THE NEW ZEALAND
MATHEMATICAL SOCIETY (INC.)

NEWSLETTER

CONTENTS

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PUBLISHER'S NOTICE

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

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NZMS COUNCIL AND OFFICERS

NEWSLETTER CORRESPONDENTS

EDITORIAL

REASSURING HEADLINES?

At a time of the year when we were preoccupied with our own student's misperceptions of our subject I read a reassurance in an article published in several metropolitan newspapers under the by-line of NZPA-Reuters. I quote from the Manawatu Evening Standard of October 10 1994:

Aids epidemic unlikely

> Chicago - A new study of sex in the United States has found Americans are far less sexually active than previously thought, and that Aids is unlikely to become a major epidemic.
>
> The study, by the University of Chicago, found sexually active Americans have sex about once a week. But a third of all adults have sex only a few times a year, or not at all. Women typically have only two sexual partners in their lifetime, while men have six, says the study, based on a survey of 3432 people aged 18 to 50.
>
> Researchers also found less than 3 percent of adult males defined themselves as homosexual or bisexual - far less than the 10 percent estimated by Alfred Kinsey in 1948.
>
> The report concluded sexual contacts between people infected with Aids and people uninfected were too infrequent for the disease to spread beyond groups now afflicted. Therefore, it was highly unlikely that there would ever be a heterosexual Aids epidemic in the US".

Despite its headline I found this alarming. Each heterosexual partnership must involve one man and one women. In a closed population with equal numbers of men and women, the number of heterosexual partners of men and of women must be equal. There are a number of possible explanations that come to mind: (1) the population is not closed, i.e. men are seeking partnerships outside the US (sex tourism?); (2) the differences come from homosexual partnerships (if only 3% of men are bi- or homo-sexual, then each would need to average 67 partners to give the 6 partner average); (3) the statistics are badly flawed (in a response to a questionnaire perhaps the men exaggerate, and the women underestimate, the number of their partners); (4) the item is just another of the meaningless inventions of a bored reporter. Whatever the explanation, none of the above are grounds for complacency about the AIDS epidemic. The connection between the number of sexual partnerships and the spread of the virus is not well quantified.

(Incidentally, did many you hear the amusing discussion that Brian Edwards had with Professor Vamanamurthy on his "Top of the morning" programme last month, on why manhole covers are round. After several valid points were put to him by his guest, Edwards finished with the statement "...and of course, a circle is the only shape which could not fall down a hole its own shape, right?"?)

Mike Hendy
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LOCAL NEWS

AgResearch

John Waller, Martin Upsdell and Harold Henderson attended the NZSA/ORSNZ conference at Massey in August. Peter Johnstone and Harold Henderson attended the International Biometric Conference in Hamilton, Ontario, in August. Peter presented a paper on "Effective statistical consulting in agricultural research institutes". Harold also visited the University of Wisconsin, Madison, and Cornell University.

Simon Woodward gave a seminar at Waikato University on 22 September entitled "Dynamical Systems Modelling of Soil Processes for Fertiliser Planning" in which he described the formulation and analysis of a soil nutrient cycling model and showed how the dynamical state equations could be used to calculate maximum profit fertiliser schedules under a constraint on fertiliser expenditure. This optimisation procedure has been coded into AgResearch Software's new fertiliser planning software called "Outlook".

Ken Louie attended the IVth International Workshop on Modelling Nutrient Utilization in Farm Animals, held at the National Institute of Animal Science, Foulum Research Centre, Denmark from Oct. 3-5. He reports that apart from one or two of the (all invited) talks, the general approach taken was that which gives modelling a bad reputation: i.e. vast systems of differential equations as complex as the original system (usually a lactating cow or some part thereof), or some empirical rule-of-thumb elevated to model status. A small group argued for the merit of research models but had a tough time of it. From there he visited the Institute of Grassland and Environmental Research in North Wyke, Devon.

Mick Roberts gave a seminar at Massey University on 13 September entitled "The Mathematics of Parasite Communities". This was later presented in a modified form at the Australian Society for Parasitology Meeting at Nelson Bay, N.S.W. Australia bound for the Genstat conference at Wagga Wagga in November are Peter Johnstone, Roger Littlejohn, David Baird and Dave Saville.

Mick Roberts

UNIVERSITY OF AUCKLAND

SCHOOL OF MATHEMATICAL & INFORMATION SCIENCES

The 20th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing will be held at the University of Auckland (City Campus) from 1994 December 5 to 9. The organizers have planned for the invited talks to cover a range of areas in combinatorics and computing. The Invited Speakers are: Charlie Colbourn (University of Waterloo), Neal Brand (University of Texas), Vaughan Jones (Berkeley), Alex Rosa (McMaster University), Brendan McKay (ANU), Cheryl Praeger (UWA), Ralph Stanton (University of Manitoba) and Paul Bonnington (University of Auckland).

DEPARTMENT OF COMPUTER SCIENCE

At the Ed-Media 94 Conference on educational multimedia and hypermedia held at Vancouver in June, Jennifer Lennon's paper on the use of dynamic abstract symbols as a way of improving computer communication was named as one of the 5 best papers presented.

The Third Joint Auckland/Waikato Colloquium was held on July 4th, with the following papers being presented:

Don Smith, "MultiLog: Data Or-Parallel Logic".
Murray Pearson, "A Highly Parallel Scalable Architecture Based on Timestamping".
Bob Barbour, "National Information Infrastructure".
Ian Witten, "Compressing the Digital Library".
Matt Humphrey, "Evaluating Visualisation Design Expressiveness".
Steve Reeves, "The Calculator Project".
John Grundy, "Collaborative, Integrated Software Development using Multiple Views".
Tony Smith, "Text Generation from Inferred Grammars".
Sally Jo Cunningham, "Who Actually Pays Attention to AI?".

The Hypermedia Unit organized a seminar on Hypermedia Applications in Business and

Medicine, on July 5 and 6. The speakers included: Hermann Maurer (University of Auckland), John Buford (University of Massachusetts), Franz Leberl (Graz Institute of Technology), Janette Wright (Director, NSW State Library), John Tiffin (VUW) and Channa Jayasinha (Museum of New Zealand). At the Seminar Dinner, the guest of honour was (virtually) Marilyn Monroe.

Seminars

John Buford (University of Massachusetts - Lowell), "Directions in Delivery of Multimedia Information in Distributed Systems".

David Skillicorn (Queen's University, Kingston), "Categorical Data Types and General-Purpose Parallel Computation".

Hans Guesgen (Auckland),"On the Relationship between Synthesizing and Tagging"

John Hosking (Auckland), "Cover Your Self with Skin".

Christine Mingins, (Monash University). "Reusable Software Quality Measures".

Jeremy Gibbons (Auckland), "An Algebraic Treatment of Graphs".

Stephen Wray (Auckland), "Pragmatic and Ethical Considerations of Conscious Artificial Systems".

Jennifer Lennon (Auckland), "Extending Work in Visual Languages Using MUSLI: A MUlti-Sensory Language Interface".

Michael Lennon (Auckland), "New Developments in Cryptography".

Mark Titchener (Auckland), "A General Sychronization Mechanism for Variable-Length Codes".

Kenneth McLeod (Auckland), "Functional Languages and their Application in Computer Graphics".

DEPARTMENT OF MATHEMATICS

Professor Graeme Wake, presently Professor of Applied Mathematics at Massey University, has been appointed as the Foundation Professor of Industrial and Applied Mathematics at the University of Auckland. He will take up his position in early September 1995, and will be based at the Tamaki Campus. Dr Geoffrey Nicholls has been appointed as Lecturer in Applied & Computational Mathematics.

The announcement in Newsletter 61 that Dr Sergey Fedorov had been appointed as Lecturer was incorrect: he is continuing here as a post-doctoral Fellow.

Professor David Gauld has been appointed as (interim) Assistant Vice-Chancellor (Research) and Chair of the Research Committee, and so he has relinquished the post of Head of Department.

Associate-Professor Vamanamurthy has been appointed as Acting Head of Department for a year. Professor Glen Anderson (University of Michigan) had been visiting here since January, and he left here on July 20th.

Vaman's 60th birthday was celebrated on July 19th (a few days before the actual anniversary) by a meeting at which Glen Anderson and Professor Ivan Reilly spoke about their fruitful collaboration with Vaman in research, and many other members of the Department spoke briefer tributes to him. He was presented with a copy of Michael Fowler's sketchbook of "The University of Auckland". Gordon Hookings represented the NZ Mathematical Olympiad Committee at the Second Congress of the World Federation of National Mathematics Competitions, at Pravets, Bulgaria, from July 21 to 28. He presented a paper (co-authored by Ivan Reilly) on "Mathematical enhancement by correspondence". At the 35th International Mathematical Olympiad, the NZ team was led by Derek Holton, with Arkadii Slin'ko as deputy.

Professor Marston Conder attended ICM94 at Zürich, and he represented NZ at the IMU meeting at Lucerne. He then took part in a workshop on modular ranks of incidence matrices at the Fields Institute in Waterloo (Ontario) in August. He has been elected to the Editorial Board of "Communications in Algebra", and has been awarded a Claude McCarthy Fellowship. David McIntyre attended ICM94, then attended the Summer Conference on Topology and its Applications at Amsterdam, and then spent a fortnight each in Oxford and Toronto.

Colin Fox has gone to Scott Base, to continue his studies of Antarctic ice.

Professor Boris Pavlov has delivered lectures on "Index of pairs of projections and expansion of resonance states" and on "Splitting of acoustic resonances" at the Semester on Harmonic Analysis at Edinburgh University (July 1994), and on "Splitting of

resonances for domains joined by a thin channel" and on "Spectral properties of quantum billiards in the close-packing limit" (with Kuperin and Mel'nikov) at the Congress of Mathematical Physics at Paris (July 1994). He then visited Athens, to work with Prof. I. Antoniou on a joint paper on "Time operators in Lax-Phillips scattering".

Professor John Butcher took part in a number of overseas conferences from June to September. Those included a meeting in Lafayette, Indiana, in honour of the 65th birthday of Walter Gautschi; the IMACS conference in Atlanta, Georgia; a conference on Numerical Analysis at Miskolc, Hungary; a conference on numerical solution of ODEs in Roccquefort, France; and a conference on Pade' Approximations and Orthogonal Polynomials in Luminy, France.

At the 1994 AGM of the Australian Mathematical Society, held at the University of New England on July 4 to 8, Professor Gaven Martin gave an invited address on "Holomorphic motions, Schottky's Theorem and discrete groups", Tim Marshall contributed a paper on "Spherical simplices and entire functions", and Garry Tee contributed a paper on "Closed walks in graphs". The retiring President, Cheryl Praeger, announced that our Department has invited the AMS to hold here its AGM in 1997, and that invitation was warmly applauded. The members also applauded enthusiastically her announcement that the AMS (supported by the NZMS) hopes to organize the ICM for 2002. Every ICM since the first (in 1893) has been held in the Northern Hemisphere.

Gaven Martin then went to ANU until September.

Norm Levenberg is on leave at the University of Illinois Urbana-Champaign, Indiana University and Universite Paul Sabatier (Toulouse 3).

Recent visitors include: Dr Eric Love (Open University), Prof. Matti Vuorinen (University of Helsinki), A-Prof. Songliang Qiu (Hangzhou Institute of Electronics Engineering), Dr Tadeusz Iwaniec (Syracuse University), Dr Roger Alexander (Iowa State University), Prof. Terry Marsh (Grahamstown University), Prof. Len Bos (University of Calgary), Dr Robert Molzon (University of Kentucky) and Dr Eric Grinberg (Temple University, Philadelphia).

The Aldis Lecture was founded in 1993 by our Department, in honour of our first Professor, William Steadman Aldis. The 2nd Aldis lecture was given by Garry Tee on September 23, on "Professor W. S. Aldis and Education for Women".

At ICM94, Efim Zelmanov (University of Wisconsin) was awarded a Fields Medal for settling the Restricted Burnside Problem (a long-standing conjecture in group theory), using methods from Jordan algebras. He will be visiting our Department in 1995 as a University of Auckland Foundation Fellow, and also as the Sir Henry Cooper Fellow.

Beverly Grove is the new Departmental Assistant.

Seminars

Numerous internal seminars and informal talks have been given by members of the Department of Mathematics, in algebra, analysis, topology, numerical analysis etc. The following visitors have given seminars:

Prof Len Bos (University of Calgary) "Weighted splines and minimum-norm networks".

Dr Robert Gassler (University of Innsbruck), "Numerical integration for nearly integrable systems", and "Whitney conditions and equisingularity".

Dr Robert McLachlan (Massey University), "Numerical integration for nearly integrable systems".

Dr Rick Thomas (University of Leicester), "On the finiteness of groups defined by certain classes of presentations".

Dr Hong Wang (Massey University), "Large independent cycles in a balanced bipartite graph".

Prof Irwin Kra (SUNY - Stonybrook), "Automorphic forms".

Dr J. W. Dold (Bristol University), "Inertial effects in a propagating density jump; the inversion of 'Tulip-Flames' ".

Prof Richard Laugesen (University of Michigan, and Institute for Advanced Studies), "The tennis ball: a homeomorphism of the sphere whose harmonic extension is not injective".

Dr Igor Boglaev (Auckland), "Domain decomposition methods for ODEs and PDEs".

Prof. Dusan Repovs (University of Ljubljana), "A survey of recent results in cohomological dimension theory of compact metric spaces and its applications", and "Cell-like mappings and their applications in geometric topology: a survey".

Prof. Ugo Brozzi (University of Genoa), "Fourier-Mukai transform, instantons and stable bundles on 3 surfaces".

Prof. Tadeusz Iwaniec (Syracuse University), "Quasiconformal mappings and PDEs".

Dr Vladimir Pestov (VUW), "Universal constructions, Banach analytic geometry, and Douady's conjecture".

Dr Oleg Okunev (Moscow), "On Lindelof sets of functions on separable spaces".

HUIA KNOTS & NODES

At Huia Lodge from December 10 to 20, Professor Vaughan Jones will lead the summer school on Knots, and Professor John Butcher will lead the summer school on Nodes (in Numerical Analysis).

Huia Knots

DEPARTMENT OF STATISTICS

Dr Renate Meyer is now a Lecturer. Dr John Petkau (UBC) and Dr Murray Jorgensen (University of Waikato) are visiting.

James Curran has signed a PhD scholarship deal with the Institute of Environmental Science and Research Ltd. His PhD topic is "Forensic applications of Bayesian inference".

Alan Lee and Prof. Alastair Scott have developed a statistical technique for correcting a particular sort of bias in Case-Control studies.

Lovina McMurchy worked on that technique, under their supervision, for her Masters degree project, and at the NZSA conference her account of that project won her the Best Student Paper prize.

Seminars

Dr Malcolm J. Faddy (University of Queensland), "Extended Poisson process modelling of count data".

Dr Robert B. Davies (Wellington), "Integrated and near-integrated processes".

Dr Lakhdar Aggoun (University of Auckland), "Finite-dimensional estimators for discrete-time hidden Markov chains".

Dr Murray Jorgensen (University of Waikato), "Robust standard errors by linearization".

Garry J. Tee

UNIVERSITY OF CANTERBURY

MATHEMATICS AND STATISTICS DEPARTMENT

Our audit review is now completed and released to the public. All in all it went well and the results were much more positive than for another Canterbury department reviewed at the same time. There were some recommendations both to the department and to the University, and questions of implementation now lie before both parties. Recommendations to the University included funding permanent tutors and another computer support person. Recommendations to us included increasing the amount of computing in Stage 1 courses, and attracting more graduate students.

A short list of preferred plans has now been selected for the Science West Precinct, which includes the new mathematics building. The short listed architectural firms have been given detailed comments on their first plans. They will submit improved plans shortly.

Dr James Sneyd and family have now arrived from Los Angeles - after a farewell earthquake or two. James is about to lead us into the brave new world of producing mathematical videos. Hardware decisions are being made as this document is written, and we should be up and writing to tape later this month. This technology seems made for mathematics teaching and research, given enough "free" time to exploit it.

We were fortunate to have another excellent team of stimulating medium term visitors this term including Anne Penfold Street, Will Light, R Vborny and Marciej Paluszynski. Their seminars are listed below but their contributions to the intellectual life of the department go far beyond the seminars.

Seminars

Dr John Hannah, "The 1994 International Mathematical Olympiad in Hong Kong".

Dr Mike Steel, " Linear Functions on Large Trees, and the Lonely Leaves Lemma".

