical giant.

What is it that has made this man one of the greatest mathematicians of the age? The answer necessarily has to be a little labyrinthine. It was Einstein who said that "The most incomprehensible fact of Nature is the fact that Nature is comprehensible". When Galileo declared over four centuries ago that "every object continues in its state of rest or uniform motion in a straight line" he effectively paved the way for Newton and his laws of motion which, in turn, permit us to predict the ebb and flow of the tides, to compute the paths of comets and planets and the motion of man-made satellites, to build bridges, to construct skyscrapers. From deep mathematico-physical analysis one often gains unimaginable and unforseeable insight into the workings of the external world: from the soul of those who search more closely into the nature of things, profound truths emerge about the mysteries of Nature, and in a strange and exhilarating fashion new ways are found to harness its forces.

It was while Vaughan Jones was presenting a seminar at the University of Geneva in 1984 in a somewhat arcane area of mathematics dealing with the knottedness of knots - how to describe and interpret the properties and distinguishability of knots - that he arrived at what has since become known, and will forever remain, as the Jones polynomial and the Jones invariant. This brilliant insight was extraordinary, for it was soon to revolutionize many seemingly different branches of physics and mathematics and latterly biology. The Jones polynomial is the pivot around which many of the advanced branches of twentieth century physics turn. Thus topology, which is concerned with the connectedness of visible objects (like knots in a string), was shown by Vaughan Jones to be linked to statistical mechanics and specialised branches of algebra in a breathtakingly unexpected way. Moreover, quantum field theory, relativity and general electromagnetism, all major areas in modern physics and cosmology, have since been shown to be interrelated via the Jones polynomial. And to cap it all, Jones' work in knot theory has already been of use in molecular biology since it deepens our understanding of the behaviour of the double helices of DNA, the most important molecule in all living things.

Your Royal Highness, there is a sense of timeless kinship between the people of Wales and members of the Welsh diaspora. I feel that in honouring Vaughan Jones - y gwr llachar ac anrhydeddus hwn o Seland Newydd - we are also honouring his Welsh grandparents, who nearly seventy years ago set out on the long and tortuous journey to an uncertain future on the other side of the world. Vaughan Jones has brought great glory to the land of his fathers. Y mae yn gwbl deilwng o'r radd Doethur yn y Gwyddorau, er anrhydedd. He is a worthy recipient of the honorary degree of Doctor of Science.

Garry Tee

Enrichment Evenings at Canterbury, 1993: A Report

Background

In 1992 the mathematics department at the University of Canterbury began a series of monthly "enrichment evenings" for interested secondary school students. The idea has been to show students some interesting mathematics (or applications of mathematics), while at the same time giving them a chance to see the university and some of its staff. Many of these students are at the point of making career choices, or at any rate are sizing up the various options, so this is also a good chance for the department to advertise its wares.

The 90-minute sessions are held on the first Fridays of those months that occur during school terms, and this year most were attended by about 50 to 60 students (along with a few parents and teachers).

Most of the students who come are third, fourth or fifth-formers, but there are usually a few sixth or seventh-formers too.

For those students who come away wanting to be extended mathematically, there is a correspondence program which has been run for some years by Alan Parris (of Linwood High School and the Canterbury Mathematical Association) and Bob Long (formerly of the mathematics department). In this program students are sent a series of problems, and their attempts are marked by Bob. The best students are invited to a camp in May each year, and the best of these then represent New Zealand at that year's Mathematics Olympiad.

What we actually did

In March, John Hannah guided the audience through the history of perfect numbers from Ancient Greece to the present day. After calculating a few examples, students could guess that powers of 2 would never be perfect, but the sums of these powers of 2 became a crucial ingredient in Euclid's recipe for making perfect numbers. Some patterns emerged after the first four perfect numbers had been found, and these led to three conjectures about perfect numbers. Testing these conjectures involved testing some numbers for primeness, a task carried out by the audience acting like a human parallel computer. In the end none of the conjectures survived closer scrutiny, though one was rescued by weakening its conclusion.

In April, Bruce Hunt from the Civil Engineering department talked about the sort of mathematics used in his subject. He looked at the calculation of forces and moments that goes into the design of a truss for a bridge. Using vectors and some trigonometry, he developed a theoretical condition for three forces acting on a body to be in equilibrium. The theory was then tested using a simple system of weights and pulleys. Bruce discussed the degree of agreement between the theory and the practice, and the way it depended on the type of string used to connect the weights. This illustrated the way models idealize real life situations (here friction had been ignored), and pointed the way towards an improved model.

Bill Taylor told May's audience all about colouring maps. He gave examples of the famous 4-colour theorem, including many based on atlases and sky charts. The theorem is of course very difficult to prove: Appel and Haken did this in 1976 using hundreds of hours of computer time. However, Bill showed some of the ideas involved by proving part of the 5-colour theorem: if the map has a pentagon (or smaller region) it can be coloured (so that no two adjacent regions have the same colour) by using at most five different colours. The same ideas extend to other surfaces besides the plane and sphere used for everyday maps. Bill gave examples of maps on a torus (doughnut) and a Mobius strip, and at the end the audience eagerly examined his cardboard and wire models of the surfaces he had discussed.

In the June session Brian Woods talked about Newton's view of mechanics. After introducing the key ideas of acceleration, force and momentum, Brian used a billiard ball version of Newton's Cradle to illustrate the conservation of momentum. This served as a background to a Newtonian view of the action of an airflow on an aeroplane's wing: the air is lots of little billiard balls bouncing off the wing's undersurface, and thus transferring some of their momentum to the wing. This view has been useful in the study of supersonic flight, an idea undreamt of by Newton. Flight even further afield was the subject of Brian's final experiment: rockets move, not by pushing off against some solid base (as has often been thought), but by conservation of momentum. The demonstration used a garden blower strapped to a skateboard (this particular rocket being deemed unsafe for human transport)!

Graham Wood took the July session, and introduced everyone to the mathematics of knots. In 1990 the New Zealander Vaughan Jones won the Fields medal (the mathematical equivalent of a Nobel prize) for his work in this area. So every young New Zealander, according to Graham, ought to be familiar with the sort of problems which interest the most famous mathematician New Zealand has produced. Armed with pieces of string, the audience tied some simple knots (reef, granny and fool's) and learned how to represent them in diagrams. They explored features of these diagrams (crossing points, components and labellings) and came up with some facts (the numbers of crossing points and components are the same) and some problems (the same knot can have several "different" representations). This led to the problem studied by Jones: how can you tell whether two

different-looking knots are actually the same? Graham concluded by looking at one technique (using labellings and some "modulo" arithmetic) which can tell the difference between some knots.

In August David Robinson talked about his research into the branching patterns of the flowering structures (or panicles) of plants, particularly members of the daisy family. He showed us examples of half a dozen or so plants (pictures only: August is not a good month for finding flowering daisies!) These seemed to show some simple patterns in the lengths of branches and also in the numbers of flowers on each branch. Could these patterns be explained? One theory, due to Thornley, imagines the plant's resources being divided up in a fixed ratio each time a branch forms. Different ratios lead to different branching patterns (if the ratio is the "golden section" you get the famous Fibonacci sequence). Another theory imagines the plant trying to reproduce on lower branches the patterns already seen higher up the panicle. This gives good agreement with the observed patterns but has the drawback that it seems to work in the wrong direction: plants grow from the bottom up, not from the top down!

For the October session we met in the Chemistry department where Ward Robinson had organized an evening for us about molecular structures. He began by talking about how we can use coordinates to describe the relative positions of points in space. At school we use coordinates relative to orthogonal (or perpendicular) axes, but chemists need to use sloping sets of axes which correspond to the shapes of the crystals they are studying. Ward then used some models to show us the typical symmetries associated with the various possible crystal structures. Some, like common salt with its cubic lattice, have many different symmetries. Others, like copper sulphate with its parallelepiped lattice, have far fewer symmetries. These symmetries are reflected in the diffraction patterns such crystals display when they are bombarded by X-rays. Ward illustrated the principles involved by showing the patterns formed when laser beams are diffracted by various simulated, magnified crystals. We then moved to the laboratory, where one of Ward's Ph.D. students showed us how such work is done in practice, starting with the selection of suitable crystals using a microscope, proceeding to the actual X-ray experiment, whose diffraction patterns are then analyzed by a computer to produce (with a little human help in the form of informed guesswork!) a model of the actual crystal.

In the final session for the year, Mike Steel talked about some examples in probability. The common theme was that our intuition can often lead us astray. His first example came from a TV game show: there are three doors; behind one of them is a car, but behind each of the other two there is a goat; a contestant chooses one of the three doors, but instead of opening it, the game show host opens one of the other doors to show the contestant one of the goats; the contestant is now offered the chance to change her mind about which door she wants opened; what should she do? The surprising answer is that she can double her chances of winning the car if she changes her mind! Mike's second example was a birthday problem: what is the probability that there are two people in the room who have the same birthday? The surprise here is how few people there need to be in the room before the probability is greater than a half. The same surprise occurs if you ask what is the probability that there are two sheep in a paddock who have the same numbers of hairs on their back! Mike's final example was the so-called Secretary Problem. In his version we were shown a sequence of ten random numbers (rather than ten applicants for the secretary's job) and asked to stop the sequence when we thought we were looking at the highest number. We weren't allowed to go back to a previous number, so we often failed in the quest. The problem is to find the best strategy; the surprise is that there is a best strategy (and even more surprisingly, it involves the number e).

John Hannah

ANZIAM (New Zealand Branch)
(Australian and New Zealand Industrial Applied Mathematics)

Fresh from the trials and rigours of the Hunter Valley Region (site of the 30th AMC) we are glad to provide an update on activities:

- **NZ in 1996**. It was agreed that the NZ Branch should host the 32nd AMC in 1996. After much discussion and several convivial visits to various likely sites - the shortlist (Taupo, Havelock North and Masterton) was whittled down to the resort of SOLWAY PARK, MASTERTON, 4-8 February 1996. Put in your calendar NOW!

  We felt, on balance, the proximity to Wellington International Airport, the self-contained nature of the resort etc, won the day. (Also the nearby Massey Department will find itself as an administrative centre for the pre-conference arrangements.) An interim Committee has been formed of

  Professor Graeme Wake (Conference Director, Massey University)
  Dr Robert McKibbin (Massey University)
  Dr Mick Roberts (AgResearch, Wellington
  Professor David Ryan (Auckland University)
  Mr Adrian Swift (Massey University)
  Dr Graham Weir (IRL, Wellington)

  but clearly many more helpers will be needed!!

- **The Industrial Mathematics Workshop** in February 1994 at Albany was postponed. The right sort of problems just did not eventuate.

- **ANZIAM Session** at 1994 NZ Mathematics Colloquium. Members are warmly invited to attend the half-day ANZIAM session within the 1994 NZ Mathematics Colloquium, 9-12 May at the University of Waikato. This is to be organised around the invited (ANZIAM) speaker at the colloquium, Professor Ian Sloan (University of New South Wales), who is speaking on "Lattice methods for numerical multiple integration". (Ian is a previous President of ANZIAM). Please indicate to the organisers if you wish your contributed talk to be in this session.

  The AGM of the NZ Branch is also to be scheduled at the Colloquium. Members are invited to nominate for the Branch Officers (President, Secretary, Treasurer and Committee) by 30 April please (to Adrian Swift).

  Graeme Wake will not be available as President of the NZ Branch 1994-5 in view of the item below.

- **Branch Rules** The revised rules (as suggested by Professor Harper) were approved by the ANZIAM executive at the recent meeting.

- **ANZIAM Presidency**. Graeme Wake was elected as the first NZ-based President of ANZIAM. He will hold office 1995-1997 and will be incoming President for 1994-95.

- **ICIAM 95.** Members will be pleased to know the third International Conference on Industrial and Applied Mathematics will be held in Hamburg, Germany, 3 - 7 July 1995. A good NZ attendance is hoped for. Details available from the undersigned.

- **Membership**. Our numbers presently stand at 31. For the Committee
  Adrian Swift
  Graeme Wake, Department of Mathematics, MASSEY UNIVERSITY

Graeme Wake

International Linear Algebra Society

Professor Jeffrey J Hunter, Department of Statistics, Massey University is the New Zealand representative on the International Committee of ILAS (International Linear Algebra Society) and as such is charged with the responsibility of encouraging linear algebra activities in NZ.

