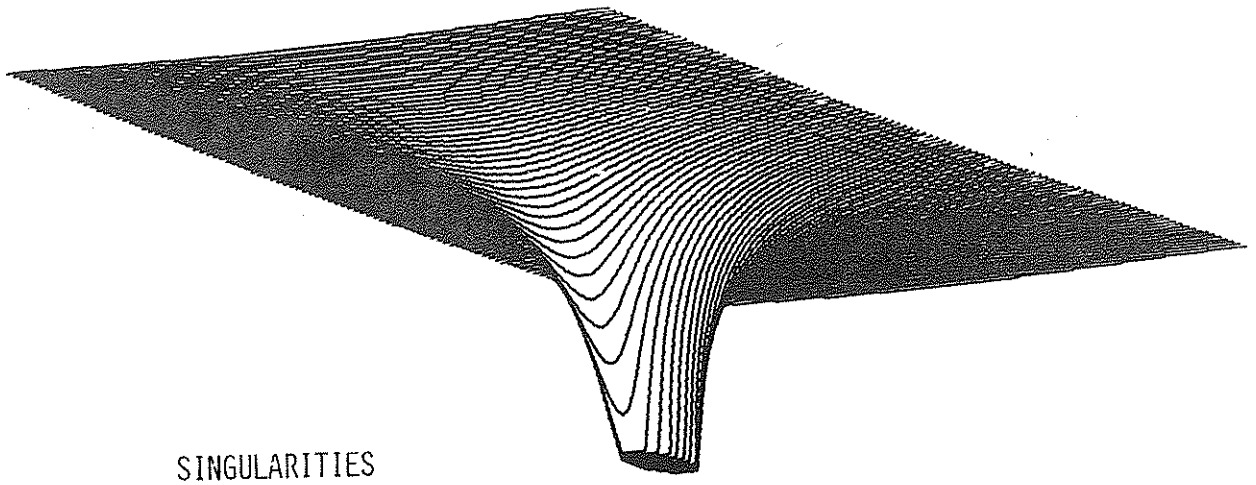
HE NEW ZEALAND MATHEMATICAL SOCIETY

NEWSLETTER



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SERO SED SERIO

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Number 21 August 1981 ISSN 0110-0025

PRESIDENT'S ANNUAL REPORT 1980/81

On behalf of the Council, I have the pleasure to present the seventh annual report of the New Zealand Mathematical Society.

The membership of the Society has increased slightly to 203 (168 ordinary members, 20 student members, 3 honorary members, and 12 reciprocal members; 175 resident in N.Z. and 28 overseas). We also have 4 institutional members whose interest and support is very welcome. We are living in a difficult inflationary period, but I am sure that, for what is a moderate subscription compared with similar professional organisations, we get value for money from the N.Z. Mathematical Society.

From July 1980 the Society became incorporated, giving it a legal standing that it did not have previously. In anticipation of this the Constitution was suitably amended at the last annual general meeting. The further amendments to be considered at this AGM concern items which could smooth certain procedures in the running of the Society.

The Secretary and I have been involved with the organisation of the Second Australasian Mathematics Convention in Sydney, which incorporates this AGM, and on behalf of our Society I wish to express sincere thanks to the Australian Mathematical Society for the consideration, cooperation and hospitality accorded us. I am sure that such joint ventures can only be beneficial to mathematics and to mathematicians on both sides of the Tasman. The New Zealand Mathematical Society Lecture at the Convention was given by Professor C.T.C. Wall, FRS, of the University of Liverpool who recently toured New Zealand.

The Newsletter is now being published four times a year. The new editor, Dr. Brent Wilson, and his sub-editors have ensured through their imaginative efforts that this publication continues to flourish. Our congratulations to them. Two supplements to the Newsletter appeared in August, one listing N.Z. theses in mathematical sciences, the other being a summary of the proceedings of the Subject Conference in Mathematics held in Auckland last May.

This has been an active year for the Society in other publishing ventures. Strong demand has necessitated further printings of the users manual for the statistical computing language STATUS, the annual list of Post-Graduate Topics in Mathematics was revised, sales of the book *Partitions, Yesterday and Today* by Professor G.E. Andrews have been continuing, and the handbook *Employment Opportunities in Mathematics* was published in its third edition with the assistance of Burroughs Ltd. But the spectacular development this year has been the publication of the Society's Mathematics Syllabus Series booklets which are aimed to cater for teachers and students who are adjusting to syllabus changes in the senior secondary school. Sales figures and orders for the three booklets *Probability and Statistics, Computing and Numerical Mathematics* and *Mechanics* for Seventh Form Applied Mathematics are most encouraging and indicate that this series is meeting an immediate need. The Society appreciates the contributions made by the authors of these publications, namely, Mr. John Turner, Mr. Raoul Cornwell, Mr. Bob Broughton, Mr. Alan Ramsay and Dr. John Harper. Clearly, the Society is in an exciting period of development in mathematical publications, and I would like to express our gratitude to Dr. Graeme Wake in particular for his energetic oversight as Convener of the Publications Committee.