Dr David Wall, "Reconstruction of events in space time -- the solution of an inverse problem".

Prof Philip Maini (Oxford), "Mathematical Modelling of Spatial and Spatial-temporal Patterning in Developmental Biology".

Prof Anne Penfold Street (Queensland), "A Mathematician in Iran".

Prof Anne Penfold Street (Queensland), "Three seminars on Designs and Graphics".

Prof Will Light (Leicester), "Distance matrices, conditionally positive definite functions, variational techniques and approximation by radial functions".

Prof Will Light (Leicester), A series of seminars on " Surface Splines, Error Estimates, and Variational Techniques in Hilbert Space".

Prof G.D.F. Duff (Toronto), "The Canadian Mathematical Society -- The First Fifty Years".

Prof Ronald Christensen (New Mexico), "Testing the Independence Assumption in Linear Models".

Prof R. Vyborny (Queensland), "The Fundamental Theorem of Calculus".

Prof R. Vborny (Queensland), "Applications of Kurzweil-Henstock Integration in Complex Analysis".

Prof Maciej Paluszynski (Wroclau), "The Method of Transference".

Rick Beatson

STOP PRESS

We sadly note the death of Peter Bryant of the Mathematics Department at Canterbury University, in Christchurch on November 25. Our sincere sympathy is extended to Peter's wife and family. His valuable contributions to the Department and the Society will be sorely missed. A fuller statement will be made in the next issue.

MASSEY UNIVERSITY
DEPARTMENT OF MATHEMATICS

Graduate news: Aroon Parshotam, who graduated PhD from the Department in 1992, is now with Landcare Research Ltd. Their move from Taita, Lower Hutt to Massey University has brought Aroon back onto the campus where he is able to maintain regular contact with us while modelling soil carbon turnover and nutrient dynamics. He recently won a British Council Grant which has taken him to the United Kingdom for several weeks to work with modelling groups at Rothamstead Experimental Station and to meet with other such groups in Europe.

After 5 years and 5 days as a mathematics secretary, Ms Fiona Davies has perfected the art of mathematics typing. There is no more to learn from the mathematicians, so it is time to move. From 21 November 1994, Fiona will work at the Department of Physiology and Anatomy. We hope the staff in the Department and the animals give her more inspiration than the 'school' of mathematicians can. Goodbye and good luck, Fiona.

During October-December Professor Graeme Wake is completing his term as a Visiting Fulbright Research Scholar in Claremont, California. The focus of this program is to develop and contrast teaching and research programmes in Industrial Mathematics. He is specially involved in the highly successful Mathematics Clinics at the Claremont Colleges. As a Fulbrighter, he is visiting and giving lectures at many other similar centres which include the University of Minnesota (IMA), University of Iowa at Iowa City, California Institute of Technology, University of Guelph (Canada), University of Maine at Orono, University of Delaware at Newark, Colorado State University at Fort Collins as well as co-organising a Mathematics in Agriculture seminar with AgResearch colleagues at Clay Centre Research Centre, Nebraska for the US Department of Agriculture in early December. In January, Graeme will be one of four invited speakers at a British SERC Workshop on Non-Linear Dynamics Applied to Combustion at the University of Leeds, UK, and is Editor of the Conference Volume which will follow. He returns home in early February after taking up the Presidency of

ANZIAM at the annual conference in Perth, Australia en route.

Dean Halford is acting HoD until Graeme returns.

In November, Alex McNabb, Robert McKibbin and Chris Palliser attended the 16th New Zealand Geothermal Workshop which was held in Auckland. Alex and Robert both presented papers. The theme for this year's workshop was "Improving Models of Geothermal Reservoirs". The hospitality, lunches and dinner were of a high standard and we all enjoyed ourselves.

Bruce Dunning attended the Australian Mathematics Bridging Network Conference in Sydney in July 1994. The conference focussed on the special needs of preliminary, service and first year quantitatively based courses in Tertiary Institutions.

Glenda Anthony has been appointed as Lecturer in Mathematics Education at Palmerston North and will take up duties in January 1995.

Glenda spent an enjoyable day at the Mathematics Advisers' National Conference held at Waikato in September. She presented a paper/workshop related to her current doctoral research, "Learning Strategies in Mathematics Education".

Dr Yow-Tzong Yeh, formerly at the University of Auckland and the Kaohsiung Polytechnic Institute, Taiwan, has been appointed to the Lectureship position at the Albany campus and will commence duties in February 1995.

There has been considerable interest in the newest offering at 100 level "Introduction to Operations Research" available from 1995. This paper should increase the profile of Operations Research for both those intending to major in the area and those from other disciplines. In particular, secondary teachers will be able to apply the principles within the revised maths curriculum framework.

Our seminar series has again been enriched by visitors to the Department.

Seminars at Palmerston North

Dr J W Dold (University of Bristol) "Inertial effects in a propagating density jump; the inversion of 'tulip-flames' ".

Dr E D Davis (Stellenbosch University) "Novel nuclear tests of spacetime symmetries".

Wei Hao (Production Technology, Massey) "Robust low order controller design for uncertain systems".

Mr Shane Dye (Massey) "Hydro-thermal power scheduling".

Mr Mark Johnston (Massey) "Modelling a competitive prize-collecting Travelling Salesman Problem".

Miss Fiona Taylor (Massey) "Modelling aspects of the search-and-rescue problem".

Mr Kelvin H Watson (Massey) "Orthogonal dualisation for the Graph Theoretic Facility Layout Problem".

Hong Wang (Massey) "Triangles in graphs".

Dr Stephen Regoczei (Trent University, Ontario, Canada) "The happy confluence of conceptual and mathematical modelling".

Professor Terrence Marsh (Rhodes University, South Africa) "Socio-political aspects of Mathematics and Science Education in South Africa and strategies for redress".

Dr H Swart (University of Natal, Durban) "Aspects of age-dependent population dynamics", "Some measures of vulnerability of graphs".

Dr Mick Roberts (AgResearch, Wallaceville Animal Research Centre) "The mathematics of parasite communities".

Dr Robert McLachlan (Massey) "Symplectic Geometry 101".

Professor George Duff (University of Toronto) "The Canadian Mathematical Society - the first 50 years".

Professor Wolfgang Vogel (Massey) "On the ICM94".

Professor Roy Leipnik (University of California, Santa Barbara) "Double strange attractors in rigid body motion with linear feedback control", "Multiparameter first and second order perturbations for eigenvalues of simple matrices".

Dr Chikashi Miyazaki (Massey) "Introduction to Buchsbaum rings and spectral sequences".

James Sneyd (University of Canterbury) "Models of calcium wave propagation".

Professor Hubert Flenner (University of Göttingen, Germany) "Introduction to intersection theory".

Professor G R W Quispel (La Trobe University, Australia) "Integrable mappings for the pedestrian".

Robert McKibbin

DEPARTMENT OF STATISTICS

The local mathematicians claim that they really would like to know what we statisticians are up to, so we return to these pages after a long absence.

At the time of writing academic matters are taking second place to genuinely important events, with three babies being produced in as many weeks. The direct departmental involvement extends to the fathers only: congratulations to Richard and Lynn Barker, John and Antoinette Koolaard and Doug and Michelle Timmer. This was also the year of our first grandfather: congratulations to Dick Brook. We must shamefacedly admit to being a male dominated group, but the congratulations list includes Megan Smith, who has just married Tom Pledger.

Five new appointments have been made to the Department in the last 18 months. Denny Meyer and Barry McDonald joined Howard Edwards at Albany a year ago. Most of their work has been service teaching for other faculties this year, but being the resident statisticians on a small campus has made this more varied and challenging than the teaching of multiple streams of introductory statistics to uninterested first year students. In particular, a concentrated 12 week course on research methodology (aka "How to use SAS without really understanding it" - just kidding!) was requested and offered to postgraduate Business Studies students. A full second year program will be taught next year, and they will also supervise graduate and diploma projects along with the rest of us.

Back at home, new appointees Doug Timmer and Mark Bebbington strengthen the applied probability and industrial statistics teaching with third year courses in quality improvement and stochastic operations research. Mhairi McHugh, who has actuarial qualifications, is introducing risk theory as a preparation for Actuarial Institute examinations.

Early in December Steve Haslett will join us as Director of the Applied Statistics Consulting Centre. His first task will be to avoid becoming the Centre.

The rest of us are hoping for a period of consolidation.

Seminars at Palmerston North

Prof Tom Hassard, Univ of Manitoba, "Describing the Invisible Man: The Gap Theory of Service Quality".

Prof Roy Leipnik, Univ of California of Santa Barbara, "On lognormal random variables: I-The characteristic function".

Prof J Templeton, University of Toronto, "On the relations among the distributions at different epochs for the discrete-time GI/Geom/1 queue".

Dr Charles Lawoko, Massey University, "A lay persons guide to neural networks".

Prof Neville Davies, Nottingham-Trent University, "Problem based approach to computer learning in statistics".

Prof Jeff Hunter, "Markovian queues with correlated arrival processes".

Dr Terry Moore, Massey University, "Wavelets".

Dr S Ganesalingam, Massey University, "Statistical discrimination based on absolute values".

Dr Chin Diew Lai, Massey University, "Construction of discrete bivariate distributions".

Prof David Eaves, Simon Fraser Universtiy "Measurement of inter-occasion agreement frequency".

Prof Bill Henderson, University of Adelaide "Networks of queues with signals".

Dr Mark Bebbington, Massey University, "An iterative aggregation/ disaggregation procedure for modelling the long-term behaviour of continuous-time evanescent markov processes".

and at Albany

Dr Barry McDonald, Massey University "Statistical Analyses of Newspaper Readership Data".

Dr S Ganesalingam, Massey University, "Statistical Analyses of Cricket Data".

Greg Arnold

UNIVERSITY OF OTAGO

DEPARTMENT OF MATHEMATICS AND STATISTICS

The news from Otago on this occasion will be even briefer than usual. The brevity is not so much due to a paucity of news but more to the plethora of "due last week" items on this correspondent's desk.

As to be expected, we are currently up to our ears in final exam fever. Consequently, there is a pause in the seminar programs, although these remained active through the second semester. No list attached with this bulletin; maybe next time.

Professor Squire, while preparing to go on leave in 1995 currently has two visitors working with him on sea-ice problems until mid December. They are Professor Hayley Shen and her PhD student Susan Frankenstein from Clarkson University.

In January we are expecting a William Evans Fellow, Professor Kent Fuller from the University of Hawaii at Manoa. Professor Fuller's interests are in Rings and Modules and he will be with us from January to March working primarily with John Clark.

Robert Aldred.

VICTORIA UNIVERSITY

INSTITUTE OF STATISTICS AND OPERATIONS RESEARCH

DEPARTMENT OF MATHEMATICS

Congratulations to Geoff Whittle and Vladimir Pestov who have been promoted over the Senior Lecturer bar, to Rod Downey who has been awarded the NZ Association of Scientists Medal and promoted within the Readers' scale, and to Lindsay Johnston who has been promoted within the Senior Lecturers' scale.

Rod has also been visited by Mike Fellows (University of Victoria, Canada), Richard Shore (Cornell) and Mike Stob (Calvin College, USA) for about 10 days each. Stob gave an entertaining talk on calculus reform in the U.S. and Shore spoke on Konig's duality theorem.

Geoff Whittle will be visiting Louisiana State University for three weeks in late November.

Mark McGuinness is off to five conferences this long vacation (is this a record?): the NZ Geothermal Workshop in Auckland, the Huia Workshop on knots and numerical methods for DEs, the Mathematics in Industry Study Group in Melbourne, the Chaos Workshop in Perth and the ANZIAM conference in Busselton, W.A. Irina Pestov will also be at the first of these, and John Harper at the third and fifth.

John Harper

UNIVERSITY OF WAIKATO

DEPARTMENT OF MATHEMATICS AND STATISTICS, CENTRE FOR APPLIED STATISTICS

Ian Urch has now returned to Australia. Mark Schroder is now in Germany on leave as planned. Murray Jorgensen is on leave, mostly in Auckland (but may sometimes be seen in the Mathematics office here by the curious). Douglas Bridges has been to Brisbane to finish off a long-standing book project with an economist there: the book took 9 years and 108 days from his invitation to be a co-author to its submission to Springer - Garry Tee please note for the record book. He also visited universities in Singapore, Kuching (Sarawak) and Penang on behalf of the School of Computing and Mathematical Sciences. Kevin Broughan spent 4 weeks in the UK on a Claude McCarthy Fellowship and presented a workshop on SENAC in London. He also presented a paper at the High Performance Computing conference in Singapore in September.

The publication of the book "Lattice Methods for Multiple Integration" by Stephen Joe and Ian Sloan was celebrated in late October.

Prof Yves Fautrelle from the University of Grenoble (or more specifically the E.N.S.H.M.G. - Ecole Nationale Superieure d'Hydraulique et de Mecanique de Grenoble) will be visiting us from 1st to 31st December. His specialty is metallurgical applications of MHD. For further details contact Alfred Sneyd.

Planning for semesterisation of our courses is underway without a great deal of enthusiasm. The decision to split into separate departments of Statistics (incorporating WCAS) and Mathematics within the School of Computing and Mathematical Sciences, commencing in 1996 has been supported by the existing Department of Mathematics and Statistics.

Seminars

V. G. Rumchev (Perth) "Spectral Characterisation and pole-assignment for positive linear discrete time systems".

V. Pestov (Victoria) "Universal constructions, Banach Analytic Geometry, and Douady's conjecture".

U. Bruzzo (Genoa) "Looking for a 'good' category of supermanifolds: an axiomatics for supermanifolds modelled over infinite dimensional algebras".

S. Woodward (Whatawhata) "Dynamical systems modelling of soil processes for fertiliser planning".
H. Spenser (Otago) "Modelling the population dynamics of a modifier of genomic imprinting".
S. Puntanen (Tampere) "Matrix tricks for regression diagnostics".

K. A. Broughan

Waikato Centre for Applied Statistics Seminars

Chris Wild (Auckland), "Vector generalised additive models"

Simo Puntanen (Tampere), "Matrix tricks for regression diagnostics"
Russell Boyles (IRL, Wellington), "Case studies in applied statistics from an investment casting operation".
Harold Henderson, "Dynamic statistical graphics and statistical practice"

Dr Lawrence Hogben

Lawrence Hogben, a grandson of George Hogben (Cambridge Wrangler, pioneer seismologist, and the first Director of Education in NZ) studied at Auckland University College, graduating in 1938 as MA with 1st-class Honours in Mathematics. He won a Rhodes Scholarship and a Cook Prize in Mathematics, and went to Oxford. His study there was terminated by World War 2, when he joined the Royal NZ Navy and became the first Naval Instructor to win a DSC in battle.

In 1944 he was one of 6 meteorologists who advised Eisenhower about the weather prospects for D-Day, which was scheduled for 1944 June 5. On June 4, Allied troops boarded the landing craft, but a storm approached the English Channel; whereupon Rommel went home and his generals went on manoeuvres in the night-clubs of Paris. At 4am on the 4th, 2 hours before departure was scheduled, the meteorologists persuaded Eisenhower that the English Channel would be very stormy on the 5th but probably calmer on the 6th, and so he postponed D-Day to June 6. On the night of the 5th, the forecasters considered their prospects of being shot at dawn on the 7th. However, their forecast proved to be accurate, and the Allied forces successfully landed in Normandy on 1944 June 6.

After the War, Lawrence Hogben gained a PhD at Imperial College, and then worked in operational research for Imperial Chemical Industries.

In June 1994, he played a prominent role in the D-Day Commemoration ceremonies. After a banquet with Queen Elizabeth 2nd, President Clinton and other Heads of State, and a moving Drumhead Service on Southsea Common in the presence of Warren Christopher (US Secretary for Foreign Affairs) and Togo West (US Secretary of the Army), James Dalton (Secretary for the US Navy) added one more to Hogben's medals, saying "We are all grateful to you for your historic recommendations". Hogben was also interviewed on the BBC and on French and American television, and featured lengthily in English and French periodicals.

After all that excitement, he has returned to his home in France.

Garry Tee

OBITUARY

Dr Philippe-Auguste Dionne S.J. (1912-1994)

Dr Philippe-Auguste Dionne, a retired member of the Department of Mathematics at the University of Auckland, has died in Paris at the age of 82.

Dr Dionne was born in Quebec in 1912, and he studied at Laval University, Ecole Normale du Sault-en-Recollet, Universite de l'Immaculee-Conception, Columbia University and College de France. He was a member of the Society of Jesus, and was ordained a priest in 1944.