ILAS, in conjunction with the Institute of Mathematical Statistics, sponsored a meeting on Matrix Methods in Statistics at the University of Auckland in December 1992, but apart from that there has not been much further activity in New Zealand.
ILAS edits and distributes a bulletin (named IMAGE) which serves as a stage for discussions and opinions. The recent issue (Volume 2, Number 6 - Issue 12), January 1994, contains a report by the ILAS Education Committee on Graduate Linear Algebra courses. The report provides a listing of suggested topics for three courses, each a year long, on Theoretical Linear Algebra, Numerical Linear Algebra and Applied Linear Algebra.

ILAS also operates ILAS-NET, an electronic news service which transmits announcements of ILAS activities, conferences and notices of interest to linear algebraists. Announcements for ILAS-NET or requests to be on the mailing list for ILAS-NET, should be sent to Danny Hershkowitz (e-mail: mar23aa@technion.bitnet). Subscription to ILAS-NET is independent of membership in ILAS and is free.

There are likely to be members of the NZMS who would like to know more about ILAS. Potential members should contact James R Weaver, Department of Mathematics and Statistics, The University of West Florida, 11000 University Parkway, Pensicola, Florida 32514-5751, USA (e-mail: jweaver@uwf.bitnet). Membership dues are $US12.00.

Jeff Hunter

Vaughan Jones in Fiction.

The leading science-fiction writer Harry Harrison has written a novel "The Turing Option" in collaboration with Marvin Minsky, the prophet of Artificial Intelligence. The first edition was published by Warner Books Inc. in 1992, with a paperback reprint by ROC, London, 1993.

In the novel, artificial intelligence is successively implemented on a computer in 2023, by a 24-year-old whizz-kid who had gained his Ph.D. at the age of 19. He remarks of his thesis that "It had a lot of what was new stuff at the time. It started simply by using an algebraic theory of knots based on the old Vaughn Jones polynomial to classify chaotically invariant trajectories, then applied this to various physics problems. Nothing very inspired and I'm sure that it must be pretty old hat now."

Note that Vaughan's name is mis-spelt in the novel.

Garry Tee

Lie Groups and Lie Algebras I. (Foundations of Lie Theory. Lie Transformation Groups.).

A.L. Onishchik (ed.), translated from Russian by A. Kozlowski. Encyclopaedia of Mathematical Sciences, Vol. 20, Springer-Verlag, 1993, vii + 235pp, DM 141. ISBN 3-540-18697-2.

Exactly six years ago, in late February 1988, the University I was working at—it was Tomsk State University, the eighth oldest one within the boundaries of the Russian Empire of bygone days, of which the main building, erected in 1888 on the donations of Siberian *kuptsy* (businessmen), was a scrupulous copy of the Geneva University main building (so they say), and is presently rotting and crumbling beyond repair both physically and morally—was hosting the Second Siberian School "Algebra and Analysis." The School took place in a health resort for manual labourers some 30 kilometres from the city, in a snow-bound hilly forest domain. It was a nice opportunity for all those Moscow and Leningrad celebrities to refresh their lungs—and minds, perhaps—by means of the simple Siberian style recreational activities, like endless cross-country ski rides by daylight and vodka-drinking sprees throughout late night, in the breaks between giving their lectures for Siberian mathematicians. Two of the three authors of the book under review attended the School as Invited Lecturers, and the reviewer himself—as an Academic Secretary of the Organizing Committee.

I remember vividly Professor Onishchik delivering his lecture which happened to be on Lie superalgebras; thin, gently stooping, bespectacled intellectual in a badly rumpled black suit, an embodied stereotype of an absent-minded professor of old, he kept turning his back on the audience for the most part of the lecture, used to erase erratic symbols of his almost immediately after they appeared on a battered blackboard, and, worst of all, his rapid speech proved to be nearly unintelligible. My basic knowledge of the subject enabled me to decipher the lecture for myself for a half an hour, then I gave up. A young friend and colleague of mine (later—a new Israeli), sitting next to me, could not help bursting into a suppressed, soundless, convulsive laughter, whispering into my ear: "He is a University Professor! Quite a Professor he is!.. I wonder if he is lecturing to his students like this, too?" We knew that Professor Onishchik, though living in Moscow, was working at the University in the ancient Russian city of Yaroslavl', commuting there on a weekly basis (four and a half hours one way by a train). To move home to Yaroslavl' meant losing forever the Moscow permanent residency, that utmost treasure for those Soviet citizens who possessed it and a height of desire for those who did not.

Of course, I write this all not with an idea of throwing a shadow on such a pillar of Lie theory in the ex-USSR as Professor Onishchik is; a prolific and hard-working mathematician, he is among those rare persons whom one can trust as book authors. Even more this last sentence applies to Ernest Vinberg, a Professor of Moscow University. He was always known as an unusually good mathematics presenter and teacher; I somewhat envied one of my friends who, while an undergraduate student at Moscow University, attended tutorials on linear algebra conducted by Professor Vinberg. Not knowing him personally, I wished to approach him during the same School in order to introduce myself and force on him an offprint of my paper on Lie groups just smuggled to France and published (illegally, against the Soviet regulations) in *C.R.Acad.Sci.Paris;* I was youthfully proud of the rebellious manner in which the results (hopefully, not too bad in themselves) were published. A reader of these lines, raised in and used to a predominantly friendly and open atmosphere of the Western mathematical community, would find it hard to believe how unapproachable a member of the mathematical establishment of the fSU normally is for a compatriot mathematician not belonging to his caste. (One may argue that the same person could be friendly and outgoing to visiting Western colleagues; that sitting inside an impenetrable nutshell of arrogance and mistrust was a reaction to and a way of survival in the poisonous atmosphere of a socialist society; but was it not, after all, just a vital component of such a society?..) When I approached Professor Vinberg hastily on one of those rare occasions when he was not busy, and started speaking to him (*Ernest Borisovich, I would like to* -), his eyes behind the round glasses became in an instant distorted with such a gaze of mixed unfriendliness, deep worry, suspicion, even shock and anger, that I gasped for a moment—and it provided him with a golden opportunity to turn his head aside and start in his soft melodious voice an animated conversation with another

visiting Muscovite, thus getting rid once and for all of such an unwanted and obviously useless acquaintance as I was!

Of course, my own, not too inspiring, minor personal experiences reflected in this reminiscence can in no way diminish the veritably Olympian status of the authors of the book. As far as the subject of it—Lie theory—is concerned, chewing the standard refrain "Lie theory has deeply penetrated into mathematics of these days, its importance is immense, etc" appears to be just wasting words. Everybody knows that not only can the sprouts of Lie theory be found in every branch of pure and applied mathematics and theoretical physics, but in many instances they are the true cornerstones of the whole subject. Lie theory deals, loosely speaking, with symmetry of any sort—including the recently discovered higher symmetries giving birth to such developments as theory of Lie superalgebras and supergroups, and quantum group theory. So versatile is the whole theory that you can find articles on Lie groups and algebras scattered all over a variety of mathematical and even physical journals, and it is only now, in 1994, that a separate journal - *Journal of Lie Theory* - is about to be launched.

This book is one in a well-known series of surveys in mathematics initiated in the then USSR some years ago, and it is formed by two lengthy survey papers: *Foundations of Lie Theory*, by Onishchik and Vinberg, and *Lie Transformation Groups*, by Gorbatsevich and Onishchik. Formally, the book starts with the very definition of a (finite-dimensional) Lie group, and the reader is only assumed to be familiar with the very basics of smooth manifold theory. However, the style of the book is openly that of a survey, which implies a very condensed, terse presentation and rather sketchy or altogether missing proofs. Because of that, the book can be hardly recommended for getting acquainted with the basic Lie group theory - with an important exception of a theoretical physicist who has no intention of studying a narrow strip of mathematics at depth and instead must grasp at a superficial level an abundance of mathematical concepts and facts, to be later guided in applying mathematics in his/her research by sheer intuition. At the same time, the book must be of a great help for a researcher who already has some idea of Lie theory, wants to employ it in his everyday research and/or teaching, and needs a source for customary reference on the subject. From my viewpoint, the volume is perfectly fit to serve as such a source, especially as far as finite-dimensional Lie transformation groups acting on finite-dimensional manifolds are concerned. This is a *hand-* rather than a *text*-book.

The introductory part of the book (approximately the first third of it) appears to be mostly a poor man's version of any of the excellent classical treatises on Lie theory, such as, to name just two, the set of 1964 Harvard lectures by Jean-Pierre Serre *Lie Algebras and Lie Groups* or *Lie Groups and Lie Algebras* by Bourbaki. (Apparently, Lie theory is presented in the aforementioned treatises simply in an ideal fashion, which can be neither surpassed nor even repeated.) After that the presentation gets rather eclectic for a while, covering hurriedly a variety of subjects such as Lie groups over non-archimedean valued fields, formal groups, infinite-dimensional Lie groups, Hilbert's Problem 5, and analytic loops. Most of these topics are covered by very good existing monographs, with a sad exception of Fréchet-Lie groups (where only very special and not quite representative topics are included in monographs; the entire theory is at an embryonic stage yet) and analytic loops (to the best of my knowledge). However, it might be good to have a variety store of basic definitions and results from Lie theory of our days being collected in one place.

The second half of the volume tends to be, as I already mentioned, more original and probably constitutes a relatively new coverage of Lie transformation theory in finite dimensions, perfectly up-to-date one. It is also an attempt to convey to a Western reader an abundance of results obtained by Russian mathematicians in the years before the Iron Curtain was lifted; many of these results have only been published in obscure Russian editions unavailable even in most parts of Russia, to say nothing of the West, and remained practically unknown to Western mathematicians. (With a saddening exception of some unscrupulous persons exploiting this information bottleneck who made their name, as a well-known saying goes, by "translating Russian mathematics into mathematical English." Of course, I would not deny that the inverse process took place in the then USSR on an even larger scale. In 1989 I was much amused to discover that a book by a certain Bielorussian Professor, written on the basis of his highest degree *Doctor of Sciences* thesis, was four-fifths a more or less accurate Russian translation of a well-known but almost unavailable in the USSR volume of the *Lecture Notes in Mathematics* by a certain francophone author; needless to say, our Bielorussian genius had forgotten to include this volume in his bibliography! Only the last

tiny chapter was original - but perhaps it came from somewhere else?) One side of this is that the reader will find many sources in the bibliography to be of little use. (What about a paper published in Russian in, say, *Geometricheskie Metody v Zadachah Algebry i Analiza*? Apart from the transparent meaning of the title—Geometric Methods in Problems of Algebra and Analysis—which makes one praise the cosmopolitan nature of mathematics once again, it tells you nothing at all. Even if you manage to find the edition, are you sure that you can read anything, title notwithstanding? After all, a universal language for scientific papers is a good idea, be it Latin, German, French, or English...)

The bibliography is apparently *everywhere dense* in the subject (© Victor Kac, 1983) as far as the areas of actual research activity of the authors are concerned. When they step aside, not only the coverage of the material but also the bibliography grow somewhat patchy (as it happens, for instance, with infinite-dimensional Lie groups; the most readable existing account of Fréchet-Lie theory, belonging to Milnor, is not even mentioned).

A surprising feature of the book is a high (at least, according to my untrustworthy judgement) quality of English translation, in spite of the fact that the translator is a person of clearly Russian extraction residing in Japan. The purely typographic quality of the book is, as one would expect of Springer-Verlag, beyond any reproach. On the whole, it is quite a pleasure, after making yourself comfortable in that favourite office armchair of yours, just to keep the volume gently in your hands and browse it slowly and thoughtfully; and after all, what more on Earth can one expect of any book?

Vladimir Pestov, Victoria University of Wellington

Discrete Mathematics: Logic and Structures (2nd ed),

by Elizabeth J. Billington, Diane Donovan, Barry D. Jones, Sheila Oates-Williams and Anne Penfold Street. Longman Chesire, 1993, xi + 316pp, $A29.99. ISBN 0-582-90947-3.

In recent years a great number of introductory textbooks on discrete mathematics have been published. Publishers have realised that courses in discrete mathematics are being taught in many universities, both to mathematics students and to those in other subjects such as computer science in which an understanding of mathematical reasoning and a knowledge of structures such as graphs and trees are thought to be useful. Unfortunately, the abundance of titles on the market has not brought a great deal of real choice: far too many of the books follow essentially the same pattern and style, and contain virtually the same material. These books, most of which are aimed at the American market, are always helpfully written and contain a wealth of explanation and examples to motivate each definition. The result is a text of perhaps 700 pages, in which the key definitions and ideas are buried in a mountain of motivation and worked examples.

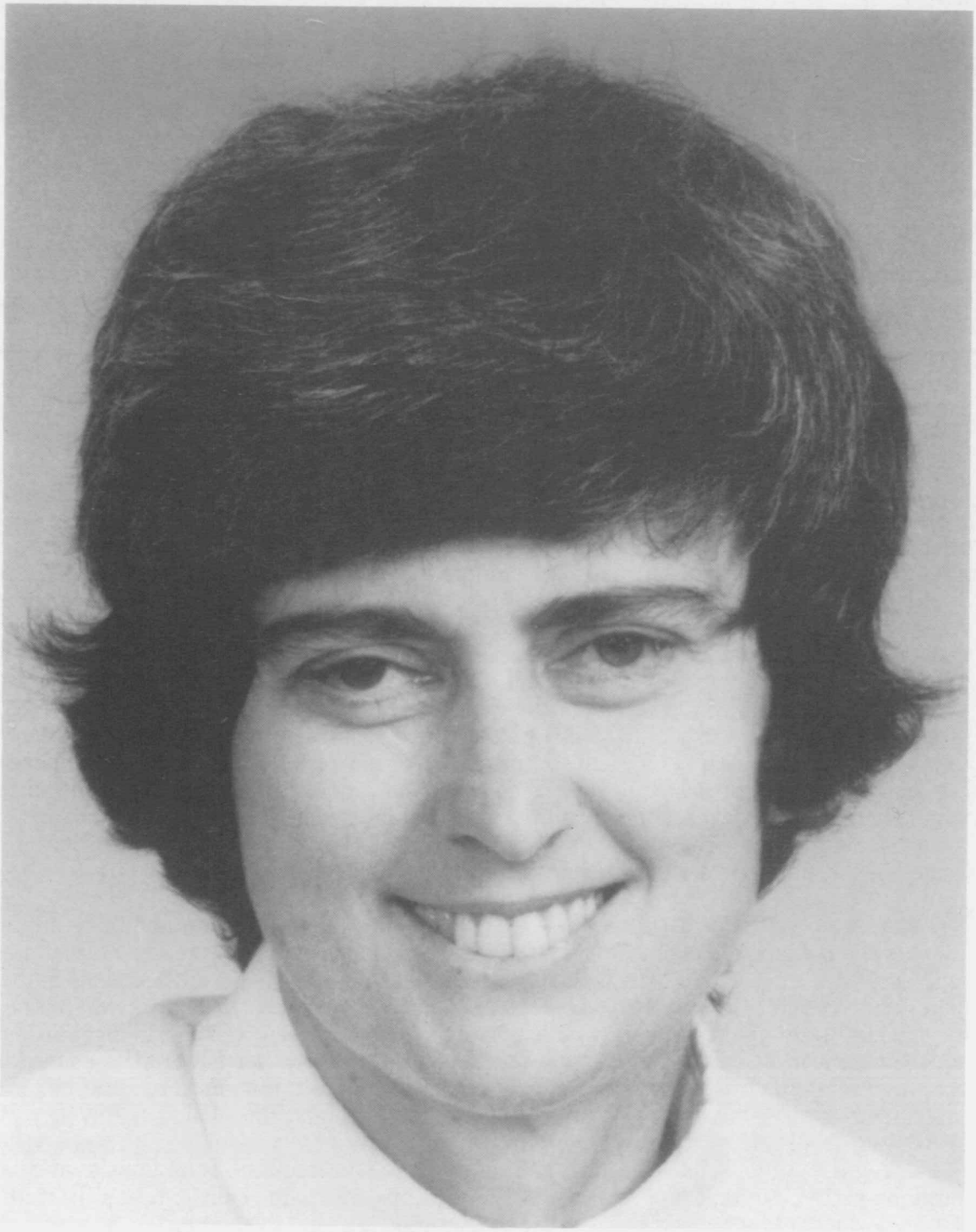
This book is very different. Although there is still plenty of explanation, and there are certainly plenty of worked examples, there is much more sense of balance: this is actually a text one can read through, and which one might even *want* to read through. Another major difference is in the choice of material. As the title suggests, the focus is on providing the framework for mathematical reasoning, and studying the structures such as graphs, number systems, Boolean algebras and so on which are useful in discrete mathematics and beyond. On the other hand, the standard topic of enumerative combinatorics is not dealt with at all, and algorithms get very little coverage: for example, there is no discussion of the complexity of the few algorithms which are given.

The book begins with a chapter on logic and set theory. The emphasis is on translating statements and arguments into formulas, so that the validity of the arguments can be tested by truth tables. Sets and the standard operations on them are then introduced, and the properties of these operations are investigated by relating them to the properties of the corresponding logical operations. Finally there is a short section on the axiom system ZFC.

The next two chapters cover graphs, digraphs and relations. After some general discussion of various types of graphs and the information they can be used to represent, relations are introduced by means of directed bipartite graphs. Properties of relations (transitivity, reflexivity and so on) are

Cont'd on P26

CENTREFOLD



Jan L Whitwell

JAN WHITWELL, 1944-1993

When a student, Jan's landlady warned her of the dangers of burning a candle at both ends. The advice was not heeded, and Jan, with her husband Adrian, continued to pack family, profession and recreation into their days until, after a day of recreation together, her activity was ended by a motor accident on 30 October last year.

Jan shed the label mathematician in 1970, but her work never lost the mathematician's imprint. She graduated from Victoria University in 1965 with a BSc(Hons) degree, largely in traditional applied mathematics, and joined the staff of a mushrooming Mathematics Department at Massey University as a Junior Lecturer the next year. At a time of life when today's graduates are establishing a research base under the guidance of senior colleagues, the young staff in this Department were developing new courses and establishing the foundations of a new Department. Jan herself wrote a third year course in linear analysis, a very different course from anything taught elsewhere.

Jan had been bored in vacations working for Arch Glenday as a statistical computer, and research topics in applied mathematics seemed very distant. Looking elsewhere for a career she chose economics. In 1970, she completed a BA with first class Honours in Economics through Victoria University, and at Massey moved across to the Economics Department. She gave a talk to the Mathematics Department shortly after her move, discussing her impressions of economics and economists. Apart from a difficulty in finding her niche (econometrician? mathematical economist? economical mathematician?) she talked mainly of the lack of rigour in economic analysis. 'Costs at the margin' for example ought to be a partial derivative of cost with respect to one of many variables. The applied mathematicians would not ignore these other variables, but economists usually did, because their tool, human intuition, can not handle several interrelated variables.

Jan would never leave an unsatisfactory situation unrighted. The same calm persistent reasoned argument used in defending herself or friends from bureaucrats and bosses was directed towards this lack of rigour in economics. Between 1971 and 1976 her commuting extended to the University of Birmingham. Here she did find a niche, monetary economics, a senior colleague, David Sheppard, and started publishing.

She returned to Massey in 1976, having previously re established links with the Mathematics Department by marrying Adrian Swift. Jan quickly resumed her place in local music groups and the Swiftwells developed a wide circle of friends which was always ready to incorporate newcomers. Both the Muldoon and Douglas era provided plenty of scope for rigorous economic criticism. Jan joined in the public debate, always with reason, clarity and good humour. Her argument that government policy of the late 1980's was not responsible for lowering inflation, but was causing unemployment, could be understood by anyone. She examined each assumption carefully, and showed that observed associations were better explained if some causal links were reversed.

Jan was promoted to Reader in 1987, but the place of economics at Massey was subject to unending reviews. With no sign that this unsatisfactory situation would be righted, and the continued attraction of Wellington, where she was already a regular visitor, Jan accepted an appointment in the Victoria University Economics Department, and at the time of her death was Chairperson of the Money and Finance Group. Her work on the influence of monetary policy in a small open economy was concerned particularly with stability, another mathematical concept difficult for intuition to analyse.

Jan earned, and accepted, acclaim as an economist, but she will be remembered for her human qualities. She took a close, lasting interest in her family, friends and all those she met.

That is why, after two and a half decades outside a Mathematics Department, so many readers of this journal will have grieved at her death, and felt strong sympathy with Adrian.

Greg Arnold

investigated in terms of properties of the corresponding graphs and their adjacency matrices. This leads to a discussion of equivalence relations and order relations, before moving on to define functions as being a particular type of relation. Countability is briefly mentioned, including a proof that the power set of the natural numbers is uncountable.

In the next three chapters the standard number systems are developed. Staring from Peano's Axioms, the properties of the natural numbers are rigorously studied. From the natural numbers we build first the integers, then the rational, real and complex numbers. The issues at stake in this construction, such as the notion of stability of an equivalence relation with respect to a function, are clearly discussed. This section also includes some elementary number theory, as is often found in a first algebra course: Euclid's algorithm, solution of Diophantine equations, the Chinese remainder theorem and so on.

The final part of the book deals with some general algebraic structures. There is a discussion of semigroups and groups, which gets as far as Lagrange's theorem, followed by a short section on public key cryptography. Then structures with two operations are discussed: rings, integral domains, fields and Boolean algebras. This last part ties together some ideas from several parts of the book, and is related to the application of simplifying switching circuits.

The book has a great many examples throughout, ranging from simple practice in the definitions to some which are quite challenging. The text is very readable, and the explanations are clear without being excessive. Some of the conventions adopted seem strange at first: for example the authors use both left notation $f(x)$ and right notation xf for the value of the function f at x. This may seem awkward, and might cause some confusion to some students. Nevertheless, it is pleasing to see the question of which notation is more suitable in which circumstances so explicitly discussed, and it is particularly suitable for a course in discrete mathematics to emphasise that flexibility is possible: to my mind it is better to use the appropriate notation, the appropriate structure or whatever in a given situation than to try to make a small number of definitions fit all possible uses.

In conclusion, then, this book is a very interesting addition to the range of introductory discrete mathematics texts available. The choice of material covered is not standard, but the coverage given to that material is excellent.

David McIntyre, University of Auckland

Joseph Liouville 1809-1882: Master of Pure and Applied Mathematics

by Jesper Lützen. Studies in the History of Mathematical and Physical Sciences, 15, Springer-Verlag, New York, 1990, xx + 884 pp. ISBN 0-387-97180-7.

Joseph Liouville (1809-1882) was the major French mathematician between Galois and Hermite. He did important work in almost every branch of pure and applied mathematics; and numerous theorems, methods, concepts *et cetera* are named after him, in most cases with justification. He founded the *Journal de Mathématiques pures et appliqués* in 1836, when Crelle's *Journal für die reine und angewandte Mathematik* was the only significant journal devoted to mathematics. Liouville edited his *Journal* single-handedly for 39 years, and it has continued to this day to be one of the world's leading mathematical journals. Until recent years, remarkably little had been published about Liouville's life and his work; even though his importance has been acknowledged by mathematicians during and since his lifetime, and vast quantities of manuscripts and other archival material relating to Liouville survive. Much archival material on Liouville was published by Neuenschwander in 1984.

Lützen explains (p.viii) that the "aim of this book is to tell the story of Liouville's scientific career: his education and his work as a teacher, journal editor, politician and academician, and not least to analyse his mathematical works and place them in a historical perspective. ... ... The mathematical analysis of Liouville's notes has not only been the most challenging but also the most interesting and rewarding work involved in the research concerned with this biography". Those notes are vast in bulk, and written in such a disordered manner that Liouville admitted that he sometimes found them very difficult to understand. Lützen shews that Liouville's notes contain many extensive treatments of ideas which he never published, and some of them anticipated very important work published several decades later by other mathematicians.