His mathematical research was mostly concerned with applications of functional analysis to hyperbolic equations. In 1970 he was appointed as Senior Lecturer in the Department of Mathematics at the University of Auckland, where he taught courses at Stage 3 and post-graduate level. He was a quietly efficient member of the Department.

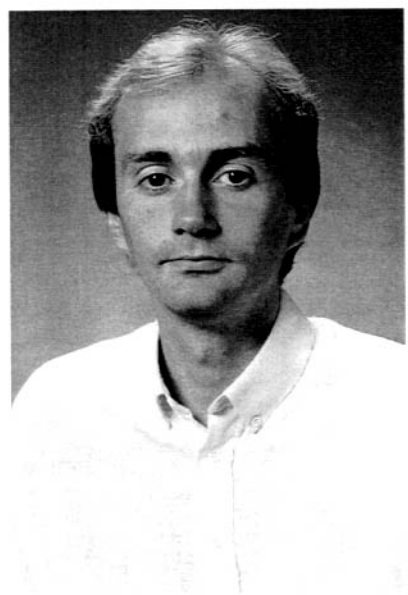
After his retirement at the end of 1977 he gave a half-year course in 1978, and then he retired to a Jesuit College in Paris. His former colleagues at Auckland continued to encounter him at various mathematical conferences, and at ICM90 at Kyoto in 1990 he was photographed with his former student Vaughan Jones, when Vaughan had been awarded the Fields Medal.

Garry Tee

NEW COLLEAGUES

DR CHRISTIAN COLLBERG (aged 33) has taken up a new Lectureship in the Computer Science Department of the University of Auckland. Born in Sweden, Dr Collberg is a graduate of Lund University where he gained a BSc in computer science and numerical analysis, and a PhD in computer science. He has also studied at Tulane University in New Orleans, Louisiana.

Dr Collberg's research interests include compiler and programming language design, distributed systems, computer ethics, and formal aspects of software engineering. His current research focuses on the combination of distributed and incremental algorithms for efficient inter-procedural code optimization, and algorithm animation.



BRIAN EASTWOOD has been appointed to a lectureship in the Department of Statistics at the University of Auckland, beginning in June 1994. Born in Canada, he received his B.Math. degree from the University of Waterloo, and his M.Statistics and PhD in Statistics from North Carolina State University in the USA. After graduating he spent a year at Carleton University as a Statistical Consultant. Then he took up an appointment as a biostatistician in the Faculty of Medicine at Dalhousie University, in Nova Scotia, Canada. He was there for 6 years, except for a 1-year visit to the Department of Mathematics and Statistics at Acadia University, also in Nova Scotia, Canada. His research interests include design and analysis of clinical trials, statistical methods in epidemiological studies, and nonparametric regression.

VERA EASTWOOD has taken up a position as Lecturer in the Department of Statistics at the University of Auckland. Her research interests include nonparametric changepoint problems, extension of Kendall-Kendall pontograms to general point processes, simulations related to these issues and stochastic demography.

Vera grew up in West Germany and attended the University of Marburg (FRG), where she obtained her BDiv, BEd, BSc and MSc degrees. From there she went to work with Professor Miklos Csorgo at Carleton University, Ottawa, Ontario, Canada. In 1988 Vera obtained her PhD degree from Carleton University and continued her career at Acadia University, Wolfville, Nova Scotia, Canada. There she started as an assistant Professor, and was promoted to Associate Professor in 1991, tenured in 1993. Vera's current teaching is centred on probability theory and on service course statistics.

RENATE MEYER has recently taken up an appointment as a Lecturer in the Department of Statistics at the University of Auckland. Born in Germany, Renate studied Mathematics and Computer Science at the University of Bonn and Aachen, and received a Diploma in Mathematics and PhD in Mathematical Statistics from the RWTH Aachen. Her research interests are in Biometrics, Multivariate Analysis, Multidimensional Scaling and Stochastic Optimization.

MATHEMATICS RESEARCH GRADUATES

Doctoral Graduates, 1974- 1993

[An earlier list of NZ research graduates appeared in issue #61.] An annual list of mathematical research students graduating in the previous 12 months is planned for insertion in each August issue of the Newsletter, commencing with issue #61, 1994.]

The information below is set out in the following format: Name; Degree; University; Title; Supervisor(s); date approved; brief description; current position.

Blakeley, Margaret R; PhD; Dept Theoretical and Applied Mechanics, University of Auckland; "Geothermal reservoir modelling"; M.J. O'Sullivan; 1986; Carried out numerical experiments to investigate the interaction between thermal state, hydrology and reservoir properties on the natural state and production behaviour of a geothermal reservoir; Research Fellow, Dept Engineering Science, University of Auckland.

Bogle, M G V; PhD; Dept Theoretical and Applied Mechanics, University of Auckland; "Stochastic optimization of water supply planning"; M.J. O'Sullivan; 1979; A combination of heuristic methods and stochastic dynamic programming was used to find the optimal operating policy for a system of reservoirs together with an alternate source of supply; Engineering consultant, Los Angeles.

Bonnington, C Paul; PhD; Massey University; "Combinatorial maps and the foundations of topographical graph theory"; 1991; Dr Charles Little; Cubic graphs with a proper edge colouring in three colours were used as models for embedding of graphs in surfaces. Theorems about such embeddings were generalised to yield theorems about proper edge colourings of cubic graphs; Paul is a Lecturer in the Department of Mathematics at the Tamaki campus, University of Auckland.

Brookes, Richard G; PhD; University of Canterbury; "The Quadratic Hermite-Pade Approximation, Approximation Theory"; Dr Allan McInnes; 1989, -; -.

Bullivant, David P; PhD; Dept Theoretical and Applied Mechanics, University of Auckland; "Tracer testing of geothermal reservoirs"; M.J. O'Sullivan; 1988; Developed a 2-dimensional flow field model, that can include a large fracture, to explain the results of tracer tests on geothermal reservoirs and applied it to the Wairakei field; Research Fellow, Dept. Engineering Science, University of Auckland.

Burnell, J G; PhD; VUW Mathematics; "A system of non-linear reaction diffusion equations"; Prof G C Wake; 1985; -; Scientist, Industrial Research Ltd., Gracefield.

Campbell, Donald G; PhD; Dept. Theoretical and Applied Mechanics, University of Auckland; "Numerical simulation of pollution problems in rivers and estuaries", M.J. O'Sullivan; 1974; Developed a finite-difference model for tidal flows and temperature pollution in rivers and estuaries; Matrix Applied Computing Ltd.

Christie, Grant W ; PhD; Dept. Theoretical and Applied Mechanics, University of Auckland; "An analysis of the mechanics of bioprosthetic heart valves"; I.M. Medland; 1984; Developed a finite-element analysis of elastic membranes and applied it to heart valves; Consultant, Auckland.

Connolly, T John ; PhD; University of Canterbury; "Nonlinear Methods for Inverse Problems", Numerical Analysis; Dr David Wall; 1990; -; -.

Davidson, Barry J; PhD; Dept. Theoretical and Applied Mechanics, University of Auckland; "A finite element for the elastic stability analysis of frameworks", I.C. Medland; 1976; Developed elastic and geometric stiffness matrices for a beam-column element for use in the linear elastic stability analysis of frameworks; Senior Lecturer, Dept. Civil & Resource Engineering, University of Auckland.

Daynes, Keith; PhD; VUW Mathematics; "Universals as generalized sets"; R I Goldblatt; 1985; -; -.

Dempsey, John P ; PhD; Dept Theoretical and Applied Mechanics, University of Auckland; "On the stress singularities in the plane elasticity of a composite wedge"; G.B. Sinclair; 1983; Complex variable techniques were applied to the title problem; Professor, Clarkson University, Potsdam, N.Y.

Ellerton, Nerida F; PhD; VUW Mathematics; "The development of abstract reasoning in mathematics"; L C Johnston; 1989; -; Senior Lecturer, Education, Deakin University, Australia.

Falkner, Julie C.; PhD; Department of Theoretical and Applied Mechanics; University of Auckland; "Bus crew scheduling and the Set Partitioning Model"; Supervisor D.M. Ryan; 1988; Investigated aspects of the natural integer structure of set partitioning and took advantage of these properties to solve large scale optimization models arising in bus crew scheduling for Christchurch Transport; Lecturer, Massey University.

Gledhill, K M; PhD; VUW Geophysics; "Shear-wave splitting and seismic anisotropy in the Wellington region, New Zealand"; J H Ansell; 1991; -; Scientist, Inst. Geological and Nuclear Sciences, Kelburn.

Guthrie, Graeme A; PhD; University of Canterbury; "Miura Transformations and Symmetry Groups of Differential Equations"; Dr Mark Hickman; 1993, -; -.

Hall, Alistair J.; PhD; Massey University; "Steady size distributions in cell populations"; Professor Graeme C. Wake, Dr Paul W. Gandar; 1991; The analysis of equations which describe the growth of groups of plant cells, with structured cell characteristics such as cell size, shows that the division of cells over a period of time follow a constant shape probability distribution; Alistair is a Scientist with Fruit and Trees Division, HortResearch Ltd, Palmerston North.

Hardley, Christopher J; PhD; Dept Theoretical and Applied Mechanics, University of Auckland; "Optimal cutting of galvanized steel coil: a cutting stock problem"; M.C. Forster & M.S. Rosser; 1978; -; Director, Mainzeal Group Ltd.

Haslett, S J; PhD; VUW Mathematics; "Time series methods and repeated sample surveys"; D Vere-Jones and P J Thomson; 1986; -; Senior Lecturer, ISOR, Victoria University of Wellington.

Horne, Roland N; PhD; Dept. Theoretical and Applied Mechanics, University of Auckland; "Transient effects in geothermal convective systems"; M.J. O'Sullivan; 1975; Employed a finite-difference numerical model to investigate transient effects in geothermal reservoirs, with salinity gradients and fluid withdrawal/recharge considered; Professor, Dept Chemical Engineering, Stanford University.

Jayne, Nicola; PhD; Massey University; "Legendre foliations on contact metric manifolds"; 1992; Dr Gillian Thornley, Dr John Hudson; The thesis develops a canonical contact metric structure for non-degenerate Legendre foliations, introduces a conjugate foliation and semi-Riemannian foliations, and reconciles the definitions of Riemannian foliations; Nicola is a Lecturer in the Centre for Computing and Mathematics at Southern Cross University, Lismore, NSW, Australia.

Jeans, Neville S; PhD; Massey University; "Calculation of fundamental units in some types of quartic number fields"; 1984; Dr Michael D. Hendy, Dr Kee L. Teo; The thesis developed computational tools to calculate a system of fundamental units of most types of algebraic number fields generated by the roots of quartic polynomials; Neville was a Postdoctoral Fellow at the University of Manitoba, then analysed satellite data for P.E.L. (Gracefield), and is now in the private computer industry in Auckland.

Knight, Gordon H; PhD; Massey University; "A Clinical Study of the Mathematical Incompetence of some University Students"; 1982; Dr D M McAlpine; Analysed the difficulties in arithmetic and algebra experienced by 26 interview subjects; Currently Associate Professor, Department of Mathematics, Massey University, Albany.

Krol, Dexter E; PhD; Dept Theoretical and Applied Mechanics, University of Auckland; "Exploitation of geothermal reservoirs"; M.J. O'Sullivan; 1979; Developed a numerical model to simulate geothermal flow, in various thermodynamic states, with reference to the Wairakei and Broadlands fields; Oil industry.

Lay, K S.; PhD; Dept. of Civil Engineering and Dept. of Engineering Science, University of Auckland; "Finite element and boundary element methods of seismic analysis of liquid storage tanks"; P.J. Hunter; 1989; Modal analysis and transient analysis were used with small strain shell finite elements and a boundary element model of the contained fluid to study the seismic behaviour of partially filled liquid storage tanks; University of Singapore.

Le Grice, Ian J; PhD; Dept Engineering Science, University of Auckland; "A finite element model of myocardial structure: Implications for electrical activation in the heart"; P.J. Hunter; 1992; Retarded measurements of the fibrous-sheet structure of myocardium were fitted with a three-dimensional finite element model and used to study the propagation of activation waves through the heart; Dept of Physiology, University of Auckland.

Lee, David M; PhD; Dept Theoretical and Applied Mechanics, University of Auckland; "The effect of base isolation on multistorey shear structures"; I.M. Medland; 1978; Investigated the effect of flexible, bilinear hysteretic supports at the bases of multistorey shear structures in reducing earthquake generated forces; Director, DataSure Management Systems Ltd., Auckland.

Levi, Inessa; PhD; University of Canterbury; "Automorphisms and Range Families of Transformation Semigroups, Functional Analysis"; Dr Graham Wood; 1985; -; -.

Loh, Chee Hoong; PhD; Dept. Theoretical and Applied Mechanics, University of Auckland; "Numerical analysis of cochlea mechanics"; P.J. Hunter; 1982; The spatial discrimination of frequency along the basilar membrane was studied using both finite element and asymptotic analysis techniques; Industry, Kuala Lumpur, Malaysia.

Loi Soh Loi; PhD, University of Canterbury; "Quadratic Approximation and its Application to Acceleration of Convergence, Approximation Theory"; Dr Allan McInnes; 1982; -; -.

Lynn, Robert D. ; PhD; Massey University; "A Comparison of Tree-Based and Traditional Classification Methods";

Associate Professor R J (Dick) Brook; 1994; -; Ministry of Health, Wellington.

Malate, R. Cedric; PhD; Dept Engineering Science, University of Auckland; "Modelling of chemical transport in geothermal reservoirs"; M.J. O'Sullivan; 1991; A problem involving silica transport and deposition in geothermal reservoirs was solved using the method of characteristics; Geothermal engineer, Philippines.

Martin, David M; PhD; Dept Theoretical and Applied Mechanics, University of Auckland; "Solution techniques for the G/G/1 quequeing system at steady state"; A.C. Tsoi; 1979; Laplace transforms and a Wiener-Hopf factorization technique were applied to solve Lindley's integral equation for the G/G/1 quequeing system; Burroughs, UNISYS N.Z. Ltd.

McCulloch, Andrew D; PhD; Dept Theoretical and Applied Mechanics, University of Auckland; "Deformation and stress in the passive heart"; P.J. Hunter; 1986; Finite element deformation elasticity theory was used with finite element techniques to study the mechanics of the heart during passive filling and to compare with experimental measurements of strain; Faculty, University of California San Diego.

McKibbin, Robert; PhD; Dept Theoretical and Applied Mechanics, University of Auckland; "Thermal convection in a layered porous medium"; M.J. O'Sullivan; 1982; Perturbation analysis and finite-amplitude analysis are used to calculate onset criteria and heat flux in a layered porous medium heated from below; Senior Lecturer, Dept of Mathematics, Massey University.

Moore, Christopher I; PhD; Dept. Theoretical and Applied Mechanics, University of Auckland; "An input-output model of Northland's economy: with application to forestry"; M.S. Rosser; 1981; -; Professor of Banking, Massey University.

Morton, R. Hugh; PhD; Massey University; "A Mathematical and Computer Simulation Model of the Running Athlete"; Dr Ron Munford; 1985; -; Associate Professor at Massey University, Palmerston North.

Nielsen, Poul M F; PhD; Dept Theoretical and Applied Mechanics, University of Auckland; "The anatomy of the heart: a finite element model"; P.J.Hunter; 1987; Mathematical representations of the three-dimensional geometry and fibrous structure of the heart were developed using least-squares data fitting of finite element models based on a prolate spheroidal coordinate system; Lecturer, Dept. Engineering Science, University of Auckland.

Parshotam, Aroon; PhD; Massey University; "A mathematical analysis of reaction-diffusion systems in chemical and biological reactors with macro and micro structures"; Professor Graeme C. Wake, Dr Alex McNabb, Prof. Rao Bhamidimarri; 1992; The thesis presented a successful blend of Biological Reactor theory and the mathematics of multi-component diffusion-reaction problems; Scientist with Landcare Research Ltd, first at Taita, Lower Hutt, now at Massey University campus, Palmerston North, where he models soil carbon turnover and nutrient dynamics.

Patterson, Murray G: PhD; Massey University; "Application for Linear Modelling in Energy Analysis"; Professor Mary Earle, Dr John Peet; 1984; -; Presently a Senior Lecturer with the Department of Resource and Environmental Planning, Massey University, Palmerston North.

Price, Christopher J ; PhD; University of Canterbury; "Nonlinear Semi-Infinite Programming, Optimisation"; Dr Ian Coope; 1992; -; Scientist, Defence Scientific Establishment, Auckland.