Part 1 (pages 1-260) is a chronological account of Liouville's career, from his period as a student at the *École Polytechnique* and the *École des Ponts et Chaussées* to his maturity as Professor at the *École Polytechnique* and the *Collège de France*, member of the *Académie des Sciences,* Fellow of the Royal Society of London, member of the Academies of Berlin, St Petersburg, Göttingen, Stockholm, Philadelphia and many others, and *Commandeur de la Légion d'Honneur*. He was a personal friend of many of the leading mathematicians of his era, including Poisson, Sturm, Dirichlet, Jacobi, Thomson, Chebyshev, Hermite and Mittag-Leffler; although he seems never to have travelled further from France than to Belgium (once). In the political convulsions of France in the mid-19th century, Liouville played a minor but honourable public role. Part 2 (pages 261-755) analyses Liouville's scientific work; and pages 757-884 contain Appendices, Notes, a Bibliography of Liouville's manuscripts and publications, plus general References and Index.

Liouville's early researches on electrodynamics and on heat conduction (1828-1831) were concerned with deducing from macroscopic phenomena the elementary forces between molecules, and through that endeavour Liouville became a major pioneer of integral equations. Leibniz, Euler, Fourier and others had attempted to extend the concept of derivatives from positive integer index to fractional index. Liouville published (1832-1837) the first large-scale connected theory of fractional calculus, which he applied to solve some integral equations earlier than did Abel, who is usually credited with being the first. Liouville's fractional calculus was extended by Riemann, and the standard modern fractional calculus is based on the Liouville-Riemann definition of a derivative of arbitrary index.

Liouville founded (1833-1841) the theory of integration in finite terms. He solved completely the problem of deciding whether an algebraic function has an algebraic integral, and of finding that algebraic integral when it exists. One of the several theorems commonly named "Liouville's Theorem" was published in 1834:

> Let y be an arbitrary algebraic function of x. If the integral $\int y dx$ is expressible in finite explicit form, it is always possible to write
>
> $$\int y dx = t + A\log u + B\log v + \ldots + C\log w,.$$
>
> where $A, B, \ldots, C$ are constants and $t, u, v, \ldots, w$ are algebraic functions of x.

Liouville's theory of integration in finite terms was extended in a series of papers (1853-1867) by Chebyshev. After that there was little further advance until the late 1960s when various computer scientists began developing computer programs for analytic integration, and in the process they generalized Liouville's theory of integration in finite terms.

Liouville and his close friend Charles Sturm published (1828-1840) a series of papers on the eigenvalues of the general linear second-order o.d.e. with general (linear) boundary conditions – now known as Sturm-Liouville Theory. The author discusses (pp.435-436) possible origins for Sturm's famous theorem on real roots of real algebraic equations, which Sturm had presented to the *Académie* in 1829. In fact, Sturm did explain to Sylvester how he had discovered that theorem. In a rejoinder to T. H. Huxley, who had described mathematics as "that study which knows nothing of observation, nothing of experiment, nothing of induction, nothing of causation", Sylvester explained that "Most, if not all, of the great ideas of modern mathematics have had their origin in observation. Take, for instance ... Sturm's theorem about the roots of equations, which, as he informed me with his own lips, stared him in the face in the midst of some mechanical investigations connected (if my memory serves me right) with the motion of compound pendulums". (J. J. Sylvester, "A plea for the mathematician", *Nature* **1**, 238; and **Collected Mathematical Papers**, CUP, Volume 2, 655-656.)

Liouville made extensive studies (1834-1843) of the stability of equilibrium of rotating gravitating fluids, especially MacLaurin's oblate ellipsoids of rotation and Jacobi's triaxial ellipsoids. He

published only a small fraction of that work, but that did influence Liapunov and (indirectly) Poincaré in their studies of stability.

Roger Cotes had published in 1714 the continued fraction expansion of e, which does not terminate and is not periodic. Cotes probably regarded it as obvious that e is therefore irrational, since any rational number has a terminating expansion as continued fraction. Lagrange proved in 1768 that a real number is a quadratic irrational (i.e. a root of a quadratic equation with integer coefficients and positive non-square discriminant), if and only if its continued fraction expansion is ultimately periodic. Lagrange's theorem, applied to Cotes's continued fraction expansion of e, shews immediately that e is not a quadratic irrational; and yet many modern authors (including Lützen on p.517) credit that result to Liouville, who published a proof of it in 1840.

A number is called algebraic if it is a root of some polynomial equation with integer coefficients. James Gregory 1st, Leibniz, Goldbach, Euler and others had asserted that various numbers are not algebraic: such (hypothetical) numbers were called transcendental. However, Liouville was the first to prove (in 1844) that transcendental numbers do exist, by constructing some numbers which are not algebraic. Liouville's elegant construction of some transcendental numbers is one of his most impressive achievements.

In a paper on planetary perturbations (1836), Liouville approximated a double integral by a complicated transformation to a Fourier cosine series, whose coefficients he expressed in terms of elliptic integrals. For a modern mathematician, it seems curious that mathematicians in the 19th century devoted so much effort to "solving" problems in terms of elliptic integrals and elliptic functions. No adequate numerical tables of elliptic integrals and elliptic functions got published in the 19th century (and only scanty tables have been published since then), and hence such "solutions" are of very little use for numerical computation. The integrals and other such problems could much better be computed by direct methods of numerical approximation. Liouville advanced greatly the theory of elliptic functions by *defining* them as doubly periodic (analytic) functions. He shewed (1844) that such a function without poles is identically constant, and then (1847) generalized the result to prove his major theorem that an analytic function which is bounded everywhere is identically constant. From his definition of an elliptic function $u(x)$, it follows incidentally that $(du/dx)^2 = P(u)$ where P is a quartic polynomial, so that $u(x)$, is indeed the inverse of the elliptic integral $x = \int du/\sqrt{P(u)}$.

Évariste Galois (1811-1832) had failed to get any of his significant work published before he was killed at the age of 20, and his friends failed to persuade any mathematician to examine Galois's manuscripts until they approached Liouville in 1842. Liouville quickly realised the profound significance of Galois's manuscripts, which he collected, studied, edited, published and expounded.

Liouville's work on mechanics culminated in his major theorem (1838) on the constancy of volume of phase space, which is very important in statistical mechanics.

Liouville's publications on potential theory were significant, but his very extensive notes (1845-1857) on spectral theory indicate that "Hilbert was probably the first mathematician whose understanding of spectral theory went beyond that of Liouville" (p.633), and "the Rayleigh-Ritz method might have been called the Liouville method" (p.635).

Liouville published (1845 & 1847) three letters from his friend William Thomson (later Baron Kelvin) on transformation of electrostatic fields by inversion in spheres. Liouville added extensive notes to the 1847 paper, in which he pointed out that the Kelvin transformation is conformal, and he gave the first proof that the conformal mappings of the complex plane into itself are the holomorphic functions and their conjugates. (That result is implied in papers by Gauß in the 1820s, but had not been stated by Gauß). In 1850, Liouville published his truly remarkable theorem that the only conformal mappings $\Re^3 \to \Re^3$ (apart from cylindrical extensions of conformal mappings in a plane) are those composed of inversion in a sphere and a similitude.

Sylvanus P. Thompson, in his biography of William Thomson (Baron Kelvin), told that

> 'Once when lecturing, he used the word "mathematician", and then interrupting himself asked his class "Do you know what a mathematician is?" Stepping to the blackboard he wrote upon it
>
> $$\int_{-\infty}^{+\infty} e^{-x^2}\,dx = \sqrt{\pi}\,.$$
>
> Then, putting his finger on what he had written, he turned to his class and said: "A mathematician is one to whom *that* is as obvious as that twice two makes four is to you.
>
> Liouville was a mathematician".'

Liouville published over 400 mathematical papers, but many of his discoveries were published by his students, acknowledging Liouville's lectures. His work was so varied that very few people today would be capable of understanding most of it. Many mathematicians will be grateful to Jesper Lützen for his impressive achievement of explaining Liouville's achievements in so many diverse branches of mathematics (although on page ix he modestly disclaims any knowledge of number theory).

However, some emendations should be made in subsequent printings of this book.

There are 96 illustrations including many portraits, but only one small photograph (page v) of Liouville (aged *c*60). Plate 22 (page 220) is captioned as Charles-Eugène Delaunay (1816-1872); but it is actually a youthful portrait of Chebyshev! Plate 21 (page 204) is captioned as Pafnuti Lvovich Chebyshev (1821-1894), which it certainly is not – might *that* be a portrait of Delaunay?

The proofreading for this book can only be deplored.

The LaTeX printing command "boldmath" gets printed as text on pages 527 (twice), 530 & 537.

Many names are mis-spelt, especially in the References and in the Index. As examples, we find: "Brounker's" for "Brouncker's" (pp.234 & 858), "Woepke" for "Woepcke" (p.235), "Lemé" for "Lamé" (p.473), "Hooks law" for "Hooke's law" (pp.704 & 868), "Riemanian" for "Riemannian" (p.753), "Stephan-Boltzmann's law" for "Stefan-Boltzmann law" (p.776), "Brusch" for "Brush" (p.819), "Legesgue" for "Lebesgue" (p.837), "Leibniz, G. L." for "Leibniz, G. W." (p.837), "Rodriques" for "Rodrigues" (p.847), "*Isac Newton*" for "*Isaac Newton*" (p.852), "d'Alembert, Jean Babtiste"(!) for "d'Alembert, Jean le Rond (1717-1783)" (p.855), "Claitaut" for "Clairaut" (p.860), "Davy, Humphrey" for "Davy, Humphry" (p.861) and "Kirchoff" for "Kirchhoff" (p.870). Many names (e.g. Évariste Galois) have been printed without accents.

p.188 The wine harvest from Liouville's vineyard in 1859 is said to have amounted to 8000 m^3 (!).

p.342 $\Sigma A_n e^{-mx}$ should be $\Sigma A_m e^{-mx}$.

p.353 The logarithmic and trigonometric functions and their inverses are said to have "been firmly established in Euler's famous **Introductio** [1748], not only because they got their own names (log, exp, sin, cos, etc.), but also" etc. But Euler wrote e^z in that text, and did not write exp(z).

p.425 "1920s" should be "1820s".

p.528, line 34.
"In their first memoir, they referred to Collo'eville's "beautiful theory"," ?

p.530 The inverse of the integral $\mu = \int_0^t (1-x^2)^{1/2}\,dx$ is not sin t.

Rather, it is $t = \sin\mu$.

p.530 In Abel's masterpiece *Recherches sur les fonctions elliptiques* [1827-1828], he "showed that the function ϕ has two periods, 2ω and $2i\omega'$ ". Actually, Abel denoted the periods by 2ω and $2i\varpi$, using the variant form ϖ of π. Likewise, in the excerpts (on pp.537-549) from Liouville's notebooks leading to the discovery of his major theorem that a bounded analytic function is constant, Liouville's symbol ϖ (in Plate 28) is misprinted as ω overlined: that could mislead readers to interpret it as the complex conjugate of ω.

p.581 "Newton succeeded in showing geometrically that the force from a homogeneous sphere on a point outside the sphere is equal to the force that would be from the center of the sphere if the entire mass was concentrated there." Actually, Newton proved that result more generally, for any pair of spherically symmetric masses (**Philosophiæ Naturalis Principia Mathematica**, Book 1, Proposition 76, Theorem 36).

p.638 "$P(t,x,x^2,\ldots,x^{(n-1)})$" should be "$P(t,x,x',x'',\ldots,x^{(n-1)})$" , and likewise for Q.

p.648 "$\cos gt = \cos qt \cos lt - \sin t \sin lt$" should be "$\cos gt = \cos qt \cos lt - \sin qt \sin lt$ " .

p.813 "(1923)" should be "(1823)".

p.829 "[18330-1835]" should be "[1830-1835]".

p.875 James Clerk Maxwell's dates are given as "(1831-1909)" instead of "(1831-1879)".

Caspar Wessel is indexed as "Wessel, Caspar" and also as "Caspar", Ossian Bonnet is indexed as "Bonnet, Ossian" and also as "Ossian Bonnet"; and Jeremy Gray is indexed not as "Gray, Jeremy" but as "Jeremy Gray". The double Index entry on p.884:

> "Woepecke, M., 234
> Woepke, Fran (1826-1864)"

should be "Woepcke, Franz (1826-1864), 235". Several names (e.g. Greenhill) are indexed without initials, even when the initials are given in the References. Many names in the Index lack dates, even for eminent scientists such as d'Alembert, Forbes, Fresnel and Planck. Several page numbers in the Index are incorrect; e.g. Greenhill is cited on p.418 but is indexed for p.417.

There are many lesser spelling errors, including: "Bibliotèque" (pp.xi & 857), "as fas as" (p.436), "multiplyer" (p.665), "conservarion" (p.683), "determins" (p.695), "maniscript" (p.758), "clasical" (p.779), "paranthesis" (p.793), "speach" (p.793), and "Force Five" for "*force vive*" (p.865).

The author announces (page vii) his plan to edit (with C. Houzel) Joseph Liouville's collected works. The prospect of a collected edition is most attractive – but Liouville (and his admirers) deserve editing more careful than this biography has received.

Garry J. Tee, University of Auckland

Dynamical Systems VIII

edited by V.I. Arnol'd. Encyclopaedia of Mathematical Sciences, 39, Springer-Verlag, Berlin-Heidelberg-New York, 1993, v+235pp, DM 141.00. ISBN 3-540-53376-1.

This volume of the series is a continuation of Dynamical Systems VI (Encyclopaedia of Mathematical Sciences Volume 6, V.I. Arnol'd (ed.), Springer-Verlag, 1993). It is subtitled "Singularity Theory II. Applications". However I found that, in large part, it was more a continuation of the theory of volume VI rather than applications of the theory per se. This book is claimed to be independent to volume VI but I feel that reading at least parts of volume VI is necessary before attempting volume VIII.

It is difficult to see what audience this volume is aimed at. In the preface to volume VI, the authors state

"In writing this survey the authors had in mind a student-reader, mathematician or physicist, who wishes to learn the modern mathematical apparatus of local mathematical analysis as an instrument for applied studies, or a specialist in the respective applied domain seeking for the needed mathematical tools and reference information."

Unfortunately, judged by these aims, I don't think that the book can be called a success. I doubt that many, if any, graduate students in New Zealand could cope with the presentation of material in this book. Indeed, I doubt that many professional applied mathematicians or theoretical physicists would either. The book calls for a considerable background in any fields that have traditionally been regarded as pure. This is unfortunate as the material covered has the promise to be of great use in applied mathematics/theoretical physics.

The results in the book are stated without proof (but references are given). I think that the major failing of the book, given that it is aimed at an applied audience, is with the examples. They tend to be rather trivial or simply stated with no hint of the computations required. The book would be much more useful if the authors had more detailed discussions on the application of the results to the examples; particularly on the complexity of the calculations involved. In many cases there is not even a reference to the literature for the example.

The examples range from purely mathematical in nature to those of genuine interest to the applied community which include, all too brief, discussions of Legendre and Lagrangian singularities, Maxwell sets, gradient dynamical systems (including a discussion of Thom's "theorem"), solutions of hyperbolic equations among others.

On a more positive note, this book does serve the specialist well. It gives an concise insight (and references) to the work of various (formerly?) Eastern European authors whose works are not as widely known in the West as perhaps they should be. An index to notation would have been appreciated here as some of the notational conventions used in this book are non-standard (to me, at least).

Mark Hickman, University of Canterbury

Numerical solution of stochastic differential equations

by Peter. E. Kloeden and Eckhard Platen. Applications in Mathematics, 23, Springer-Verlag, Berlin 1992, xxxv + 632 pages, DM 118.00. ISBN 3-540-54062-8.

I. Preliminaries
II. Stochastic differential equations
III. Applications of stochastic differential equations
IV. Time discrete approximations
V. Strong approximations
VI. Weak approximations

This is a well written book which can be highly recommended to all students and researchers alike who want to start using stochastic differential equations in applications. It is the first text on the market which covers the problem of numerical solutions in such a comprehensive way.

The theory of stochastic differential equations is one of the main achievements of modern probability theory. Stochastic calculus is one of the well developed and understood fields which allows for a wide range of applications in biology, physics, engineering and finance. For example, over the last few years it has been recognised as a necessity to teach fundamentals of stochastic calculus for graduate students in business schools.

The text by P.E. Kloeden and E. Platen is written for a very wide readership. It can be used as an introduction to stochastic calculus for graduate students or for researchers who are interested in applications of stochastic differential equations. The text can also be taken as a guide for graduate courses on stochastic differential equations and/or their numerical solution.

It is not a research monograph which covers the latest achievements of the theory of stochastic differential equations. The advanced theory of stochastic integration and differential equations has been treated in the books by P. Protter (1990), I. Karatzas and S.E. Shreve (1988), continuous time martingales and Brownian motion have been handled in Revuz and Yor (1991). Those are monographs for the reader with a strong background in stochastic analysis. The text by K.L. Chung and R. Williams (1990) is certainly the closest to Kloeden's and Platen's work although it does not deal with the various applications and the numerical aspect. The applications are here mainly in mathematics and physics.

The book under review cannot be understood as a guide to applications of stochastic differential equations in a particular field. So the reader who is only interested in pricing of options should search for another book. This also concerns the statistical side although the authors touch on some statistical problems (e.g. in Chapter 6.4 "Parameter estimation", Chapter 16 "Variance reduction methods"). The part on applications treats various problems in genetics, hydrology, energetics, simulated annealing, radio-astronomy, seismology etc. These are examples of possible applications which show how one can model certain phenomena. The applications are completed by a chapter on modelling with stochastic differential equations. In it the use of different stochastic calculi, problems of stochastic stability, filtering, optimal stochastic control and others are discussed.

Part IV is a general introduction to numerical solutions. It starts with a chapter on numerical methods for deterministic differential equations. It continues with a chapter on basic concepts of stochastic time discrete approximations. The more specific problems are handled in Parts V and VI. Different approximation schemes are discussed in detail and are illustrated by computer graphs. In eight chapters on 220 pages one can find everything which is known on different kinds of approximation schemes, strong and weak approximation schemes, explicit and implicit schemes, their advantages and disadvantages.

The main advantage of the book (and this is what makes it unique) is that the reader is introduced to the numerical aspect of the theory at every step. Starting with a discussion of random number generation via the simulation of elementary processes such as Brownian motion the reader is led into the more complicated theory of numerical solutions. One is already warned at the beginning that one should not believe that the methods for numerically solving ordinary and stochastic differential equations are the same. In the stochastic case, the use of so-called stochastic Taylor expansions requires a deep understanding of stochastic calculus combined with the refinements of the classical techniques of numerical solutions. Chapter 5 with 70 pages is only devoted to stochastic Taylor expansions which are of great use for numerical approximations in parts IV, V and VI.

The book is written for readers with quite a different taste and knowledge. In "Suggestions for the Reader" the authors propose several menus for those who are mainly interested in the mathematical aspect and for those who just want to apply stochastic differential equations. Every chapter contains plenty of exercises (with solutions at the end) and so-called PC-exercises. The authors spend a lot of efforts in convincing the reader to actually sit down and work out some examples. The aspect of applications and computabilty is the main concern of a companion volume by the authors and Henry Schurz "The numerical solution of stochastic differential equations through computer experiments" which is to appear in Springer-Verlag.

The book has got 28 pages of references and 10 pages of bibliographical notes containing all the relevant information for some further special search for theory or applications of stochastic differential equations. The price of the book is certainly not moderate but it is good value for good money.

References

Chung, K.L. and Williams, R.J. (1990) *Introduction to Stochastic Integration.* Birkhäuser, Boston.
Karatzas, I. and Shreve, S.E. (1988) *Brownian Motion and Stochastic Calculus.* Springer, New York.
Protter, P. (1990) *Stochastic Integration and Differential Equations.* Springer, New York.
Revuz, D. and Yor, M. (1991) *Continuous Martingales and Brownian Motion.* Springer, Berlin.

T. Mikosch, Victoria University of Wellington

CONFERENCES

30th Conference of the Operational Research Society of New Zealand
and the
45th Conference of the New Zealand Statistical Association
25-26 August 1994

Massey University
Palmerston North
New Zealand

First Announcement and Call for Papers

The 30th Annual Conference of the Operational Research Society of New Zealand (ORSNZ) and the 45th Annual Conference of the New Zealand Statistical Association will be held at Massey University, Palmerston North on the 25th and 26th of August 1994. The conference is intended to bring together operational research workers and statisticians from many groups, ranging from those involved in academic research to practitioners in local industry.

Registration Forms

Registration forms with the preliminary conference programme will be posted in May 1994.

Conference Enquiries and Abstracts

ORSNZ Dr Julie Falkner, Department of Mathematics
Email: j.c.falkner@massey.ac.nz

NZSA Dr Charles R O Lawoko, Department of Statistics
Email: c.r.o.lawoko@massey.ac.nz

Julie Falkner

May 9-12 (Hamilton, New Zealand) **1994 New Zealand Mathematics Colloquium and Mathematics Education Day**
Contact the Colloquium Secretary, Department of Mathematics and Statistics, University of Waikato, Private Bag 3105, Hamilton, New Zealand
e-mail: nzmc94@hoiho.math.waikato.ac.nz

May 16-20 (Auckland, New Zealand) **Conference on Groups & Geometry**
Contact: Marston Conder or Gaven Martin, Department of Mathematics, University of Auckland, Private Bag 92019, Auckland, New Zealand.
e-mail: conder@mat.aukuni.ac.nz Fax 0064-9-9737457

July 4-8 (Armidale, New South Wales) **38th Annual Meeting of the Australian Mathematical Society**
Contact Dr I. Bokor, Department of Mathematics, Statistics and Computing Science, University of New England, Armidale, NSW 2351, Australia
e-mail: ams94@neumann.une.edu.au

July 4-8 (Clayton, Victoria, Australia) **12th Australian Statistical Society Conference**
Contact Dr R C Griffiths, Mathematics Department, Monash University, Clayton, Victoria 3168, Australia.
e-mail: apm466b@vaxc.cc.monash.edu.au

July 10-13 (Gold Coast, Queensland) **2nd Conference on Mathematics and Computers in Sport**
Contact Associate Professor N de Mestre, School of Information and Technology, Bond University, Gold Coast, QLD 4229, Australia.

July 11-13 (Melbourne, Victoria) **AEMC94 - 1st Biennial Engineering Mathematics Conference**
Contact Dr Joseph Steiner, Department of Mathematics, Swinburne University of Technology, Hawthorn, Victoria 3122, Australia
e-mail: aenc94@swin.edu.au

July 13-15 (Armidale, New South Wales) **1994 Australian Meetings of the Econometric Society**
Contact Dr Chris O'Donnell, Department of Econometrics, University of New England, Armidale, NSW 2351, Australia.
e-mail: codonnel@netz.une.edu.au

August 1-5 (Chiba, Japan) **3rd World Congress on Computational Mechanics**
Contact T. Kawai, WCCM III Office, Dept of Electrical Engineering, Science University of Tokyo, 1-3 Kagurazaka, Shijukuku, Tokyo 162, Japan.

August 1-9 (Les Houches, France) **Fluctuating Geometries in Statistical Mechanics and Field Theory**
Contact Professor J. Zinn-Justin, CEA-CEN Saday, Service de Physique Theorique, F-91191 Gif-Sur-Yvette Cedek, France.

August 1-19 (Minneapolis, Minnesota) **IMA Course on Mathematical Modeling for Teachers**
Contact IMA: see (3) below.

August 3-11 (Zürich, Switzerland) **The International Congress of Mathematicians 1994**
Contact R. Jeltsch, Seminar für Angewandte Mathematik, ETH, CH-8092 Zürich, Switzerland.

August 7-13 (Oberwolfach, Germany) **Effiziente Algorithmen**
Contact MFOG: see (1) below.