Pullan, Andrew J; PhD; Dept Theoretical and Applied Mechanics, University of Auckland; "Quasilinearization infiltration and the boundary element method", I.F. Collins; 1988; Developed a boundary element method for analysing the infiltration and seepage in unsaturated soils; Lecturer, Dept Engineering Science, University of Auckland.

Reilly, Ivan L; DSc; VUW Mathematics; Publications [on topology and other branches of mathematics]; -; 1991; -; Professor of Mathematics and Maths. Education, Auckland University.

Renner, R M.; PhD; Victoria University of Wellington Mathematics; "On the resolution of compositional datasets into convex combinations of extreme vectors"; D Vere-Jones; 1989; -; Senior Lecturer, ISOR, Victoria University of Wellington.

Rinsma-Melchert, Ingrid; PhD; University of Canterbury; "Existence Theorems for Floorplans"; Dr David Robinson; 1987; -; Lecturer in Department of Mathematics, University of Waikato.

Robinson, Timothy F; PhD; Dept Theoretical and Applied Mechanics, University of Auckland; "Rectangular stock cutting using optimization"; D.M. Ryan; 1988; Investigated the potential benefits of nonguilllotineable patterns in 2-dimensional stock cutting, and considered automatic column generation of patterns in both optimization and heuristic methods; Logging Research Institute, Rotorua.

Rutherford, J Christopher; PhD; Dept. Theoretical and Applied Mechanics, University of Auckland; "The simulation of water quality in the Waikato and Tarawera rivers"; M.J. O'Sullivan; 1975; A finite-difference model was developed to predict concentrations of oxygen and pollutants in rivers; N.I.W.A.R.

Segedin, Rosemary H; PhD; Dept Theoretical and Applied Mechanics, University of Auckland; "Tensile wrinkling of thin sheets"; I.F. Collins; 1988; Investigated elastic buckling and wrinking occurring in homogeneous tension fields; Tutor, Dept Mathematics and the Learning Resource Center, University of Auckland.

Sharp, Phillip W; PhD; University of Canterbury; "Unsteady Waves on an Open Two layer Fluid"; Dr Peter Bryant; 1983; Fluid Mechanics; -; Lecturer in the Department of Mathematics and Statistics at the University of Auckland.

Sisson, Robert A; PhD; Massey University; "On mathematical modelling of the self-heating of cellulosic materials"; Professor Graeme C. Wake, Mr Adrian Swift; 1991; This thesis analysed the steady states of the spatially uniform model of a reaction-diffusion equation arising in chemical kinetics, and established existence and multiplicity for steady states of the spatially distributed model; -.

Spencer, Susan E ; PhD; Dept Theoretical and Applied Mechanics, University of Auckland; "Analysis of twin tunnels in a gravitating half-space"; I.F. Collins; 1983; Used boundary element techniques to analyse the interaction between two tunnels; New Zealand Steel.

Steel, Michael A ; PhD; Massey University; "Distributions on Bicoloured Evolutionary Trees"; Dr M D Hendy; 1989; The thesis addressed three themes in the reconstruction of evolutionary trees from sequence data - comparison, consistency and confidence intervals - by analysing distributions arising from phylogenetic trees; Senior Lecturer, Department of Mathematics, University of Canterbury.

Stirling, W. Douglas; PhD; Massey University; "General Algorithms based on Least Squares Calculations for Maximum Likelihood Estimation in Multiparameter Models"; Associate Professor R J (Dick) Brook; 1985; -; Senior Lecturer at Massey University.

Thompson, Alan R; PhD; University of Canterbury; "A Census of 3-(12,6,4) and 2-(11,5,4) Designs, Combinatorics"; Dr Derrick Breach; -; -; -.

Townsend, G M; PhD; VUW Mathematics; "Quantum theory and relativity"; C G Grigson; 1983; -; -.

Wang, Yan; PhD; Dept Engineering Science, University of Auckland; "Cavity expansion in sands with applications to cone penetrometer tests"; I.F. Collins; 1991; Used new constitutive theories for sands and similarity techniques to develop new models for the interpretation of in situ testing procedures; Research Officer, Dept. of Mathematics, University of Waikato, and Software development, Electricorp.

Wewala, G Sirimathie (deceased); PhD; Massey University; "Methods of Accounting for Maternal Effects in the Estimation and Prediction of Genetic Parameters" Associate Professor R J (Dick) Brook; 1980; -; -.

Yang, Zhonge; PhD; Dept Engineering Science, University of Auckland; "Numerical simulations of geothermal systems with an unsaturated zone"; M.J. O.Sullivan; 1993; Numerically simulated the effect of topography on a geothermal system with a large unsaturated zone; Research Fellow, University of NSW.

Young, Alistair A; PhD; Dept. Engineering Science, University of Auckland; "Epicardial deformation from coronary cineangiograms"; P.J.Hunter; 1990, Image analysis techniques based on large deformation finite element models were developed to recover epicardial strain from the movement of coronary arteries observed by biplane cineangiography; Department of Anatomy, University of Auckland.

Young, Roger; PhD; Victoria University of Wellington, Department of Mathematics; "The interaction of elastic waves with inhomogeneous media"; J H Ansell; 1985; -; Scientist, Industrial Research Ltd., Gracefield.

BOOK REVIEWS

Recursion Theory, by J. R. Schoenfield, (Lecture Notes in Logic, Vol. 1), Springer-Verlag, Berlin-New York-London, 1993, 84pp, DM 44.00, ISBN 3-540-57093-4.

Recursion theory grew out of the fundamental work of a talented group of logicians including Kleene, Rosser, Church, Turing, and Post in the 1930's. The delineation of the notion of computability and the basic techniques that were developed have had a profound impact on the 20th century; each time you press a button on the workstation on your desk you see the evidence.

Because of this, most computer science departments feel that their students should have some basic training in recursion theory perhaps in conjunction with a course in automata theory. There are many standard texts with such courses. (For example, Salomaar [5], Lewis and Papadimitriou [1], and Hopcroft and Uhlmann [2].) Similarly, one could argue that the notion of computability is so fundamental, so important, and so ubiquitous, that all mathematics graduates should have some basic training in the basics of recursion and complexity theory, in the same way that we would expect them to have seen abstract algebra or general topology. (I will admit some bias here!) Sadly this is not the case, and certainly in New Zealand Mathematics Departments, we find that recursion theory/computability theory courses are usually relegated to graduate courses if they exist at all. Aside from the fact that many of the faculty of mathematics departments themselves are not trained in this area, one reason for this is that most textbooks are either aimed at computer scientist, or they are aimed at graduate level courses and are rather sophisticated. (For example Soare [5], Rogers [4], Odifreddi [3] are all beautiful books but certainly fall into the latter category.)

We have only to look at how our student numbers have grown and see that Discrete Mathematics has rapidly grown, and Computability Theory should be of the same ilk. Moreover our core mathematics students surely should be aware of complexity theoretical and hence recursion theoretical issues as a matter of course, since there is hardly any area of mathematics that has not been revolutionized by the computer.

Because of all this I approached the book by Shoenfield with great expectations. After all, Shoenfield was one of the pioneers of the modern era of classical recursion theory. He invented the infinite injury priority method (Shoenfield [6]), and wrote a classic graduate text (Shoenfield [8]) that revolutionized many arguments in degree theory, and is justly famous for his contributions to Logic such as Shoenfield [9], and his classic Mathematical Logic text [7].

Furthermore this short text is definitely aimed at a 3rd year (or possibly 4th year) one semester course. The good news is that the text has an excellent selection of material modulo the fact that it ignores complexity theory. This would make it okay for computer science students since they will probably pick up the rudiments of complexity theory along the way, but nowadays I would hope that any introductory course on recursion theory should mention complexity theory.

The basic material is all here, enumeration/coding, Church's Thesis, the arithmetical hierarchy, relative recursion, degrees, and recursively enumerable degrees up to the solution of Post's problem, as well as analogues such as the development of the basic analytic hierarchy and the projective hierarchy. All of these topics are given a light treatment. The basic model is the register machine with Kleene recursion mentioned but not primitive recursion. A really nice feature of the book is that it includes applications to word problems such as semigroups, Post correspondence, and undecidable theories.

On the other hand, there are some features I do not like. To begin with, a quibble: reading the author prepared copy makes one realise how nice it is to read TEX (which this is not), and how a well set out document can really invite the reader to read (which this does not). Nowadays with all the fonts available, there is no need to underline etc. Now to matters of more substance. First while there is nothing wrong with using register machines as the basis for defining the class of partial recursive functions, it would definitely be nice to see a

mention of Turing Machines (since they are so standard), particularly in respect of Church's thesis and the evidence for it. Some important terminology is very nonstandard and might be rather confusing since the book is aimed to "prepare the student for studying advanced books and journal articles in recursion theory." Most nonstandard is that while almost all books and articles that I am aware of use recursive function to mean total and recursive and use partial recursive otherwise Shoenfield does not. Moreover, he uses the notation Φ to denote a real whereas in most recursion books/articles if Φ is used at all, it will almost certainly denote a Turing procedure. Similarly instead of using the time-honoured and standard $\leq_T$ for Turing reducibility, Shoenfield uses $\leq_R$. Also he uses the logical but nonstandard name of "parameter theorem" for the s-m-n theorem.

Finally, and to me most importantly, I find the writing to be "over formal" for an elementary course in classical recursion theory. Part of this is the notation such as the explicit use of χ instead of the standard identification of sets with their characteristic function, part of this is the explicit studying of k-ary functions rather than concentrating on unary ones and arguing via analogy and coding, but mainly I feel that it is a philosophical thing that is the difference between, say, calculus and analysis. I find it rather formal for a first course, and personally much prefer the approaches of either Salomaa [5], or Odifreddi [3]. I am happy to admit that there are many who would disagree with me and argue that in a first course the students need to see all the details.

So there it is: on the one hand we have a relatively inexpensive well organized book with all the details spelled out covering an excellent selection of topics. On the other hand, the book uses some nonstandard notation and terminology, and is in my view rather formal in its approach. Certainly, I could see this book quite easily being used as a perfectly satisfactory text, and I for one would not be too unhappy to use it, the above remarks notwithstanding. If you like the style of, for instance Serge Lang's books, you would probably like this one.

References

[1] H. Lewis and C. Papadimitriou, Elements of the Theory of Computation, Prentice-Hall, New Jersey, 1981.

[2] J. Hopcroft and J. Ullmann, Introduction to Automata Theory, Addison-Wesley, Mass., 1979.

[3] P. Odifreddi, Classical Recursion Theory, North-Holland, 1980.

[4] H. Rogers, Jr., Theory of Recursive Functions and Effective Computability, McGraw Hill, New York, 1968.

[5] A. Salomaa, Computation and Automata, Cambridge University Press, Cambridge, 1985.

[6] J. R. Shoenfield, "Undecidable and creative theories," Fund. Math., Vol. 49, (1961), 171-179.

[7] J. R. Shoenfield, Mathematical Logic, Addison-Wesley, Reading, Mass., 1967.

[8] J. R. Shoenfield, Degrees of Unsolvability, North-Holland, Amsterdam, 1971.

[9] J. R. Shoenfield, "Unramified forcing," in Axiomatic Set Theory, (D. Scott, ed.), Amer. Math. Soc., (1971), 357-381.

[10] R. I. Soare, Recursively Enumerable Sets and Degrees, Springer-Verlag, 1987.

R. Downey

George Green, Mathematician and Physicist 1793-1841. The Background to his Life and Work, by D.M. Cannell. The Athlone Press, London & Atlantic Highlands, NJ, 1993, xxvi + 265 pages, £35.00. ISBN 0 485 11433.

The life of George Green (1793-1841) was one of the strangest of any great mathematician. It can be compared and contrasted only with the life of his younger contemporary Évariste Galois. But whereas there is substantial documentation for the tragically brief life of Galois, Green (who lived more than twice as long as Galois) is shrouded in silence and obscurity. The life of Galois should have inspired Hector Berlioz to compose a tragic opera, but the very scanty

data about Green could have inspired a brief elegy by Anton Webern.

The mathematician's father George Green senior (1758-1829) was a prosperous baker and miller, who built some of the worst of the slums which rapidly converted Nottingham from a pleasant county town into one of the foulest industrial cities in Great Britain. George Green junior was born in Nottingham on 1793 July 14th, and at the age of 7 he was enrolled at Robert Goodacre's Academy in Nottingham. A cousin later explained that "his schoolmasters soon perceiving his strong inclination for and profound knowledge in the mathematics and which far transcended their own, relinquished the direction of his studies", and so young George finished school after 4 terms and started working for his father, at the age of 9. In 1807 his father bought land at Sneinton, a village about 1·6km from Nottingham, and there he built a substantial windmill. The future mathematician was assigned to the arduous occupation of a miller, a laborious trade which rarely stimulated any intellectual interests.

In England, mathematics was dead. At Cambridge University, those students who had intellectual interests competed fiercely in the Mathematical Tripos examination; but the dons contented themselves with worshipping Isaac Newton, without taking the trouble to understand his mathematics. Mathematics was flourishing mightily in Europe, using Leibniz's version of the calculus rather than Newton's, and so the Cambridge dons disdained to pay attention to it. Hardly anyone in England could even read the works of Euler, Laplace, Lagrange, Legendre, Poisson and Fourier.

Some students at Cambridge were dismayed by the abysmal state of mathematics in England, and so in 1812 the Analytical Society of Cambridge was founded by Charles Babbage, John Herschel, Augustus De Morgan, George Peacock, Edward ffrench Bromhead and others, to revive mathematics in England. The dons denounced those impudent young rebels for seeking to destroy everything that Cambridge stood for – which was quite accurate. A constitution for the Analytical Society of Cambridge was belatedly drawn up at a meeting at Bromhead's home in Thurlby, Lincolnshire, in 1817; but by then the Society had accomplished its objectives, and it was succeeded in 1819 by the Cambridge Philosophical Society. Leibniz's version of the calculus was accepted at Cambridge by 1819, and mathematics began to revive in England.

In 1823 George Green joined Nottingham Subscription Library, a society of the local intelligentsia with a good "gentleman's library", which included a few mathematical works.

And then in 1828 George Green, a 36-year-old working miller, published by subscription his epoch-making monograph *An Essay on the Application of Mathematical Analysis to the Theories of Electricity and Magnetism.* Fifty-one copies were subscribed for, with 26 of the subscribers being members of the Nottingham Subscription Library or of its associated literary society. That booklet founded modern mathematical physics, advancing the mathematical theory of electricity and magnetism beyond the stage reached by Poisson, Gauss, Ostrogradskii and Ampère. Green named the potential function, he proved Green's Theorem and he introduced Green's functions. In the Preface, Green explained that "After I had composed the following Essay, I naturally felt anxious to become acquainted with what had been effected by former writers on the same subject", and he briefly discussed some writings of Cavendish, Poisson, Laplace, Fourier and Cauchy.

The publication seemed initially to be a total failure, understood by nobody. But Edward ffrench Bromhead had subscribed, and he read the *Essay* and appreciated it. He wrote a highly encouraging letter to Green, offering to arrange for further studies by Green to be published by the Royal Societies of London or Edinburgh. George Green's father died in 1829, and he did not respond to Bromhead's letter until 1830. After his father's death Green was able to give up his work as a miller. He leased the Sneinton windmill, and dedicated himself to advancing his mathematical researches. Green wrote 9 further papers on mathematical physics, which were published in the *Transactions of the Cambridge Philosophical Society* from 1832 to 1839, with Bromhead communicating 2 of those papers. Green's *Essay* remains his major work; but those 9 papers contain much important material, including propagation of light in anisotropic crystals, vibrations in viscous fluids, the first paper on n-dimensional Euclidean space, and the first paper on solitons.

In 1833 Green matriculated at Gonville and Caius College, at the age of 40. He had read

much mathematics in French, but at Cambridge he had to devote 2 years to acquiring those rudiments of Latin and Greek which were required of undergraduates. Green's friends expected him to become Senior Wrangler in 1837, but in those circumstances he gained 4th place. Nonetheless, in 1837 he was elected a Fellow of the Cambridge Philosophical Society, and in 1839 he was belatedly elected a Fellow of Gonville and Caius College. But after only 2 terms in residence as a Fellow, Green's failing health required him to leave Cambridge in 1840 and return to Nottingham, where he died at the age of 47, on May 31st, 1841.

Robert Murphy, a colleague of Green at Gonville and Caius College, briefly mentioned Green's *Essay* in a paper in 1833. William Thomson (later Baron Kelvin) searched extensively for that *Essay*, and in January 1845 he finally found a copy. He took it to Paris, where Sturm, Liouville and Chasles were astonished and delighted by it. Green's *Essay* was reprinted in Crelle's *Journal* (1850, 1852, 1854), and Green's collected works were published in 1871. William Thomson and George Gabriel Stokes repeatedly praised Green's work, and by 1900 Green was recognized as the founder of the 'Cambridge School' of mathematical physics. And Green's functions remain fundamental in much of modern physics, including Quantum Electro Dynamics and solid-state physics.

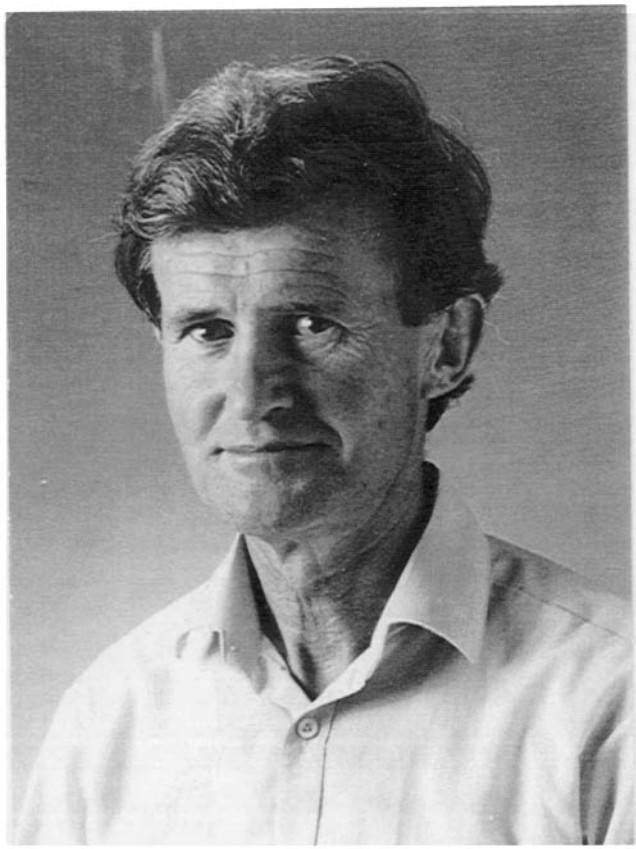
But what of George Green the man? In Nottingham he was almost totally forgotten soon after his death. Almost nothing about him got published before 1945, apart from the bare statement that he was self-educated and had written his great *Essay* whilst labouring at uncongenial employment. Green had been elected a Fellow, and hence he was not married. But enquirers about Green, from William Thomson onwards, encountered the awkward fact that Green had made careful provision in his Will for his 7 children, and for their mother. His youngest daughter Clara (1840-1919) lived on the rent from the frightful slums built by her grandfather, until she died at the age of 78. Some neighbours burnt the rubbish left in her house, which appears to have included her father's papers. The Crown then sold the estate of "Clara Green otherwise Clara Green Smith ...a spinster and a bastard", to pay part of her debts. Since Clara Green died in 1919, several members of Nottingham University have made extensive researches into the life of George Green. Green's will and his letters to Bromhead are almost the only personal documents which have been found, apart from a few municipal records relating to his mill and property. It seemed that Clara had been the last descendant of George Green. But Dr J. M. Rollett discovered recently that Green's eldest daughter Jane Green (1824-1900) had married Frederick Moth, and that their son George Green Moth has left many descendants.

In 1985 the City of Nottingham opened the George Green Science Centre at Sneinton, with Green's windmill restored to operation; and that has become a major attraction for visitors. In 1993 the bicentenary of Green's birth was celebrated in Nottingham, with descendants of Green coming from various places in the U.K., Canada and Australia. Conferences were devoted to the life and work of Green, and Nottingham University bestowed honorary degrees on Julian Schwinger and Freeman Dyson, both of whom have emphasized the importance of Green's functions in their physics research. Gonville and Caius College installed a window in honour of Green in the College Hall, and a plaque honouring George Green was dedicated in Westminster Abbey.

This book has been well-produced, with only a few misprints. Green's schoolmaster Robert Goodacre is said to have been born in 1877 (p.19), the English Revolution of 1688 is mis-dated to 1669 (p.33); and Clara Green's grave was discovered in 1989, which was 70 years after her death and not 80 years (p.135). Cauchy is wrongly said to have "published no major work in book form" (p.31). The collected edition of Green's works is described (p.149) as "*Mathematical Papers of George Green*, edited by Norman Ferrers and published by Gonville and Caius College". Rather, Ferrers edited Green's works at the request of the Master and Fellows of Gonville and Caius College, and *Mathematical Papers of the Late George Green* was published by Macmillan and Co; London, 1871.

Charles Babbage named his eldest son Benjamin Herschel Babbage in honour of his Analytical friend John Herschel, and he asked Bromhead to become godfather to a later son. There is a puzzling passage telling that "Bromhead was happy that his Christian name would be chosen, for 'indeed there is a dreadful want of euphony in "Bromhead Babbage".' " (p.65). In fact, Charles Babbage did name his youngest son (born in 1825) as Dugald Bromhead Babbage, in

CENTREFOLD



Brian Woods

Brian retired on 31 January 1994 after 24 years as Professor of Engineering Mathematics at the University of Canterbury. He was President of the New Zealand Mathematical Society in 1988--89. Brian applied in 1969 for the Chair in Mechanical Engineering, for which the University had another very able applicant, so in the sort of operation done at that time Brian was installed in a vacant Chair in Mathematics and given responsibility for Engineering Mathematics. These responsibilities have now been returned to the Chair in Applied Mathematics, which means that he may have been Canterbury's one and only Professor of Engineering Mathematics.

Brian grew up in Southland, being a boarder with his twin brother at Waitaki Boys High School, Oamaru, when boys were made men with cold showers in the morning and beds on open balconies in mid-winter. After an Intermediate year at Otago, he came to the School of Engineering at Canterbury to do a degree in Mechanical Engineering, specialising in aeronautics. He joined the RNZAF in the Defence Science Corps and was sent by them to the College of Aeronautics, Cranfield, followed by secondment to the Royal Aircraft Establishment, Farnborough. He spent four years as a lecturer in Applied Mathematics at Leeds before returning to Canterbury.

His research interest at that time was in supersonic flight, where he found some nice solutions for the supersonic flow around a delta-wing. The decreasing importance of supersonic flow theory eventually led him to retool at the opposite end of the fluid mechanics spectrum, studying lava flows from volcanoes. His skill in mathematical techniques was evident in some interesting solutions for the creeping flow of lava, but these became entwined with experiments which were not entirely successful and unfortunately may never appear in print.

Brian had an important role in our department for many years as the buffer between Gordon Petersen and the real world. He became well-practised at moderating Gordon's more extreme ideas and continues to visit Gordon in his unhappy bed-ridden decline. He was the Department's social manager, arranging functions and providing hospitality for visiting Poles from Papua New Guinea and others.

His skill at handling people led to a number of important appointments or elections at Canterbury, including Dean of Science, President of the AUT, President of the Staff Club, University Mediator, and election to the University Council. When we were each told to select a mentor, a large number of the Department chose Brian, which is a measure of the important role he played in the Department. We wish him well in his retirement, which already has included a trip to Canada to visit friends and relatives. At the present time he is taking maximum advantage of this year's extended ski season.

Peter Bryant

honour of his Analytical friend Edward Bromhead.

The minutes for the meeting at Bromhead's home at Thurlby Hall, Lincolnshire, on 1817 December 20, at which a constitution for the Analytical Society of Cambridge was adopted, contain the intriguing statement that

"The Green M.S. being read it was unanimously resolved

1. That the Business of this Society shall for the future be transacted in London ...

2. That Charles Babbage ... shall be Secretary".

(cf. J. M. Dubbey, *The Mathematical Work of Charles Babbage*, Cambridge University Press, 1978, page 48). Babbage's very extensive acquaintance did not include anyone prominent named Green. Could "The Green M.S." have been an early mathematical paper by George Green? In 1828 Bromhead subscribed to Green's *Essay*, and on 1828 April 20 he wrote a highly encouraging letter to Green, offering to arrange for any further works by Green to be published by the Royal Societies of London or Edinburgh (p.67). But, around the same time Bromhead wrote to the Director of Lincoln Asylum (!) seeking information about George Green (p.68). What could "The Green M.S." of 1817 have been?

When Auckland University College was founded in 1883, Gonville and Caius College presented a copy of the 1871 edition of the works of Green, inscribed "from Gonville and Caius College". Auckland University College founded its Library in 1893, and the Science Library of the University of Auckland now holds that presentation copy of Mathematical Papers of the Late George Green.

Garry J. Tee

Theory of function spaces II, by Hans Triebel. Monographs in Mathematics, Vol. 84, Birkhäuser Verlag, 1991, 380pp, DM 188. ISBN 3-7643-2639-5.

Various function spaces have made their appearance in different branches of analysis; for example, Hölder-Zygmund spaces in approximation theory and PDE, Hardy spaces in harmonic analysis, Sobolev spaces in PDE. Their study has been partly motivated by and mainly aimed at applications in these fields. However, since the early 1960's, there have been attempts to unify the treatments of the above and other function spaces. The most successful approach in this direction is probably via the Littlewood-Paley theory, which was used by Littlewood and Paley in the study of Fourier series and analytic functions in the unit disc, and which was extended to the n-dimensional setting by Stein and his school (see e.g., [9]).

In this theory, properties of a function, such as size, smoothness, are characterized by various Littlewood-Paley functions. An example of such a function is the following function $g_1(f)$. Let $f \in L^p(\mathbf{R}^n)$, $1 \le p \le \infty$, and $P_t(x) = c_n t(t^2 + |x|^2)^{-(n+1)/2}$ be the Poisson kernel on $\mathbf{R}^{n+1}_+$. Define

$$g_1(f)(x) = \left(\int_0^\infty |t \frac{\partial u}{\partial t}(x,t)|^2 \frac{dt}{t} \right)^{1/2},$$

where

$$u(x,t) = P_t * f(x).$$

Then

$$\|f\|_p \approx \|g_1(f)\|_p \qquad (1)$$

for $1 < p < \infty$. (See again [9] for other variants of $g_1(f)$.) On the other hand, if $0 < \alpha < 1$ and f is in $L^\infty(\mathbf{R}^n)$, then

$$\sup_{x \neq y} \frac{|f(x) - f(y)|}{|x - y|^\alpha} < \infty \qquad (2)$$

if and only if

$$\sup_{t>0} t^{-\alpha} \| t \frac{\partial u}{\partial t}(\cdot, t) \|_\infty < \infty. \tag{3}$$

Generalizing (2), mathematicians in the (former) Soviet Union (Nikolskij, Besov, ...) defined the Besov(-Lipschitz) space $B^\alpha_{p,q}$. For example, if $0 < \alpha < 1$ and $1 \le p, q \le \infty$, then

$$B^\alpha_{p.q} = \left\{ f : \| f \|_{B^\alpha_{p,q}} = \| f \|_p + \left(\int_{\mathbf{R}^n} \left(\frac{\| f(\cdot + h) - f \|_p}{|h|^\alpha} \right)^q \frac{dh}{|h|^n} \right)^{1/q} < \infty \right\}. \tag{4}$$

The fact that $B^\alpha_{p.q}$ has a Littlewood-Paley characterization of the type (3) was due to Taibleson [10] who also considered the Gaussian kernel $W_t(x) = (4\pi t)^{-n/2} e^{-|x|^2/4t}$.

Note that if we let $\hat{\phi}(\xi) = -|\xi| e^{-|\xi|}$, then $t \frac{\partial u}{\partial t}(x,t) = \phi_t * f(x)$, where $\phi_t(x) = t^{-n}\phi(x/t)$. Influenced partly by the work of Hörmander (in PDE) in the case $p = q = 2$, Peetre [6] considered the "discrete" version of $\phi_t * f$ for a large class of functions ϕ for which $\hat{\phi}$ has compact support. In particular, if $\phi \in S(\mathbf{R}^n)$ is such that supp $\hat{\phi} \subseteq \{1/2 \le |\xi| \le 2\}$, $\sum_{j=-\infty}^{\infty} \hat{\phi}(2^{-j}\xi) = 1 \quad \forall \xi \ne 0$, $\Phi \in S(\mathbf{R}^n)$ with

$$\hat{\Phi}(\xi) + \sum_{j=1}^{\infty} \hat{\phi}(2^{-j}\xi) = 1 \quad \forall \xi, \text{ and } \hat{\phi}_j(\xi) = \hat{\phi}(2^{-j}\xi), \ j = 1, 2, \ldots,$$

then Peetre proved that

$$\| f \|_{B^\alpha_{p,q}} \approx \| \Phi * f \|_p + \left(\sum_{j=1}^{\infty} \left(2^{j\alpha} \| \phi_j * f \|_p \right)^q \right)^{1/q} \tag{5}$$

for $1 \le p, q \le \infty$, $-\infty < \alpha < \infty$.

Motivated by the above characterization of $B^\alpha_{p,q}$ by Peetre, and by reversing the order of the summation and the integration in (5), Triebel [11] defined the Triebel-Lizorkin space

$$F^\alpha_{p,q} = \left\{ f \in S'(\mathbf{R}^n) : \| f \|_{F^\alpha_{p,q}} = \| \Phi * f \|_p + \left\| \left(\sum_{j=1}^{\infty} \left(2^{j\alpha} | \phi_j * f | \right)^q \right)^{1/q} \right\|_p < \infty \right\} \tag{6}$$

where $1 < p, q < \infty$, $-\infty < \alpha < \infty$. (This space was also independently introduced by Lizorkin by using a different decomposition.) The scale of function spaces defined by (6) contains the Sobolev spaces and potential spaces as special cases. After the fundamental work by Fefferman and Stein on the Hardy space H^p [3], Peetre [7,8] extended the definitions of the spaces in (5) and (6) to the whole range $0 < p, q \le \infty$ (with $0 < p < \infty$ in (6)). These two scales of function spaces and their homogeneous counterparts (spaces denoted with a dot) contain most function spaces used in analysis. In particular, $\dot{F}^0_{p.2} = H^p$ (mod. polynomials).

An advantage of the definitions in (5) and (6) is that each $\phi_j * f$ is an entire function of exponential type, a fact which is important in the case $0 < p \le 1$. Also the decomposition $f = \Phi * f + \sum_{j=1}^{\infty} \phi_j * f$ stimulates later works by Frazier and Jawerth [4] on atomic decompositions and ϕ-transforms, and, to a certain extent, the wavelet theory (see [5] for a nice account of these developments). On the other hand, for many interesting functions ϕ, such as derivatives of the Poisson kernel or the Gaussian kernel, $\hat{\phi}$ does not have compact support. Nevertheless, the characterizations of the function spaces in (5) and (6) via these kernels were obtained by Peetre, Triebel, and the reviewer (see [1]). This raises the question of what conditions should one impose on ϕ so that the corresponding norms in (5) and (6) or their continuous

counterparts are equivalent to the original ones. This question is dealt with extensively in Triebel's new book (chapter 2), though the answer is still incomplete, and this is perhaps the most significant open problem in the area.

The book under review, which could be subtitled "Littlewood-Paley theory and the theory of function spaces", is partly an updated version and partly a continuation of the author's earlier monograph [12]. The author is an authority in the field of function space theory and has made many important contributions to the subject; he also wrote two other books on function spaces (one of them jointly with Schmeisser). The new book is written in a more leisurely style. It begins with chapter 1, a survey of the main results presented in the book with remarks on the historical development. This chapter is an excellent introduction to function spaces and will be valuable to non-specialists who want to see an overview of the subject. In chapter 2, the author defines the Besov and Triebel-Lizorkin spaces using the discrete decomposition in (5) and (6), and then proceeds to give equivalent "norms" on these spaces via a large class of kernels ϕ (for which $\hat{\phi}$ does not necessarily have compact support); this chapter largely follows the author's paper [13]. Chapter 3 is devoted to the atomic decompositions of these spaces as well as characterizations of Campanato type. This chapter and chapter 2 give the technical tools necessary to simplify proofs of known results (already in [12]) and/or to prove new results in this book in chapters 4, 5 and 6. These latter chapters cover: key theorems on pointwise multipliers, diffeomorphisms, traces; spaces on domains, extension problems; and boundedness of pseudo-differential operators. The final chapter, chapter 7, is devoted to spaces on Riemannian manifolds and Lie groups, in which the tools developed in chapters 2 and 4 are crucial. Here, interestingly, the space $F^{\alpha}_{p,q}(M)$ is defined first, and the scale of spaces $B^{\alpha}_{p,q}(M)$ is then obtained via real interpolation. The book provides a substantial and up-to-date list of references, including many works in the Russian literature.