August 8-12 (Hamilton, Ontario) **17th International Biometric Conference**
Contact IBC 94 Local Organizing Committee, Department of Mathematics and Statistics, McMaster University, Hamilton, Ontario, Canada L85 4K1
e-mail: ibc 94@mcmail.cis.mcmaster.ca

August 12-20 (Moscow) **1994 Summer Workshop - Conference on Classical and Quantum Geometry of Homogeneous Spaces**
Contact B. Komrakov, ISLC, Department of Mathematics, University of Oslo, P O Box 1053, Blindern, N-0316, Oslo, Norway.
e-mail: islc@math.uio.no

August 13-17 (Plovdiv, Bulgaria) **Third Colloquium on Numerical Analysis**
Contact Secretary Stoyan Zlatev, Mathematical Faculty of the Plovdiv University, Tsaw Assen Str. 24, Plovdiv 4000, Bulgaria.

August 13-19 (Kouty, Czech Republic) **International Conference on Potential Theory (ICPT 94)**
Contact ICPT 94, MFF UK, Sokolovska 83, 186 00 Praha 8, The Czech Republic.
e-mail: icpt94@cspquk11.bitnet

August 14-20 (Oberwolfach, Germany) **Nonlinear Evolution Equations**
Contact MFOG: see (1) below.

August 14-21 (Moscow) **International Conference on Functional Differential Equations and Applications**
Contact A. L. Skubachevskii, Moscow Aviation Institute, Moscow, Volokolanskoe shosse 4, Russia 125871.
e-mail: aet@tk.mainet.msk.su

August 14-27 (Istanbul, Turnkey) **NATO Advanced Study Institute: Finite and Locally Finite Groups**
Contact B. Hartley, Department of Mathematics, University of Manchester, Manchester M13 9PL, England.

August 15-18 (Amsterdam) **10th Summer Conference on General Topology and Applications**
Contact Dr E. Coplakova, Faculty of Mathematics and Informatics, TU Delft, P O Box 5031, 2600 GA Delft, The Netherlands.
e-mail: top94@cs.vu.nl

August 15-19 (Szeged, Hungary) **Colloquium on Semigroups**
Contact Mária B Szendrei Jósef Attila University, Boylai Institute, 6720 Szeged, Aradi vértanúk tere 1, Hungary.
e-mail: h6178sze@huella.bitnet

August 15-19 (Ann Arbor, Michigan) **15th International Symposium on Mathematical Programming**
Contact 15th International Symposium on Mathematical Programming, Conferences and Seminars, 541 Thompson Street, Room 112, University of Michigan, Ann Arbor, MI 49109-1360, USA.
3-mail: xvismp@um.cc.umich.edu

August 15-19 (Rotterdam, The Netherlands) **Fourth Conference of the International Linear Algebra Society**
Contact H Bart, Econometric Inst., Erasmus University, P O Box 1738, 3000 DR Rotterdam, The Netherlands.
e-mail: bart@wis.few.eur.nl

August 16-20 (Shanghai) **ICMI-China Regional Conference on Mathematics Education**
Contact Zhang Dian-zhou, Dept. of Mathematics, East China Normal University, Shanghai 2000062, People's Republic of China
FAX (+86 - 021 - 257-8367

August 18 - 23 (Plovdiv, Bulgaria) **Fifth Colloquium on Differential Equations**
Contact Secretary Stoyan Zlatev, Mathematical Faculty of the Plovdiv University, Tsar Assen Str. 24, Plovdiv 4000, Bulgaria.

August 18-25 (Pusan, South Korea) **3rd International Conference on the Theory of Groups (Groups-Korea 1994)**
Contact Professor An n Chi Kim, Department of Mathematics, Pusan National University, South Korea.
e-mail: ackim@hyowon.pusan.ac.kr.

August 20-26 (Shijiazhuang, China) **International Conference on Rings and Radicals**
Contact Y.S. Zhu, Hebei Teachers University, Dept. of Math, Shijazhuang, China 050016.

August 21-27 (Oberwolfach, Germany) **Mathematical Models in Phase Transitions**
Contact MFOG: see (1) below.

August 22-25 (Leuven, Belgium) **3rd International Workshop on Singular Value Decomposition and Signal Processing**
Contact Lieven De Lathauwer, E.E. Department, ESAT/SISA, Kath. Universiteit Leuven, K. Mercierlaan 94, B-3001 Heverlee, Belgium.

August 22-26 (Mishok, Hungary) **6th Conference on Numerical Methods in Hungary**
Contact K Balla
e-mail: balla@na-net.ornl.gov

August 25-26 (Palmerston North) 30th Conference of the Operations Society and 45th Conference of the New Zealand Statistical Association, joint conference. Details see above.

August 27-28 (University Park, Pennsylvania) **Conference on the History of Mathematics in Honor of Boris Rosenfeld**
Contact S Katok, Dept of Mathematics, Pennsylvania State University, University Park, PA 16802-6401, USA.
e-mail: katok_s@math.psu.edu

August 27-31 (Lahore, Pakistan) **4th Islamic Countries Conference on Statistical Sciences (ICCS-IV)**
Contact Akhlad Ahmad, Conference Secretary, Awani Complex, Usman Block, New Garden Town, Lahore - 54600, Pakistan.
e-mail: fac024@saupmoo.bitnet

August 28-September 3 (Oberwolfach, Germany) **Komplexe Analysis**
Contact MFOG: see (1) below.

August 20-31 (Leuven, Belgium) **3rd International Workshop on Algorithms and Parallel VLSI Architectures**
Contact Filiep Vanpoucke, E.E. Department, ESAT/SISTA, Kath. Universiteit Leuven, K. Mercierlaan 94, B-3001 Heverlee, Belgium.
e-mail: Filikep.vanpoucke@esat.kuleuven.ac.be

September (Russia) **Suslin Jubilee International Conferences**
Contact V Molchanov, Executive Director of the Suslin Foundation, Faculty of Mathematical Studies, The Pedagogical Institue, u. Michurina 92, Saratov, Russia.

September 4-10 (Oberwolfach, Germany) **Topologie**
Contact MFOG: see (1) below.

September 5-7 (London) **Sixth IMA Conference on the Mathematics of Surfaces**
Contact IMA: see (7) below).

September 5-8 (Stuttgart, Germany) **ECCOMAS - Second European Computational Fluid Dynamics Conference**
Contact S. Wagner, DGLR ECCOMAS 18994 Conference, Grodesberger Allee 70, D-53175 Bonn, Germany.

September 6-8 (Linz, Austria) **International Conference on Parallel Processing**
Contact Siegfried Grabner, University of Linz, Altenbergerstr. 69, A-4040 Linz, Austria.
e-mail: conpor94@gup.uni-linz.ac.at

September 11-17 (Oberwolfach, Germany) **Homotopietheorie**
Contact MFOG: see (1) below.

September 18-20 (Prague, Czech Republic) **Teaching of Mathematics for Industry**
Contact L. Rade, Mathematics Department, Chalmers University of Technology, S-412 96 Gröteborg, Sweden.
e-mail: deml@csearn.bitnet

September 18-24 (Oberwolfach, Germany) **Risk Theory**
Contact MFOG: see (1) below.

September 18-24 (Duisberg, Germany) **DMV-Jahrestagung 1994 (Annual Meeting of the German Mathematical Society)**
Contact W Eberhard, Univ of Duisberg, FB Math, Jahrestagung 94, Lotharstr. 65, D-47048 Duisberg, Germany.
e-mail: eberhard@math.uni-duisberg.de

September 19-21 (Selford, UK) **Quantitative Modelling in the Management of Health Care**
Contact ImMA: see (7) below.

September 19-23 (Marseille, France) 3éme Atalier International de Théorie des Ensembles
Contact CIRM: see (8) below.

September 21-22 (Palermo, Italy) International Symposium on Object-Oriented Methodologies and Systems
Contact F Sorbello, Dipt. di Ingegneria Elettrica, Univ di Palermo, Viale della Scienze, 90128 Palermo, Italy.
e-mail: sorbello@vlsipa.cres.it

September 21-23 (Bitoria-Gasteiz, Spain) **Meeting on Matrix Analysis and its Applications**
Contact J M Garcia, Dept Mathemática Aplicada y Estadistica e I.O., Universidad del Pais Vasco, Apartado 450, E-01080, Vitoria-Gasteiz, Spain.
e-mail: mepgrmej@lg.ehu.es

September 25 - October 1 (Oberwolfach, Germany) **Mathematical Methods in Tomography**
Contact MFOG: see (1) below.

September 26 - October 1 (Trier, Germany) **1st International Workshop on Functional Analysis**
Contact FBIV-Mathematik, Universität Trier, D-54286 Trier, Germany.
e-mail: dierolf@uni-trier.dpe.de

September 29 - October 1 (Gainesville, Florida) **IMA Special Topics Meeting: Generalised Linear Models**
Contact M. Ghosh
e-mail: ghoshm@stat.ufl.edu

October 2-8 (Oberwolfach, Germany) **Randelementenmethoden: Anwendungen and Fehleranalysis**
Contact MFOG: see (1) below.

October 16-22 (Oberwolfach, Germany) **Geometrie**
Contact MFOG: see (1) below.

October 23-29 (Oberwolfach, Germany) **Wahrscheinlichkeitsmasse auf Gruppen und Verwandten Strukturen**
Contact MFOG: see (1) below.

October 30-November 5 (Oberwolfach, Germany) **Finite Volume Methods**
Contact MFOG: see (1) below.

October 31 - November 4 (Delft, The Netherlands) **International Conference on Orthogonality, Moment Problems and Continued Fraction in Honour of Thomas Jan Stieltjes Jr. (1956-94)**
Contact TJS94, Mekelweg 4 (Room H4.11), Department of Pure Mathematics, Delft University of Technology, P O Boc 5031, 2600 Delft, The Netherlands.
e-mail: tjs94@twi.tudelft.nl

November 7-9 (Brighton, UK) ESORICS-94 (**European Symposium on Research in Computer Security**)
Contact IMA: see (7) below.
or e-mail: to Dieter Gollman: dieter@des.rhlonc.ac.uk

November 13-17 (Ithaca, New York **1994 International Symposium on Logic Programming**
Contact V Marek.
e-mail: marek@ms.uky.edu

November 13-19 (Oberwolfach, Germany) **Komplexitätstheorie**
Contact MFOG: see (1) below.

November 20-26 (Oberwolfach, Germany) **Mathematical Aspects of Computational Fluid Dynamics**
Contact MFOG: see (1) below.

November 27 - December 3 (Oberwolfach, Germany) **Mathematical Models for Infectious Diseases**
Contact MFOG: see (1) below.

December 4-10 (Oberwolfach, Germany) **Applied Probability**
Contact MFOG: see (1) below.

December 5-9 (Auckland, New Zealand) **Twentieth Australasian Conference on Combinatorial Mathematics and Combinatorial Computing**
Contact Peter Gibbons, Department of Computer Science, University of Auckland, Private Bag 92019, Auckland, New Zealand.
e-mail: p_gibbons@cs.auckland.ac.nz FAX 0064-9-373757

December 12-14 (Fish Camp, California) **SIAM Conference on Inverse Problems**
Contact SIAM: see (6) below.

December 12-17 (Singapore) **Pacific Rim Geometry Conference**
Contact Roger Chen, Department of Mathematics, National University of Singapore, Singapore 0511.
e-mail: matchen@nusunix.nus.sy

December 14-16 (Oxford) **The Applications of Combinatorial Mathematics**
Contact IMA: see (7) below.

December 18-23 (Oberwolfach, Germany) **Asymptotic Hochdimensionaler Statisticher Modelle**
Contact MFOG: see (1) below.

December 27-31 (Pune, India) **Research Workshop on Analysis of Censored Data**
Contact H L Koul, Dept of Statistics and Probability, Michigan State University, East Lansing, MI 48824, USA.
e-mail: 20974ajt@msu.bitnet

****1995****

(Italy) **Second International Conference on Numerical Methods for Volterra and Delay Equations (A conference to celebrate the 100th anniversary of Volterra's birth.)**
Contact A Feldstein, Dept of Math, Arizona State University, Tempe, Arizona 85287, USA.
January 23-27 (Havana, Cuba) **3rd International Symposium on the Development of Mathematics**
Contact ICIMAF-ACC, Calle 15 No 551, Vedado, La Habana 10400, Cuba.
e-mail: icink@redacc.cu

April 23-25 (Manhattan, Kansas) **Conference on Applied Statistics in Agriculture**
Contact James R Schwenke, Kansas State University, Department of Statistics, Dickens Hall, Manhattan, Kansas 66506-0802, USA.

April 23-26 (Amsterdam) **KvD '95**
Contact Mrs M I van der Kooij, Dept of Applied Math, University of Twente, P O Box 217, 7500 AE Enschede, The Netherlands.
e-mail: mirande@math.utwente.nl

May 11-13 (Daytona Beach, Florida) **1st International Conference on Nonlinear Problems in Aviation and Aerospace 1994**
Contact S Sivasundaram, Department of Mathematics, Embry-Riddle Aeronautical University, 600 S. Clyde Morris Blvd, Daytona Beach, FL 32114, USA.

May 25 - June 5 (Hefei, China) **Summer School and International Conference on Combinatorics**
Contact Associate Professor Ku Tung-Hsin, The Hefei Branch Research Centre of Combinatorial Mathematics and Computer Science, Academic Sinica, P O Box 1110 Hefei, Anhui 230031, China.

July 3-7 (Hobart) **39th Annual Meeting of the Australian Mathematical Society**
Contact Dr Barry Gardner, Department of Mathematics, University of Tasmania, Box 252C, GPO, Hobart, Tasmania 7001, Australia.

July 8-9 (Hobart) **Mathematica in Mathematics Research and Education**
Contact D Fearnley-Sander, Department of Mathematics, University of Tasmania, Hobart, Tasmania 7001, Australia.

July 10-12 (Manchester) **Linear Algebra and its Applications**
Contact IMA: see (7) below.

July 10-13 (Palmerston North) **New Zealand Mathematics Colloquium**
Contact Dr R McKibbin, Department of Mathematics, Massey University, Private Bag, Palmerston North, New Zealand
e-mail: R.McKibbin@massey.ac.nz

July 10-14 (Melbourne) CTAC-94: **7th Biennial Conference of the Computational Mathematics Group**
Contact Associate Professor Alan Easton, Department of Mathematics, Swinburne University of Technology, Hawthorn, Victoria 3122, Australia.
e-mail: ctac94@swin.edu.au

August (Beijing) **International Statistical Institute: 50th Biennial session**
Contact ISI Permanent Office, 428 Princes Beatrixlaan, Postbus 950, NL-2270 AZ Voobury, The Netherlands
e-mail: isi@vs.vu.nl

August 28 - September 1 (Dunedin) **The A C Aitken Centenary Conference (incorporating the 3rd Pacific Statistical Congress and the Annual Meeting of the New Zealand Statistical Association)**
Contact the Aitken Conference Secretary, Department of Mathematics and Statistics, University of Otago, P O Box 56, Dunedin, New Zealand.
e-mail: casm@maths.otago.ac.nz

**** 1996 ****

April 28-30 (Manhattan, Kansas) **Conference on Applied Statistics in Agriculture**
Contact James R Schwenke, Kansas State University, Department of Statistics, Dickens Hall, Manhattan, Kansas 66506-0802, USA.

July 1-5 (Amsterdam) **18th International Biometric Conference**
Contact Paul Koopman, Secretary, Netherlands Region of the Biometric Society
Fax 02940-13906

July 7-12 (Sydney) **Sydney Statistical Meetings**
e-mail: sydney06@syd.dms.csiro.au

Special Contact Addresses:

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

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

(3) **IMA**: Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street S E, Minneapolis, Minnesota 55455, USA.
e-mail: ima-staff@ima.umn.edu

(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.

(6) **SIAM**: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, Pennsylvania 19104-2688, USA.
e-mail: meetings@siam.org

(6) **SIAM**: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, Pennsylvania 19104-2688, USA.
e-mail: meetings@siam.org

(7) **IMA:** Miss Pamela Irving, Conference Officer, The Institute of Mathematics and its Applications, 16 Nelson Street, Southend-on-Sea, Essex SS1 1EF, England.

(8) **CIRM:** Centre International de Rencontres Mathematiques, Case 916, Luminy, 70 Route Leon-Lachamp, 13288 Marseille, Cedex 9, France.

(9) **CRM**: S. Chenevert, Centre de Recherches Mathématiques, Université de Montréal, CP 6128-A, Montréal, Quebec H3C 3J7, Canada.

(10) **FIRMS**: E Reidt, The Fields Institute for Research in Mathematical Sciences, 185 Columbia St West, Waterloo, Ontario N2L 5Z5, Canada.

M R Carter

MATHEMATICAL VISITORS TO NEW ZEALAND

List No. 37 : 1 March 1994

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 .

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.

Professor Glen Anderson; Michigan State U; wife and child; complex analysis; January to July 1994; University of Auckland; A/Prof MK Vamanamurthy.

Mrs Dianne Barrows; EQUALS, University of California, Berkeley; educational equity in mathematics and technology; June to August 1994; University of Auckland; Dr Margaret Morton; Fulbright Visitor.

Professor Adriano Barlotti; University of Firenze, Italy; wife; foundations of geometry; February to April 1994; University of Canterbury; Dr DG Glynn.

Professor Henrik Bresinsky; University of Maine at Orono; algebraic geometry; May to June 1994; Massey University; Prof. Wolfgang Vogel.

Professor John Casti; Santa Fe Institute, Santa Fe New Mexico; dynamical systems; 5 September to 10 October 1994; University of Canterbury; Marty Gimpl (Management) and David Wall (Mathematics).

Dr Philippe Chartier; Universit 82 de Beaulieu, France; wife and children; numerical analysis; September 1993 to September 1994; Auckland University; Prof. J Butcher.

Dr Thomas Forster; University of Cambridge; logic; March to April 1994; University of Canterbury; W Taylor.

Ms Susan Frankenstein; Clarkson University, USA; unaccompanied; polar engineering, oceanography and geophysics; October to December 1994; University of Otago; Professor Vernon Squire.

Dr J Gao; University of Science and Technology of China; unaccompanied; statistics; 1 February 1994 to 31 January 1995; Auckland University; Prof. Seber.

Professor Fred Gehring; University of Michigan; wife; complex analysis; February to May 1994; Auckland University; Dr Martin.

Professor Chris Godsil; University of Waterloo; algebraic combinatorics; March 1994; University of Auckland; Prof. Marston Conder.

Mr Malcolm Hood; University of Western Australia; wife; 28 February to 20 April 1994; applied nonlinear PDEs; Massey University; Prof. Graeme Wake.

Professor Don James; Pennsylvania State University; algebra; January to June 1994; Auckland University; Prof. Lorimer/Dr Morton.

Professor Roy Leipnik; University of Santa Barbara; wife; September 1994 to January 1995; applied mathematics; quantum mechanics and probability; Massey University; Dr Alex McNabb.

Professor W. Light; University of Leicester; wife (Anita); approximation theory, numerical analysis, wavelets; August to October 1994; University of Canterbury; Dr RK Beatson.

Dr Colin Maclachlan; University of Aberdeen, Scotland; accompanied by wife (Dorothy); group theory and topology; February to August 1994; University of Auckland; Prof. Marston Conder.

Professor Michael Plummer; Vanderbilt University; wife; graph theory; 17 March to end of April 1994; University of Otago; Prof. Derek Holton.

Dr Burkard Polster; Universit 84t Erlangen - Nürnberg; incidence geometry; October 1993 to October 1994; University of Canterbury; Dr D.Glynn.

Mary Ellen Rudin; University of Wisconsin; husband (next entry); February to March 1994; topology; Auckland University; Prof. Reilly, Prof. Gauld.

Walter Rudin; University of Wisconsin; wife (previous entry); February to March 1994; complex analysis; Auckland University; Prof Reilly / Prof Gauld.

Dr Chew Seng; National University of Singapore; wife and 2 children; December 1993 to September 1994; integration theory and dynamical systems; Massey University; Prof. Graeme Wake.

Professor Hayley Shen; Clarkson University USA; polar engineering, oceanography and geophysics; October to December 1994; Prof. Vernon Squire; William Evans Fellow.

Professor Takeshi Sugimoto; Saitama Inst. of Technology; 1 April 1993 to 31 May 1994; University of Waikato; Assoc. Prof. Alfred Sneyd.

Professor M. H. Taibleson; Washington University; Analysis; May to August 1994; University of Canterbury; Dr H-Q Bui; Visiting Erskine Fellow.

Professor Roland Thomas; Carleton University, Ottawa, Canada; accompanied by wife and son, statistics; August 1993 to June 1994; University of Auckland; Prof. Alistair Scott.

Professor Rudolf Vyborny; University of Queensland; wife; PDEs and integration theory; 3 September to 15 October 1994; University of Canterbury: N.A. Watson; Visiting Erskine Fellow.

Professor Arnold Zellner; Graduate School of Business, University of Chicago; statistics; June to August 1994; University of Canterbury; Prof. J.J. Deely; Visiting Erskine Fellow.

CONFERENCES IN NEW ZEALAND:

When arranging visits it might be useful to remember the following:

New Zealand Mathematics Colloquium. University of Waikato; 9 to 12 May 1994.
20th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing; University of Auckland; 5 to 9 December 1994.

Please note: Production of these lists is dependent on me receiving information. When you know about a visit (whether it be definite, very likely, or possible), would you please forward the details to me at the earliest convenient time. Thank you.

David Robinson
N.Z. Mathematical Society Visitors' Co-ordinator
Department of Mathematics, University of Canterbury
Private Bag 4800, Christchurch, New Zealand

SECRETARIAL

Notice of Annual General Meeting

The Annual General Meeting of the New Zealand Mathematical Society will be held on Monday 9 May 1994, following the last lecture for the day at the 1994 N.Z. Mathematics Colloquium at the University of Waikato in Hamilton.

Items for the Agenda should be forwarded to the NZMS Secretary, Dr Margaret Morton, Department of Mathematics, University of Auckland, Private Bag 92019, Auckland (FAX (09) 373-7457 or e-mail "nzms@mat.auckland.ac.nz").

Call for Nominations for NZMS Council Positions

As the terms of office of the Outgoing Vice-President (Derek Holton) and two Council members (Margaret Morton and Graham Weir) come to an end in May 1994, nominations are called for the following vacancies on the NZMS Council

Incoming Vice-President
Council members (two).

The term of office of the Incoming Vice-President is one year, at the end of which that person is expected to become President for a two-year period, and then Outgoing Vice-president for a further year. The term of office of a Council member is three years.
Please forward nominations to the NZMS Secretary, Dr Margaret Morton, Department of Mathematics, University of Auckland, Private Bag 92019, Auckland (FAX (09) 373-7457). Nominations should be signed by two proposers and the nominee, all of whom should be current members of the New Zealand Mathematical Society.

Forder Lectureship

The Forder Lectureship was established in 1985 following a bequest to the London Mathematical Society from the late Professor Henry George Forder (Professor of Mathematics at the University of Auckland 1934-55). Under the terms of the Lectureship, every two years a prominent UK mathematician is selected (by the London Mathematical Society in consultation with the NZMS Council) to tour New Zealand for a period of three to four weeks and to give lectures in most NZ universities.

The first Forder Lecturer was Professor Christopher Zeeman in 1987, and was followed by Professor Sir Michael Atiyah in 1989, Professor Peter Whittle in 1991, and Professor Roger Penrose in 1993.

The Forder Lecturer for 1995 will be Professor Elmer Rees, of the University of Edinburgh. Professor Rees is the current holder of the Chair held by Alexander Craig Aitken, the centenary of whose birth in New Zealand will be celebrated in 1995. Further details of the visit by Professor Rees will be given at a later date.

Minutes of the thirty-fourth Council Meeting Monday 15 November 1993

The meeting was held by teleconference and began at 10am.

PRESENT: Rick Beatson, Robert Chan, Marston Conder (Chair), Ernie Kalnins, Mark McGuinness, Margaret Morton, David Smith, Kee Teo.

APOLOGIES: Mike Hendy, Derek Holton, Graham Weir.

Marston welcomed the new Councillors (Rick Beatson, Ernie Kalnins and Mark McGuinness), congratulated Derek Holton on being made a Fellow of the Royal Society, and extended sympathy on behalf of the Council to Adrian Swift on the death of his wife in a car accident.