In conclusion, "Theory of Function Spaces II" is a very well-written book. It will be of interest to harmonic analysts, function space theorists, as well as to non-specialists wishing to have an overview of the subject. It will be also useful to people wanting to use function spaces in other fields, e.g., PDE, approximation theory.

[For the non-specialists: There are a couple of misprints in the introductory chapter 1.

page 37 line $\uparrow$ 9 $\| a \,|A_0 \cap A_1\| + \| a \,|A_0\| + \| a \,|A_1\|$
should read $\| a \,|A_0 \cap A_1\| = \| a \,|A_0\| + \| a \,|A_1\|$

page 46 last line $\sup_{|Q|=1} \int_Q |f(x)|dx$
should read $\sup_{|Q|>1} \frac{1}{Q} \int_Q |f(x)|dx$.]

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[11] H. Triebel, Spaces of distributions of Besov type on Euclidean n-space. Duality, interpolation, Ark. Mat. 11(1973), 13-64.
[12] H. Triebel, Theory of function spaces, Birkhäuser, Basel, Boston, 1983.
[13] H. Triebel, Characterizations of Besov-Hardy-Sobolev spaces: A unified approach, J. Approx. Theory 52(1988), 162-203.

CONFERENCES

**** 1995 ****

February 5 - 9 (Busselton, Western Australia) **31st Applied Mathematics Conference (ANZIAM '95)**
Contact ANZIAM '95, Department of Mathematics, University of Western Australia, Nedlands, WA 6009, Australia
e-mail: anziam@maths.awa.edu.au

April 19 - 23 (Clayton, Victoria) **ICMI Regional Conference: Regional Collaboration in Mathematics Education**
Contact Conference Secretariat, 144 Jolimont Road, East Melbourne, Victoria 3002, Australia.

May 29 - June 1 (Brunei Darussalam) **International Conference on Mathematical Modelling (Physical, Biological, Engineering and Social Systems)**
Contact the Organising Secretary, International Conference on Mathematical Modelling 1995, Department of Mathematics, Universiti Brunei Darussalam, Gadong 3186, Brunei Darussalam.

June 19 - 23 (Singapore) **23rd Conference on Stochastic Processes and their Applications**
Contact Louis Chen, Department of Mathematics, National University of Singapore, Lower Kent Ridge Road, Singapore 0511, Republic of Singapore.
3-mail: matspa95@leonis.nus.sg

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 - 14 (Melbourne) CTAC-95: **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: ctac95@swin.edu.au

August 28 - September 1 (Dunedin) **The A C Aitken Centenary Conference (incorporating the 3rd Pacific Statistical Congress, the 1995 New Zealand Mathematics Colloquium 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

Registrations will be accepted at a reduced fee ($150) (without the Proceedings) for Tuesday-Thursday for the NZ Maths Colloquium only, or Wednesday-Friday for the NZSA conference only. There will also be an Education day (Monday) for which the committee still has to set the fee. The $300 fee still stands for the whole 5-day conference.

November 19 - 22 (Bahrain) **International Conference on Pure and Applied Mathematics**
Contact Professor A Q M Khaliq, Conference Secretary - ICPAM95, Department of Mathematics, University of Bahrain, P O Box 32038, Isa Town, Bahrain.
e-mail: ICPAM95@isa.cc.uob.bh

**** 1996 ****

February 4 - 8 (Masterton, New Zealand) **32nd Australian Applied Mathematics Conference (AMC 96, also referred to as ANZIAM 96)**
Contact Professor Graeme Wake, Department of Mathematics, Massey University, Private Bag 11222, Palmerston North, New Zealand
e-mail: G.Wake@massey.ac.nz

July 8 - 12 (Sydney) **Sydney International Statistical Congress**
[Comprising: 13th Australian Statistical Conference, July 8 - 12
Computer Science and Statistics: 28th Symposium on the Interface (July 8 - 10)
IMS Special Topics Meeting on Contemporary Nonparametrics (July 10-12)]

Contact Director, SISC-96, CSIRO Division of Mathematics and Statistics, Locked Bag 17, North Ryde, New South Wales 2113, Australia.
e-mail: sydney96@syd.dms.csiro.au

July 15 - 19 (Graz, Austria) **Seventh International Conference on Fibonacci Numbers and their Applications**
Contact John Turner, Department of Mathematics and Statistics, University of Waikato, Private Bag 3105, Hamilton, New Zealand.

Mike Carter
Massey University

MATHEMATICAL VISITORS TO NEW ZEALAND

List No. 39 : 1 November 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.

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Professor Jim Berger; Purdue University; accompanied by wife (Ann); Bayesian statistics; September to October 1995; University of Canterbury; Prof. J J Deely; Erskine Fellow.

Associate Professor Ugo Bruzzo; University of Genoa and SISSA, Trieste (Italy); unaccompanied; algebraic aspects of Donaldson theory and geometry of supermanifolds; October 1994; Victoria University of Wellington; Dr V Pestov.

Professor P. Cholak; University of Notre Dame; logic; February 1995, 3 weeks, possibly 3 months; Victoria University of Wellington; Prof Rod Downey

Professor Yves Fautrelle; Ecole Normale Superieure d'Hydraulique et de Mecanique de Grenoble (France): MHD, metallurgical MHD, fluid mechanics; 1 to 31 December 1994; University of Waikato; Assoc. Prof. A D Sneyd.

Dr Sergey Federov; St Petersburg University; functional analysis; February 1994 to February 1996; Auckland University; Prof B Pavlov.

Dr Jim Filliben, Senior statistician, US National Institute of Standards & Technology; statistical package DATAPLOT; August 1995; Applied Mathematics Group, Institute of Industrial Research, P.O. Box 31-310, Lower Hutt; Dr Kit Withers (email: c.withers@irl.cri.nz)

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

Professor Kent Fuller; University of Hawaii at Manoa; accompanied by Mrs Fuller; rings and modules; 27 January to 19 March 1995; University of Otago; Dr John Clark; William Evans Visiting Fellow.

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

Mr Robert Gassler; University of Innsbruck; complex analysis; Auckland University; Prof D Gauld.

Professor Peter Graves-Morris; Bradford University ;accompanied; approximation theory; March to April 1995; University of Canterbury; Dr Ian Coope; Erskine Fellow.

Dr Jim Hartman; The College of Wooster, Ohio, USA; applied statistics; May 1995 to May 1996; University of Otago; Prof. Bryan Manly.

Professor Jan Jaworowski; Indiana University; accompanied by Wanda and Eva; topology; December 1994 to June 1995; Auckland University; Prof. David Gauld.

Professor C Jockusch; University of Illinois; recursion theory; January 1995 for two weeks; Victoria University of Wellington; Prof. Rod Downey

Professor Jerry King, Lehigh University USA; complex variables, philosophy of mathematics; 24 January to 31 March 1995; Waikato University; Prof. D Bridges; author of "The Art of Mathematics".

Dr Zorana Lazarevic; USA; theoretical topology; February 1994 to February 1995; Auckland University; Prof. D Gauld.

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

Dr Garry Newsam;Defence Science and Technology Organisation, Salisbury, South Australia and Research Centre for Sensor Signal and Information Processing; accompanied by wife; radial basis functions and applications to image processing; September 1995 (?); University of Canterbury; Dr. R K Beatson.

Dr Galina Okuneva; University of Aizu (Japan); husband (next entry); differential topology and computer science; first half of November 1994; Victoria University of Wellington; Dr V Pestov.

Dr Oleg Okunev; University of Aizu (Japan); wife (previous entry); general topology and computer science; first half of November 1994; Victoria University of Wellington; Dr V Pestov.

Professor Allan Reid; low-dimensional topology, arithmetic number theory; University of Auckland; Prof. G Martin.

Professor Chris Rodger; Auburn University, Alabama; accompanied by wife and two daughters; combinatorics, steiner systems, graph theory, coding theory; March and April (?) 1995; University of Canterbury; Dr Derrick Breach; Erskine Fellow.

Professor R Shore; Cornell University; recursion theory; early December 1994 for two weeks; Victoria University of Wellington; Prof. Rod Downey.

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

Professor Dan Tandberg; Department of Emergency Medicine, University of New Mexico, Albuquerque; accompanied by wife (Nancy) and two children; medical statistics; January to June 1995; University of Canterbury; Prof. J J Deely.

Professor Ioan Tomescu; Bucharest University, Romania; unaccompanied; combinatorics, graph theory; February to June 1995; Department of Computer Science, University of Auckland; Prof Cris Calude; very likely.

Dr Yang Yue; National University of Singapore; recursion theory; July 1995 for two weeks; Victoria University of Wellington; Prof. Rod Downey; probable.

Professor Shen Yu; University of Western Ontario, Canada; unaccompanied (?); formal language theory, cellular automata; February to June 1995; Department of Computer Science, University of Auckland; Prof. Cris Calude; very likely.

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
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SECRETARIAL

CALL FOR NOMINATIONS FOR NZMS COUNCIL POSITIONS

The terms of office of two Council members (Robert Chan and Mike Hendy) come to an end in 1995, and nominations are called for the resulting vacancies. The term of office of a Council member is three years. Members may hold office for two (but no more than two) consecutive terms.

Nominations should be signed by two proposers and the nominee, all of whom should be current members of the NZ Mathematical Society. Please forward nominations to the NZMS Secretary, Dr Margaret Morton, Department of Mathematics, University of Auckland, Private Bag 92019, Auckland (FAX (09) 373-7457), by 1st March 1995. Please include also a few lines of bio-data about the nominee, for inclusion in the April issue of the NZMS Newsletter.

GRANTEE REPORT

On behalf of EQUALS (NZ) I would like to thank the NZMS for their support in helping to bring Dianne Barrows, an Associate of EQUALS(Ca), to NZ as a Fulbright Visitor earlier this year. The following is an extract from her report to the New Zealand—United States Educational Foundation and describes her activities in NZ.

Margaret Morton
University of Auckland

Extract from Dianne Barrows' Report on her 1994 visit to New Zealand

My assignment, as a visiting lecturer and teacher, was to expand and extend much of the EQUALS programs in New Zealand by working with primary and secondary teachers in both the North and South Islands. My three month assignment was the last of three visits from EQUALS lecturers. Kay Gilliland initiated and introduced many EQUALS ideas during her visit from June through August in 1990. Helen Joseph followed in 1991 (February-May) and she extended the work primarily in the area of technology with a focus on computers. The focus of my visit centered on the ways that EQUALS ideas support the implementation of the New Zealand Curriculum in mathematics.

Through the investigation of problem-solving, including open-ended questions and dealing with assessment, the workshops addressed teachers' needs in this area.

Generally workshops were organized in one or two-day blocks of six hours each day. They were hands-on sessions, during which teachers experienced and practiced techniques for solving and creating both closed and open-ended problems, and then addressed the need for alternative assessment in light of the curriculum requirements. Often EQUALS Network members assisted in the preparation and presentation. Other presentations were to maths associations and university faculty and lasted from one to three hours.

A major element in an EQUALS workshop is the debriefing of activities to focus on instruction techniques and to examine criteria for using the task. Therefore, activities were often presented as they would be to a class, and teachers were asked to use various materials, and talk and write about their experiences. Participating in this way allows teachers to look at what can help the reluctant learner by giving him or her more confidence and creating a classroom environment that is safe and encourages learning. In the workshops it provided a basis for dialogue and sharing between teachers from different schools and often different levels—primary and secondary.

My role was to encourage the work that is already being done by New Zealand educators to implement the new curriculum and to extend the EQUALS ideas for encouragement of girls, Maori, and Pacific Island students in the study of mathematics. I was able to share many ideas and techniques I have found successful, and encourage dialogue and thinking by teachers to address these issues. Being a full time classroom teacher, I felt I had more status with the participants because I could share both my successes and frustrations in the classroom. I could also empathize with their concerns and difficulties and assure them that persistence is worth it. The written comments offered at the end of each day were so favourable that I felt I had lived up to expectations and my status was high.

(Dianne gave workshops and/or talks in Auckland, Whangarei, Kerikeri, Hamilton, Invercargill, Dunedin, Christchurch, Blenheim, Wellington and Napier.) A couple of typical comments follow.

"Great variety of useful problems. Good to have problems that are simpler, e.g. 11-12 yr old level, as these are great to start with for 13-16 year olds—build confidence first at this level. Problem of week problems and use of manipulatives and OHP to show the algebraic manipulations I see would be helpful to many students. There is lots here I can use in my classroom tomorrow—and I think this is important—to feel a session is useful to classroom teachers. Think tube is fun and great!"

"Very stimulating. Many good ideas. Opened up a number of possibilities—oh dear, where will I get the time? I thought I was in the wrong place to start with—coming from an all boys school. Any more ideas—with or without solutions would always be helpful."

NOTICES

MATHEMATICAL & INFORMATION SCIENCES COUNCIL OF NEW ZEALAND

The Mathematical Sciences Council was formed in 1993 out of representatives of the NZMS, NZ Statistical Association, Operational Research Society of NZ, and NZ Association of Mathematics Teachers [see NZMS Newsletter No. 59, Dec 93].

The Standing Committee also has the role of the "Mathematical and Information Sciences Council" which was formed in 1993 with these objectives in mind. At the launch of the Standing Committee in Wellington the Convenor for 1994/5, Professor Graeme Wake of Massey University said "the low appreciation of our disciplines in NZ means there is a real possibility of Mathematical and Information Sciences falling through the cracks to the detriment of Science in this country". The deputy convenor of the Standing Committee is Professor Marston Conder of the University of Auckland. The professional societies represented in this Standing Committee Council are the

NZ Mathematical Society
Informatics Group of the NZ Computer Society
Operational Research Society of NZ
NZ Statistical Association
NZ Association of Mathematics Teachers

This Council will continue its dual roles of fostering and promoting the mathematical and information sciences in New Zealand and providing a means of liaison between the professional societies it represents. Its first meeting was held on 29 September followed by an official reception at the RSNZ offices in Wellington. A report on the meeting on 29 September 1994 follows.

Graeme Wake

REPORT and MINUTES of the INAUGURAL MEETING OF THE MATHEMATICAL AND INFORMATION SCIENCES STANDING COMMITTEE OF ROYAL SOCIETY OF NEW ZEALAND 29 September 1994 at Science House, Wellington

This Committee has been formed under the new proposed procedures of RSNZ and is based on the previously formed "Mathematical and Information Sciences Council - with the dual objectives of promoting the advancement of the mathematical and information sciences in New Zealand and providing liaison between the five constituent professional Societies.

Present: Ms Sylvia Bishton (NZAMT), Professor Doug Bridges (NZMS), Professor Marston Conder (NZMS), Mr Bill Ellwood (NZAMT), Professor Ian Graham (Informatics group of NZCS), Professor Jeff Hunter (NZSA), Mr Ross Moore (Executive Secretary RSNZ), Dr Alex McNabb (Fellowship), Mrs Jean Thompson (NZSA), Professor Graeme Wake (RS Interim Board).

In attendance (part of the meeting)
Mrs Margriet Theron (MoRST)
Mr Peter Spratt (RSNZ)

Mr Ross Moore opened the meeting and set out the procedures for the meeting and explained the rules that the Interim Board (IB) electoral college representatives are to be the Convenors of the Standing Committees.

1 **Apology**
Was received and accepted from Professor Derek Holton (Fellowship). No representatives from ORSNZ attended but their decision (along with Informatics/NZCS) to join this grouping was warmly received.

Professor Graeme Wake took the chair.

2 **Constitutional Matters** - the following matters were agreed

2.1 The name of the Committee is confirmed as above.

2.2 It will also (in ex-RSNZ situations especially) be known as the "NZ Mathematical and Information Sciences Council".

2.3 **Two Fellowship** representatives are to be included elected by the Fellows each October from the group of 12 or so Fellows from these disciplines. Until further elections are held it was agreed that **Professor Derek Holton FRSNZ** and **Dr Alex McNabb FRSNZ** will be the Fellows' representatives. The term of the present Committee/Council is until October 1995.

Professor Marston Conder will act as Acting Convenor and IB representative while Professor Wake is away on leave 16 October 1994 to 12 February 1995.

3 **Additional items for the agenda**

Topics 9.1 E-mail link with MISC
9.2 Coordinating the meetings schedule
9.3 Next meeting

were added.

4 **Convenorship**
Professor Graeme Wake (IB member) will be convenor for one year until October 1995 and Professor Marston Conder will be Deputy-Convenor.

Activity reports

5.1 **Mathematics**: current issues reported were

(i) 1995 Forder Lecturer is Professor Elmer Rees, University of Edinburgh, who will be in NZ August and September.

(ii) the proposal under discussion of getting an under-graduate scholarship endowment fund established - this could possibly cover all the subjects represented in MISC.

Current membership of NZMS is about 180 ordinary members (+ student members).

5.2 **Statistics**: current issues reported are

(i) the successful meeting with ORSNZ held in August at Palmerston North.

(ii) the forthcoming production of a booklet marking Women's Suffrage Centennial Year "Women in Mathematics making a difference", and a travelling display on this theme.

Current membership of NZSA is about 350 ordinary members (+ student members).

5.3 **Operations Research**: is now affiliating with RSNZ and its conference is noted for its strong student involvement and its links to Asia-Pacific OR Societies.

5.4 **Informatics Group of NZCS**
This group which has now affiliated with RSNZ has a membership of about 180. There is a strong link developing with the South East Asian Region Computing Council (SEARCC).

5.5 **Mathematics Teachers**
The NZ Association of Mathematics Teachers is a federation of 15 Regional Mathematics Associations. It also now has individual memberships totalling about 300 in 1994.

Current activities include:

(i) national certificate and the qualifications framework;
(ii) NZAMT policy;
(iii) the biennial conference in Auckland in August 1995;
(iv) RSNZ affiliation (now consummated);
(v) the needs of primary mathematics teachers;
(vi) the encouragement of excellence in classroom teaching and the need for more awards.

5.6 **Fellowship**: current issues include
(i) selection of fellowship nominees;
(ii) request for RSNZ to include Information Sciences in the "Maths" Fellowship group;
(It is suggested that MISCNZ could provide nominations and discuss these)
(iii) the situation for Mathematics and Information Sciences in PGSF: "Mathematics is falling through the cracks".

5.7 **The Minutes of the MISCNZ** Council Meeting of 10 May 1994 were noted. Most of the items which were discussed were taken up at this meeting.

6 **International Matters**

6.1 **IMU, IUTAM, ICMI, ISI** etc

The role of National Committees for the International Unions was discussed. It is believed National Committees will still be needed "on paper" but their role could be handled by the Standing Committee with the convenors, (e.g. Dr Michael Carter, for Mathematics) being coopted onto this Council. Non-ICSU (= International Commission of Scientific Unions) group like the Statistical one (ISI) can also be "related to" via RSNZ.

Professor Marston Conder, NZ delegate to the recent IMU General Assembly at Zurich presented his report. Concerns on the need for democratization of the proceedings (pointed out for many years) remain.

6.2 **World Mathematics Year 2000**

Professor Marston Conder reported on the planned activities for this milestone event. Further details will be provided later.

6.3 **Joint Conferences with the Australians**

These are planned as follows

- 32nd (Australian) Applied Mathematics Conference. The New Zealand Branch of ANZIAM is hosting this conference in the Solway Park Conference Centre, Masterton 4-8 February 1996. The conference Director will be Professor Graeme Wake, Massey University. All areas of Applied Mathematics, including Operations Research, will be involved. This conference is **definite**.
- Joint Australian Mathematics Society/NZ Mathematics Colloquium. Meeting is proposed for 7-11 July 1997 in Auckland.

It is agreed that regular joint meetings with the Australians are a good idea and a degree of coordination is important.

7 **Science Policy Matters**

7.1 **PGSF Research Funding**

It was widely felt that "Mathematics falls between the cracks". The small number of grants to Maths/Stats/Computing was noted. It was agreed to raise this at the following Public Gathering and with the MoRST representatives.

7.2 **Basic Science Fund**

The formation of this fund was welcomed.

- Dr Margriet Theron of MoRST joined the meeting at this point and was briefed on 7.1 above. She reported that

- the large number of submissions on this point had led to the revision that -
  "Mathematical and Information Sciences would be one of the five categories in BSF".
  This was welcomed by members of the Committee.
- the BSF criteria for funding would be
  (i) scientific merit
  (ii) contribution to the advancement of knowledge
  (iii) broadening and development of research skills.
- the Basic Research Council is likely to have administrative support from FRST. Nominations for membership should be with Dr Ian Axford as soon as possible.
- that there is extra funding for "Science and Technology promotion", about $317,000 for the current year. The Minister wants to increase Science and Technology awareness and to enhance the attractiveness of Science for young people.

8 **Education Matters**

8.1 **Career Brochure**
The delay in production of the NZMS/NZSA brochure was noted. It was **agreed** that the opportunity of the production of a brochure via the University of Auckland encompassing all of the Mathematical Sciences including Computing be taken. All Societies agreed to support this and/or possible future publications of this type.

8.2 **NZQA Mathematics Advisory Group**
Three members present (Bill Ellwood, Sylvia Bishton and Graeme Wake) reported on the "state of play" on the approach of the Draft Unit Standards for levels 1-4 which will be available for comment/trialling in November. Members **agreed** to encourage debate during the consultative process.

8.3 **RSNZ Activity**
Mr Moore agreed to recommend "Mathematical & Information Sciences" representatives on RSNZ Committees whenever appropriate.

8.4 **RSNZ Involvement**
The role of RSNZ in education matters was noted. Mr Peter Spratt (RSNZ) addressed the meeting and agreed to assist in matters of mutual interest. Especially of interest is the α- and β- series, Mathematics Exhibitions, Science Centres.

9 **General Business**

9.1 **E-mail link**
Professor Ian Graham agreed to set up an e-mail link for the Standing Committee/MISCNZ

9.2 Coordination of Meetings. Representatives agreed that for the 5 groups represented - NZMS, NZSA, ORSNZ, Informatics/NZCS, NZAMT - attempts should be made to coordinate joint meetings involving 2 or more of the annual meetings so as to provide the sort of cross-fertilisation expected by current science policies. It was agreed that this Council will try to facilitate this. Coordination will be required. Each society is asked to submit its <u>likely scenarios for meeting venues,</u> so coordination is effected. Details reported include:

1995: 1995 Mathematics Colloquium and Statistical Association meetings are to be incorporated in the Aitken meeting at the University of Otago, 28 August - 1 September.
Informatics/NZCS: to be advised
ORSNZ: to be advised
NZAMT: University of Auckland, 28 August - 1 September

1996: 32nd Australian (+NZ!) Applied Mathematics Conference at Masterton, 4 - 8 February 1996.

Mathematics Colloquium **expected** to be at Massey University in early July (to be confirmed).

1997* Australasian Mathematics Convention at Auckland 7 - 11 July 1997
Further details to be provided.
* tentative.

9.3 **Next Meeting**
It was agreed that the Council/Standing Committee next meet in February 1995.

The meeting closed at 5.00pm and was followed by a public launch of the Standing Committee hosted by RSNZ.

A press announcement on the formation of the Standing Committee is to be released.

M D E Conder
G C Wake
for the Committee

ANZIAM MEETING COMES TO NEW ZEALAND

For the third time the (Australian) Applied Mathematics Conference is to be held in New Zealand-this time at the Solway Park Conference Centre, in Masterton 4th to 8th February 1996. Now that the Division of Applied Mathematics of the Australian Mathematical Society is renamed as Australian New Zealand Industrial Applied Mathematics (ANZIAM) it seems even more appropriate for this to happen at regular intervals. (previously...Wairakei (1987), Hanmer Springs (1991)).

This conference, named the 32nd AMC is to have all parts of Applied Mathematics represented, including Operations Research.

Conference Director Professor Graeme Wake says "we hope this conference will be supported by the Applied Mathematics fraternity in New Zealand as there will be a large measure of support from the Australians". There are to be seven invited speakers, two from the US and one each from Canada, Japan, Australia, Holland and New Zealand. The NZ Branch of ANZIAM is to be the host for this conference. The facilities at Solway Park are ideally suited to this type of conference and it should be enjoyed by all. Early enquiries can be directed to Professor Graeme Wake at Massey University. [Details appear in the conferences section of this issue on p29.]

Peter Bryant

A SMALL STEP FOR NEW ZEALAND?

It is reported that on the afternoon of September 9th 1994, the sun shone directly on the building in Wellington that houses the New Zealand Qualifications Authority (NZQA) . It is rumoured that this event was caused by the seemingly innocent action of the Mathematics Advisory Group (MAG) in recommending that the mathematics unit standards be accepted for trial and for consultation with teachers. That it was a cause for joy in high places was due to the length of the gestation period - approximately

16 months; the difficulty of birth - the MAG had come close to resigning en masse and maybe they had also been close to being sacked at least once; and the fact that mathematics was among the first generic subject to find its way on to the NZQA's lists. Although proper registration was probably still some 8 months or more away, statements of achievement had been written for assessment, so proving that unit standards could be produced for other than vocational subjects.

Before I can go into any more details on the exact nature of the proposed mathematics unit standards, it's necessary to set the National Qualifications Framework scene in which the mathematics drama was played.

First, there is the need for change. What was wrong with the old system that it had to be changed? There are a couple of arguments. For a start there are, or were, a number of different qualifications, granted by a number of bodies, that a student could obtain. One of the thrusts of the new regime was to bring all these certificates, diplomas and degrees, under the one banner. This is the so-called "seamless" education that enables students to follow an educational pathway independently of particular educational institutions. By having a uniform system of recognition of achievement, qualifications should be nationally more portable and acceptable. It should now be easier to know how each piece of credit fits together and make it easier for them to be used for whatever next educational step a student desires to take. At the same time, every student's record of learning will be placed in one central data base.

But perhaps above all, there was the desire to raise the level of everyone's skills. This was to be done by changing from a normed base reference system to a standards based one.

Up until now, where certain students failed, others crept through and others did very well, but this was only relative to the population being assessed. The marks for the assessment were spread over some range and an arbitrary "pass" mark was assigned. Under this scheme there is no guarantee that students in one year who pass, are necessarily better than students in another year who fail. If in a particular year for some reason all of the students are all very good, under a norm based system, some of them will probably fail because they are being compared against each other. The theory goes that if a standard is declared, students can work towards that standard. When the standard is achieved, the credit is gained. Although this sounds fine in theory, there are certain practical problems, not the least of which is how do you define a standard?

This change to "standards" is a paradigm shift. It makes no sense any more to ask how many students will achieve credit or what percentage of students will gain credit. Conceivably all students who work at a unit standard long enough will succeed.

Then there is the National Qualifications Framework itself. This is an entity based on Levels and unit standards. Diagrammatically, the Framework looks roughly like this.

Other degrees	Level 8	Masters, PhDs
First degree	Level 7	
	Level 6	National Diploma
	Level 5	
Bursary	Level 4	
	Level 3	
	Level 2	National Certificate
NC* Level 6	Level 1	

(NC = National Curriculum)

Here the National Certificate covers Levels 1 to 4 and the National Diploma Levels 5 to 7. I'll get back to what the National Curriculum is and where that fits in in a moment. For now, it is enough to know that students proceed up through the Levels to an appropriate qualification.

At each Level, there are, or will be, a range of unit standards. These are the building blocks of the Qualifications Framework. Eventually there will be thousands of these unit standards covering academic and vocational areas. To achieve credit for a unit standard, students have to achieve all the performance criteria of the unit standard. Once sufficient credits have been gained, the relevant Certificate, Diploma or Degree will be awarded.

Then there is the National Curriculum. This is the curriculum for all school based subjects. So there is a document called Mathematics in the New Zealand Curriculum (MINZC), which lays down what mathematics is to be taught at what Level. In the National Curriculum there are again eight levels. Unfortunately, these levels don't match the Qualifications Framework levels.

Curriculum Level 6 is, for the moment anyway, equated with Level 1 on that Framework. This is a little unfortunate perhaps, but hopefully it will work out alright in the end!

When the MINZC document, or "burgundy bible" as it is known in some quarters, was produced in 1992, it was the last thing in mathematics education. Its six strands covered not only the usual and expected ones of Number, Measurement, Geometry, Algebra and Statistics, but also the unusual and novel one of Mathematical Processes. This latter took the lead from Britain's Cockroft Report, from the American NCTM's Standards document (nothing to do with unit standards, incidentally), and from the Problem Solving movement in Australia represented early on by RIME and RAMP and later by the MCTP work. So Mathematical Processes embodies not the skills of mathematics so much as the feeling of the subject. Processes comprise Problem Solving, Communication and Logic and Reasoning. In so doing, they emphasise that it is important not only to know certain skills, algorithms and results but also how to produce, use and tell others about the more traditional aspects of the subject.

Although good teachers had been underlining and using these Processes for some time, their embodiment in the "burgundy bible" was their first official recognition on the New Zealand scene since the last world war. Actually, as far as content was concerned, MINZC was a conservative document, there being very few changes in what had previously been taught at each level. The emphasis then, was on the approach to learning.

The reason that I have spelled out this emphasis on Process, is because it was a major stumbling block in the MAG's attempts to produce unit standards for mathematics. The concept of standards derives from technical areas where it is relatively straightforward to define the required level of ability. For instance, it might be decided that a typist is proficient if he can type 60 words per minute. Practice decides the number of words that a reasonably accurate and efficient person can produce. A simple assessment can be provided that will test whether the desired ability has been achieved. If the standard isn't reached today, more practice tomorrow will enable the performance criterion to be reached later.

In this context, it is probably the case that many people think of mathematics as being close to typing. There is no difficulty in defining a standard. "Can solve a linear equation" is easy to say and assess. If it isn't done today, a little practice will make it so. Unfortunately, it isn't as easy as it looks to produce performance criteria in mathematics or in other subjects. As different subjects come to grips with the problem they will undoubtedly find their own solutions. But there are at least two difficulties.

A first difficulty may even apply equally to typing. What at first sight looks easy to define may not be easy to assess. How many "big" words would you put in that 60 words per minute? How many errors are allowed? How complicated can your linear equation be? Is the variable a Roman x or a Greek α? Does the unknown have a coefficient of 1, 3 or -8? The point is that all of these numerous but apparently small changes to the typing task or to the linear equations, will produce different levels of achievement. So by themselves, simple stating "can type 60 words a minute" or "can solve a linear equation", does not uniquely define a standard that is equally well understood simultaneously by a teacher in the Waitake or a teacher in Waimate.

But a second difficulty probably applies more to maths than to typing. How do you write a standard for a Process? This is a way of approaching the creation of the subject, or communicating it or thinking about it. "Can problem solve." Yes, but when and under what conditions and always? To define this anywhere like precisely may take 50 pages rather than 50 words. NZQA can't allow that sort of space. This was a problem more for Superman than for the MAG but a good superperson never seems to be around when you want one.

The next problem that confronted the MAG was the notion of credit. This was to be an all or nothing affair. No 65 marks out of 100. To produce a cohesive unit standard, one that incorporated the skills and Processes of a given Level, it seemed reasonable to require a large unit standard. Perhaps even, one that covered everything in the year. However, if this was done, it was likely that very few people would ever be granted credit! Under the norm referenced system only a small percentage of students are able to display a mastery of all of the year's work on the final

exam. So a large unit standard seemed to be out of the question. The other extreme was to have a large number of small unit standards. The difficulty here was that it appeared very hard to retain any performance criteria relating to Process in a small unit standard. In small unit standards it seemed only possible for a student to demonstrate achievement of skills. On the other hand, small unit standards would enable weaker students to achieve some credit for their year's work. And students who left school after a term, might have done enough in that time to be given credit for one or two unit standards. These credits would undoubtedly be of some use to such students when seeking employment.

In the end the MAG came up with a compromise. At Levels 1 and 2, their model has umbrella unit standards worth about 6 credits (24 is considered to be about a year's work in one subject). These are Process unit standards. To these are loosely attached a range of essentially skills unit standards worth 2 or 3 credits. Because you can't "do" Processes in a vacuum, credit for the Process unit standards can only be gained if a certain number of skills credits have been acquired; of the order of 8 credits have to be achieved in skills unit standards. Someone gaining credit for the Processes unit standards then, automatically ends up with a minimum of around 14 credits. On the other hand, students can obtain credits for the skills unit standards alone but the total credits for these do not amount to a full year's worth of 24. Under this model, therefore, students are able to gain from 2 to 24 credits to reflect their ability and their year's work. Actually an advantage of the new system is that the weaker students will be able to get more recognition for their year's work than they do currently.