1. Minutes of the thirty-third council meeting:

The minutes of the previous meeting (held in August 1993) were received and discussed. Matters arising from the minutes:

(a) NZMS Constitution: The amended constitution has been sent to the Justice Department for registration. In the meantime a letter arrived to say the Society had been struck off the Register of Incorporated Societies. This would need to be investigated and corrected.

(b) 1994 NZ Mathematics Colloquium: The organising committee has agreed to distribute grant money available to students who want to attend the conference, in consultation with the NZMS President.

(c) RSNZ: Marston had written to the RSNZ endorsing the change of name of the electoral college to "Mathematical and Information Sciences", and to renominate Graeme Wake as our representative on the Interim Board. His nomination was uncontested and he has been duly re-elected.

(d) Forder Lecturership: The London Mathematical Society was in the process of inviting one of the nominated candidates to take up the Forder Lecturership for 1995.

(e) NZAMT: Margaret Morton attended the executive committee meeting on behalf of the NZMS in August. The NZAMT has decided to separate their executive and conference committees. The executive committee will remain based in Christchurch for the next two years, while the NZAMT95 conference committee will be based in Auckland.

(f) Careers pamphlet: Marston had discussed this with Ingrid Rinsma. The total cost is expected to be about $2200, and this will be shared with the NZ Statistical Association. It was agreed to commit $500 of the total to the design phase. The pamphlet should be ready for distribution in June 1994.

(g) Grantee Reports: After prompting by the Secretary a number of these have been received, and will be published in the December issue of the Newsletter.

2. TREASURER'S REPORT

Kee Teo presented a brief report on the state of the Society's finances. It was agreed that the student travel fund should be made up to $1000 for 1994, and this would be controlled directly by the 1994 NZMS Colloquium committee in consultation with the NZMS Executive. Mark McGuinness has offered to become Treasurer from the end of the year. It was suggested that the auditors continue to be McKenzie McPhail (part of the Peat Marwick group) in Palmerston North. It was moved from the Chair that the Treasurer's report be accepted and the suggested measures be adopted. The motion was carried.

3. NZ JOURNAL OF MATHEMATICS

Council had received a report from the NZJM committee on the current position of the Journal, and a request for an annual commitment of $1000 beyond 1994. This was approved for 1995, with the situation for future years to be reviewed at the May 1995 Council meeting. It was suggested that the NZMS might consider assisting a publicity drive for overseas subscriptions.

4. GRANT REQUESTS

A grant of $250 was approved to assist Irene Pestov to attend the 30th Australasian Applied Mathematics Conference and to take part in the 1994 Mathematics-in-Industry study group. No other applications had been received since the previous Council meeting.

5. 1994 COUNCIL NOMINATIONS

The positions of Incoming Vice President and two Council members become vacant in 1994. Nominations will be called for in the April 1994 Newsletter.

6. OFFICES OF TREASURER, NEWSLETTER EDITOR and PUBLICATIONS CONVENOR

Mark McGuinness has agreed to serve as Treasurer from the end of 1993, and David Smith has indicated he would like to step down as Newsletter Editor. Arms will be gently twisted to fill the two vacant positions.

7. MEMBERSHIP REPORT

A report from the Membership Secretary was received and discussed. John Shanks has offered to continue as Membership Secretary, and a vote of thanks was made to John for his services.

8. NZ MATHEMATICS COLLOQUIUM

A brief discussion was held about a suggestion that the NZMS might take over the financial operation of the Colloquium. It was agreed there appears to be no compelling case to change the status quo, as direct NZMS control would be impractical, and would bring no obvious advantages (especially as the Colloquium has GST exempt status). It was, however, felt that relevant papers from the Colloquium should be sent to the NZMS Secretary so a permanent record could be kept of appropriate procedures. Also it was suggested that closer involvement could come about by representation of the NZMS Council on the Colloquium organising committee. Another suggestion was made that the Society pay directly some of the expenses relevant to the invited speakers (such as internal airfares, accommodation), for GST purposes.

9. NZQA MATHEMATICS ADVISORY GROUP

Derek Holton's position as the NZMS representative on this group was endorsed, and his report was discussed briefly.

10. ACCREDITATION

An article on the proposed accreditation guidelines for the Australian Mathematical Society was circulated. The preliminary impression was favourable, but further discussion on this matter was deferred until the Council meeting in May 1994.

11. CLOSER RELATIONS WITH THE AUSTRALIAN MATHEMATICAL SOCIETY

Marston had previously consulted Council members about this by email. The general feeling was that while a closer relationship was a good idea in principle, the possible amalgamation of the Society newsletters needed further discussion. The matter should also be raised at the AGM to assess the feeling of the membership.

12. GENERAL BUSINESS

The President and Secretary of the NZMS agreed to write to Adrian Swift expressing the Council's condolences.

The meeting closed at 11am.

THE NEW ZEALAND MATHEMATICAL SOCIETY (INC.)

APPLICATION FOR FINANCIAL ASSISTANCE

Please fill in where appropriate

Name of applicant: .....

Address: .....

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Academic affiliation / Official status / Present position:

.....

NZMS status: Ordinary member ..... Student member .....

Other (give details) .....

Signature: ..... Date: .....

Type of assistance sought	Amount
(a) Student Travel Grant	.....
(b) Research Grant: conference/travel/visitors/other	.....
(c) Grant from South Pacific Fund	.....
(d) Conference/Workshop Organisation	.....
(e) Other (please specify below)	.....

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Estimated total expenditure: .....

Other sources of assistance sought/approved (please specify below):

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Please describe your reasons for making this application and the plans you have for spending the grant if your application is successful:

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Please list any supporting documents or other evidence (attached to your application):

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Supporting statement from supervisor or Head of Department (for student applicants only):

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Please send this application (and any supporting documents or other evidence) to:

Dr Margaret Morton, Secretary, N.Z. Mathematical Society,
Department of Mathematics, University of Auckland, Private Bag 92019, Auckland

The NZMS Council normally considers these applications at its meetings in May and November each year, but applications may be considered at other times in exceptional circumstances.

Applications for NZMS financial assistance

The NZMS Council invites applications for financial assistance, in particular for grants from its Student Travel Fund, Research Fund, and South Pacific Fund.

Students who wish to apply for financial assistance to attend the NZ Mathematics Colloquium should contact the organisers of the Colloquium, who have been empowered to distribute funds on behalf of the NZMS. Students who wish to attend other conferences should apply to the NZMS Council using the form which is printed in this issue of the NZMS Newsletter.

Ordinary members of the NZMS may apply for financial assistance with the costs of hosting mathematical visitors, organising conferences or workshops, attending conferences, and any other mathematical research-related activity. They too should apply to the NZMS Council using the form which is printed in the preceding two pages of the Newsletter.

A relatively high priority will be given to applications involving contact between the mathematical communities of New Zealand and the islands of the South Pacific.

The Council normally considers applications at its meetings in May and November each year, but applications may be considered at other times in exceptional circumstances. Completed application forms should be sent to the NZMS Secretary, Dr Margaret Morton, Department of Mathematics, University of Auckland, Private Bag 92019, Auckland.

THE UNIVERSITY OF AUCKLAND

A Lectureship in Applied and Computational Mathematics

Department of Mathematics
School of Mathematical and Information Sciences
(Vacancy UAC.401)

Applicants must have a Doctorate or equivalent and should have a proven record in teaching and research in some branch of Applied and Computational Mathematics. Applications are particularly welcome from candidates with expertise in fields that will strengthen the existing research interests of the Applied and Computational Mathematics Unit. These include differential equations, dynamical systems and bifurcation theory, inverse problems, numerical analysis.

Commencing salary will be established within the range $NZ37,440 - $NZ49,088 per annum.

Further information, Conditions of Appointment and Method of Application, should be obtained from the Academic Appointments Office, Telephone 64-9 373 7999, Extn 5097; Fax 64-9 373 7454. Three copies of applications should be forwarded to reach the Registrar by 20 May 1994.

SOLUTIONS TO CROSSWORD NO. 41

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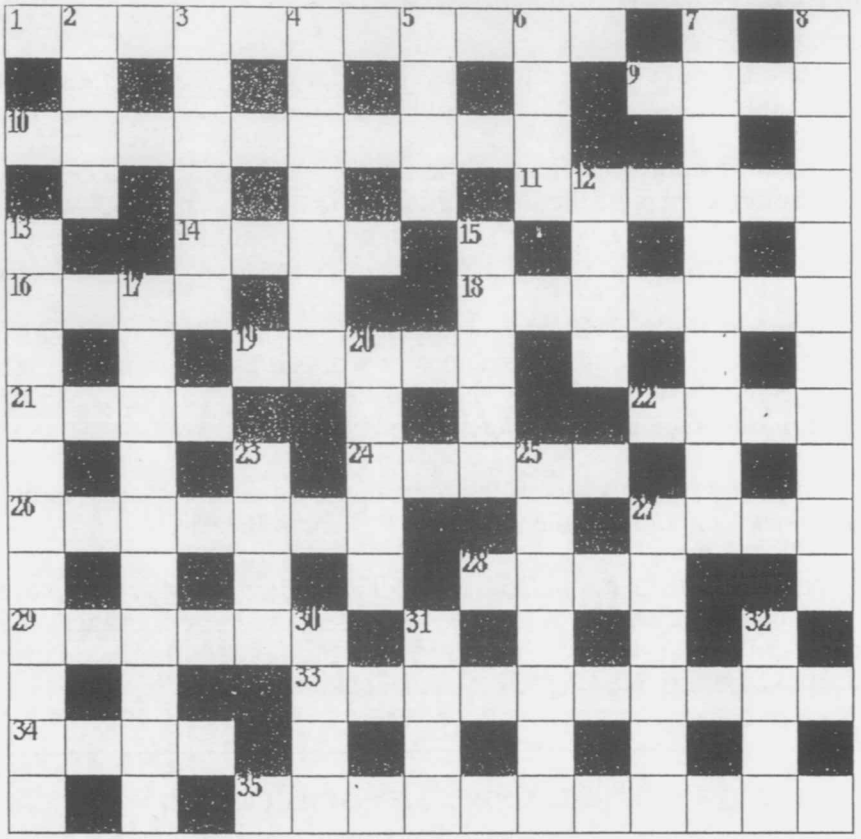
CROSSWORD

by Matt Varnish



ACROSS

1. Dark base done in the 1920's. (11)
9. Step of peace out east. (4)
10 and 27 ac. The bowler's dance? or naval reprimand? (7, 3, 4)
11. Make good (as in the Progressive Barndance?). (6)
14. Part over is the snare and could be with the drums. (4)
16. Dance of the Roman hour. (4)
18. Her type of song is the last word in 35. (7)
19. A 5 in low dish is slow in 4–4. (5)
21. Call for the arrangement of 33. (4)
22. Sort of lean quality of the Dashing White Sergeant? (4)
24. Lixiviate with 50 apiece. (5)
26. Dance article concealed nothing with us, almost a hideous rearrangemnt. (7)
27. See 10 ac.
28. Wedding picture or dance from the shortened Suez for example. (4)
29. Making steps on the green about to flog a tee before the first. (2, 4)
33. Presumably not for squares. (5, 5)
34. Frolic left with musical sign. (4)
35. Cockney's drunk in 3–4 best known in a flat. (6, 5)

DOWN

2. Metal as do the gentlemen. (4)
3. Lute dance from spreading talc around the AA. (6)
4. From Rajasthan forbid the container before the article. (7)
5. Dance skirt double Caesar's penultimate. (4)
6. Umpire's cry comes after 'The Ball'. (4)
7. Black stuff, insect and girl make an antidote for spider bite? (10)
8. Tops the easy way round done at no northern crowned king's hall to make foreign dance. (11)
12. WWII's entertainers from sane ingredients. (4)
13. Brag raised about an hour the girl follows with the northern anglican making folk movement. (6, 5).
15. Not singular directive could be in a brief moment. (5)
17. Perhaps a jogging group but in Appalachia can have 14 figures. (7, 3)
20. Salve treatment for French version of 35. (5)
23. Edible drum sound is half of a dance. (4)
25. Hungarian dance as on the shuffled cards. (7)