In addition, it needs to be stated that the unit standards aren't meant to be units of work. Teachers aren't supposed to take them, teach them individually and then assess them. They are assessment units, put together for accreditation purposes only, so that students can take their record of learning with all the unit standards credits on it, and show a prospective employer what they have achieved. The introduction of the umbrella units is supposed to emphasise the fact that the unit standards are not meant to be stand alone teaching entities.

One of the things that concerned the MAG was the minimalist approach to learning as it is assessed through unit standards. Once a standard is achieved, there is no need to push further into the subject and explore it in any greater depth. In an effort to ensure that able students are extended, the MINZC has what is called a development band. This is essentially extension work. At each of the first three Levels of the Framework in mathematics, development band unit standards with around three credits have been devised.

Now there are going to be students who, in the regular (ie non development band) unit standards, produce work well beyond the credit level. To both encourage and reward such work, the MAG has proposed a merit award. This means that in some unit standards, one student may get credit and another merit.

Now different subjects may award merit in different ways. In the maths model, the onus is on the student to apply for merit on the basis of work designated by the teacher as of merit standard during the year. Merit will be granted on a combination of depth and breadth. A student who does one exceptional piece of work may be awarded merit. So may a student who produces a lot of small but imaginative pieces of work.

One final thing with merit, it will only be awarded to the umbrella Process unit standards. The MAG thought that students would need to show ability in a number of strands to obtain merit. As the skills unit standards are limited in scope, it did not seem appropriate to allow merit to be achieved there.

Having done all this, the MAG still realizes that standards can't be defined uniquely in the simple terms required by NZQA. I think it is probably true to say that NZQA realizes this too. After all, in the current system, examination prescriptions don't really define the level of understanding required to pass an examination. This level is determined over a number of years by the examination papers themselves. By seeing what examiners require, teachers are able to adjust their level of teaching. Hence there are to be two more instruments to help to determine standards. These are assessment guides and moderation.

One of the essential features of assessment guides is that they will provide examples of appropriate assessment. They will also give examples of students' work along with whether it is at credit level or not. These guides then, will help teachers to see precisely what is meant by a given unit standard.

External moderation is a process in which all teachers will be involved. The details are not complete yet but it might work in two ways. First, there could be common assessment tasks that all students working towards a given unit standard will undertake. Teachers will probably be asked to submit to a regional moderator, examples of work in their class which is below credit level, at or around credit level, and well above credit level. By meeting together and with the regional moderator, the level of unit standards will be more precisely defined. Later, the regional moderators will have similar meetings with the national moderator in order to ensure that common levels are achieved across the country.

The second common task that could be required is a sort of open common task. This will be defined within certain limits but each teacher will be allowed to set the precise situation or problem for their own class. These tasks will be finalized in the year before they are used, in consultation with the regional moderator and other teachers in a region. They will be moderated in the same way that the common tasks are moderated.

Let me return to the problem of Levels for a moment. The fact that in mathematics essentially four levels of work have been condensed into three, points up some problems with the level system at this stage. Currently, Level 1 contains unit standards derived from Curriculum Level 6 but is open-ended downwards. This means that material from below Curriculum Level 6 will be assessed through Level 1 unit standards. This may seem a little unfair. But that may be a small injustice compared with the students who do Level 1 in maths and Level 2 in some other subject. There are already unit standards registered at Level 2 which are demonstrably comparable with maths Level 1 unit standards. Hopefully in time these anomalies will be corrected. And finally here, there is a danger that Level 4 will not be used for mathematics at all! At the moment only three levels have been defined because there has to be a link between Curriculum Level 6 and Framework Level 1. At the same time, everything "below" Level 1 is included at Level 1. This puts Bursaries maths at Level 3. However, university papers are planned to start at Level 5. What is going to happen to Level 4 I'm not yet sure. The MAG is suggesting to the NZQA that perhaps Curriculum Level 6 should be equated with Level 2. Time will tell on that one.

It is important to note that the unit standards that the MAG has produced will not be registered straight away. Two things will happen before that historic action. These are consultation with teachers and a year's trial.

Because the maths unit standards still have to meet NZQA's specific technical requirements, they will probably not surface for public view until April next year. However, at that time they will be sent to all schools so that teachers can comment on them. I hope that this way they will be given a thorough going over and that all the obvious errors that the MAG has missed will be corrected. It will also give teachers a chance to comment on the basic structure. From discussions with teachers on the MAG, I think that the actual structure of the model that the MAG has finally adopted, will enable teachers a fair degree of latitude in their style of teaching. It should mean that the classroom practice of most people will have to change very little. Anyway, teachers will have six weeks or so next year in order to discuss the draft unit standards and to send back their comments.

The other means of testing the unit standards is a year long trial in schools. About 60 schools throughout the country will be asked to work towards the standards at Levels 1 and 2. (Standards for assessing Curriculum Level 8 will not be trialled as it is thought that it may disrupt students' preparation for Bursaries examinations.) So probably about 30 schools will trial the maths unit standards and 30 the Geography ones. Some schools are likely to trial both subjects. There are many reasons for the trial. NZQA wants to see how much help teachers require to adjust to the new system. It is hoped that the trial schools will produce a certain amount of exemplar material both of assessment and of students' work, that can be included in subject specific assessment guides. The trial will also test the moderation system and see what problems there may be there. One of

the concerns that many people have is that, at least in the initial phases, teachers may over-assess in a desire to cover all the performance criteria of the unit standards. The trial will look carefully at this issue.

As a result of the trial and the consultation, improvements will be made in the draft unit standards and in the moderation process. The present plan is to do sufficient work on the draft material so that the unit standards can be registered sometime next year. Once registered they will be available for schools for a two year period. After that they will need to be registered again. Hence the unit standards will be continually improved.

It is fair to say that, although the sun shone in Wellington when the draft maths unit standards were approved, the MAG itself was fairly subdued. I think we were not sure precisely what we had done. Will the new scheme be an improvement? Will students learn more and better? We await the jury.

Derek Holton

POSITION AVAILABLE

Palmerston North:

PhD Scholarship in Soil Biological Processes

Massey University,
Department of Mathematics

Applications are invited for a PhD Scholarship funded by AgResearch (NZ Pastoral Agricultural Research Institute Ltd) for modelling of soil biological processes. The successful candidate will work as a member of the Mathematical Biology Group of the Mathematics Department and related Departments, and will be expected to participate in a research project focussed on the development of dynamical systems model of earthworms in relation to their environment.

This project offers a unique opportunity to test model outcomes in a practical context. Applicants should have a first or upper-second class honours degree in mathematics and its applications and an interest in biology. Experience in computer simulation would be an advantage.

The candidate will be expected to undertake some study in the biology of soil systems within AgResearch and Massey University.

The scholarship is funded at $15,000 per annum (plus enrolment fees) for two years with an extension for a further year subject to review. It is available from February 1995.

Applications and enquiries for further details should be addressed to Professor Graeme Wake, Mathematics Department, Massey University, Palmerston North, New Zealand, Tel (06) 350-5081, Fax (06) 350-5611, e-mail G.Wake@massey.ac.nz.

Applications should be accompanied by a full curriculum vitae and academic record, together with names, addresses and fax numbers of two academic referees.

Closing date for applications is 15 December 1994.

NZMS VISITING LECTURESHIP

Each year the NZMS coordinates and provides some financial support for a tour of NZ universities by a visiting mathematician. Usually this person — known as the NZMS Visiting Lecturer — will spend 2 to 3 days at each of the six main university centres (Dunedin, Christchurch, Wellington, Palmerston North, Hamilton and Auckland), and give at least two lectures at each place: one for a general audience, and one more closely tied to his or her own particular research interests. Recent NZMS Visiting Lecturers have included Professor John Loxton (Macquarie University) in 1992, Professor Andreas Dress (University of Bielefeld) in 1993, and Dr Colin Maclachlan (University of Aberdeen) in 1994. The following is a report from Dr Maclachlan, who was based in Auckland for several months of 1994:

"I visited the universities Waikato, Massey, Victoria and Canterbury, each for two days in the period 18 April – 3 May. Also I visited Otago University for ten days: 11–21 July. At each of these, I gave a general lecture on "Fibonacci numbers, groups, manifolds and generalisations", and a more specialised lecture on "Symmetries of surfaces" or "Arithmetic Fuchsian and Kleinian groups". Some additional lectures were given in Auckland. At all places, accommodation arrangements and hospitality for both myself and my wife were excellent, and all visits were most enjoyable from our point of view. Some universities were able to provide an office and access to a terminal and telnet, which was useful, particularly when the hosts were busy with lectures, meetings, etc. I particularly enjoyed having the opportunity to speak to other faculty and students about their interests. There was, however, quite a bit of "dead time" on some of these visits, perhaps partly accounted for by their timing.

I wonder if an additional useful function for the visiting lecturer would be that some semi-formal arrangements be made for some graduate students to meet with the visiting lecturer on a one-to-one basis to outline their research. I feel this might be a useful exercise for these graduate students. I am not suggesting that this be restricted to students in the same field as the visiting lecturer, but perhaps a distinction should be made between pure maths, applied maths, and statistics. Please thank all my hosts for very enjoyable visits. Best wishes, Colin Maclachlan."

Host departments each contributed $200 towards the costs of travel and provided 2 or 3 nights accommodation for Dr and Mrs Maclachlan. The NZMS contributed an additional $400 towards travel costs. The NZMS Council has offered the NZMS Visiting Lecturership for 1995 to Prof. Roger Grimshaw, who holds the Chair of Applied Mathematics at Monash University, Australia. Professor Grimshaw is likely to tour in November 1995.

Nominations are now being called for the 1996 NZMS Visiting Lectureship. Names of suitable candidates should be sent, together with a brief description of their current position and field(s) of interest, to the NZMS Secretary, Dr Margaret Morton, Department of Mathematics, University of Auckland, Private Bag 92019, Auckland, no later than 1 May 1995.

NZMS STUDENT PRIZE

The NZMS Council has decided to establish an annual prize for the best talk or paper presented by a student at the NZ Mathematics Colloquium. This prize will be known as the Aitken Prize, in honour of the New Zealand born mathematician Alexander Craig Aitken, and will be offered for the first time at the Colloquium held in conjunction with the A.C. Aitken Centenary Conference at the University of Otago during the week 28 August to 1 September 1995. The prize will consist of a cheque for NZ$250, accompanied by a certificate. Entrants for the prize must be enrolled (or have been enrolled) for a degree in Mathematics at a university or other tertiary institution in New Zealand in the year of the award. They should give a talk or present a paper on a topic in any branch of the mathematical sciences, during the Colloquium.

A judging panel will be appointed by the NZMS Council, and make recommendations to the NZMS President and Vice-President for the award. Normally the prize will be awarded to one person, but in exceptional circumstances the prize may be shared, or no prize may be awarded. Entrants should write to the NZMS Secretary, Margaret Morton (C/- Department of Mathematics, University of Auckland, Private Bag 92019, Auckland) to indicate their intention to be considered for the award, at least one month before the starting date of the Colloquium.

THE NEW ZEALAND MATHEMATICAL SOCIETY (INC.)

APPLICATION FOR FINANCIAL ASSISTANCE

Please fill in where appropriate

Name of applicant: .....

Address: .....

.....

.....

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)	.....

.....

.....

Estimated total expenditure: .....

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

.....

.....

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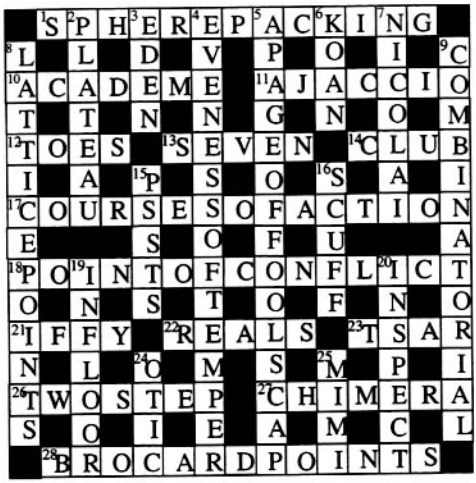
Please send this application (and any supporting documents or other evidence) to:

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.

SOLUTIONS TO CROSSWORD NO 43



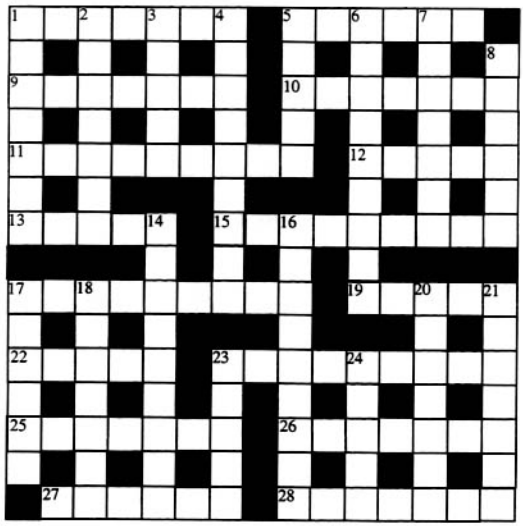
ACROSS

1. Starting price here stepping round the king about space filling (6, 7)
10. Ace made the philosophers' garden (7)
11. Where boney began (7)
12. End ten to two quarters (4)
13. These venues contain an odd number (5)
14. White's? or black trefoil? (4)
17. Where steeplechases are for procedures (sound like applied forces?) (7, 2, 6)
18. Where geometers disagree at the sharp end about war? (5,2,8)
21. Dicey one very loud almost the last (4)
22. Coins that match numbers are about pounds sterling (5)
23. Ruler beginning to start a reign (4)
26. Small staircase for a dance? (3-4)
27. From the start of Archimedes' monster with greek beginning (7)
28. Rich material damaged in end before tips of twelve; every triangle has two (7, 6)

DOWN

2. On the level his problem is extremal (7)
3. Paradise for the Earl of Avon (4)
4. 50/50 yielding before imperial hesitation, disposition needed for the 48? (7, 2, 6)
5. Paper from a bearer of the ass's headgear (1, 4, 2, 8)
6. Meaningless question OK about an answer? (4)
7. Responsible for *The Merry Wives of Windsor* music (7)
8. I, in cattle stop can be connected with 1 and 22 (7, 6)
9. Discretely referring to the arrangement of mathematicians' underwear (13)
15. Pass eats without vowels for surreptitious attention getters (5)
16. Damage the shirt ends, hurt the shoes (5)
19. A florin and nothing more for kind of heating (2-5)
20. Examine point by point since short point shows up (7)
24. Of an organ (with prefix, foreign) (4)
25. Bohemian a thousand and one encored (4)

Crossword No 44 **by Matt Varnish**



Across

1. Cayugas, Oneidas, Onondagas, Mohawks (7)
5. Classically apt end for title (6)
9. Erie, Huron, Michigan, Superior (7)
10. Nottingham, Leicester, Derby, Stamford (7)
11. Nerva, Trajan, Hadrian, Marcus Aurelius (9)
12. Dover, Sandwich, Hastings, Romney (5)
13. Elizabeth, Jane, Kitty, Mary (5)
15. India, South Africa, Canada, The Old Country (9)
17. Kashmir, Mysore, Gwalior, Baroda (9)
19. Semi-as, as, denarius, solidus (5)
22. Chico, Groucho, Harpo, Gummo (5)
23. Clifford, Ashley, Buckingham, Lauderdale (9)
25. Julius, Arthur, Herbert, Milton (7)
26. Balakirev, Cui, Borodon, Mussorsky, Rimsky-Korsakov (7)
27. Victoria, Alice, Louise, Beatrice (6)
28. Exodus, Leviticus, Numbers, Deuteronomy (7)

Down

1. Shall hold painful response to hide nothing (4, 3)
2. One of 17 an Edward nodded in precession (7)
3. Modified Quirinus (before a red grave?) (5)
4. Barbered offspring proverbially with tuning wind (5, 4)
5. Measures clichéd apart (5)
6. Unsing epithet of Beethoven's first eight (3-6)
7. As pilot made marginal note (7)
8. She, heavenly creature, finally alters a traditional vertex (6)
14. Haloed gold about nothing dead (9)
16. Sad sack about misled storage on horseback (6, 5)
17. The girl is nuts (6)
18. Shorthand sign to get hip done (7)
20. Happens to be conspirator's tip in 44 BC? (7)
21. Without right warnings give shade makers (7)
23. After a road east a heron and bittern (5)
24. Broadway flop? Does not count at cricket (2, 3)