The Human Rights Sub-committee of Council has continued to represent us in a difficult area under the convenership of Dr. Gloria Olive, while the Mathematics Education Sub-committee convened by Mr. John Turner has been chiefly concerned with the education section of the Sydney Convention and with the seventh form syllabus booklets mentioned above.

Dr. Joe Gani, Chief, CSIRO-DMS in Canberra was the 1980 Visiting Lecturer. Some of his talks have been published in the Newsletter and the N.Z. Mathematical Chronicle.

I am pleased to report that we now have a reciprocity agreement with the Mathematical Society of Japan. This brings the number of overseas associations with whom we have reciprocity agreements to seven. Within New Zealand, our Society maintains close relations with the N.Z. Association of Mathematics Teachers. Also, as a member body of the Royal Society of New Zealand we have made nominations to and voted on the membership of some of its committees.

The Society sponsored a one-day seminar on "Finite Geometries" at the University of Auckland in August.

The pre-doctoral thesis competition which was successfully introduced last year has been suspended for organisational reasons. It is the intention of Council to run the second of these competitions so that the prizes can be awarded in May 1982.

In the December 1980 issue of the Newsletter I drew attention to some concerns and some issues pertaining to the future of mathematics in New Zealand. I indicated the importance of keeping the public and those in authority fully aware of the significant role mathematics has in New Zealand society (in particular, the role of research and teaching at the tertiary level). It also behoves us as mathematicians to be cognisant of the needs and opportunities for mathematics in this country, so that we may play our part in the fulfilment of this role. The New Zealand Mathematical Society has shown initiative and vigour in its seven years of existence. Given enthusiastic support from its membership, we can be confident that the Society will continue to display these characteristics. May I leave you with one word that I think is central to the Society's future and to its involvement with the shaping of the future of mathematics: that word is professionalism.

Council met twice in full session, held two regional meetings (in Palmerston North and Christchurch) and a postal meeting to deal with the matters I have mentioned plus a number of smaller activities. I wish to thank all members of Council for their efforts on behalf of the Society, and especially the Secretary, Dr. Gillian Thornley, whose thorough contribution has been of great support to me. Our thanks and best wishes go to those who are retiring from Council at this time.

W.D. Halford

REPORT ON THE DISBURSEMENT OF THE CONVENTION TRAVEL FUND 1981

Application forms were distributed with the August Newsletter. Batch lots were also sent to each university, AMD, PEL and advertisements were placed in the NZMS Newsletter and New Zealand Mathematics magazine.

18 applications were received by the due date (30 January) and there was one late application.

A list of tentative allocations was drawn up giving the larger awards to those with little or no travel support. An effort was made to ensure that each applicant obtained the airfare from one source or another.

Applicants were then informed of their tentative allocation and asked to supply an up-to-date declaration of financial assistance from other sources and evidence of registration for the Convention. As a result, one application was withdrawn and some people voluntarily reduced their allocations. This allowed us to make a grant to the late applicant.

Payments were made in three batches as replies were received (March 31, April 8 and April 28). Applicants were asked to return the money should they be prevented from attending the Convention.

Grants ranging from $50 to $350 were made to 18 people. Total payments were $2855 leaving a balance of $4 in the fund.

We intend that the balance of $4 be transferred to the general fund to contribute to postal expenses.

Dean Halford, President *Gillian Thornley, Secretary*

MEMBERSHIP SUBSCRIPTIONS NOW DUE

The rates are as follows:

Ordinary member	$15.00
Reciprocal member	$ 7.00
Student	$ 2.00

Please send your name and address with your remittance to the treasurer:

Dr. J.L. Schiff - Treasurer, NZMS, Department of Mathematics,
University of Auckland, Private Bag,
AUCKLAND.

News and Notices

VACANCY IN OPERATIONAL RESEARCH DSIR, AMD: EXPERIENCED PRACTITIONER OR RECENT GRADUATE

We are seeking a graduate to join our operational research group in Wellington immediately.

Applied Mathematics Division has an active OR group of five people out of a full professional mathematical and statistical staff of 30. The group carries out a varied range of assignments, from projects with other government departments to advisory and consultant work with industry groups. Much of the work has been in the areas of transport, distribution, manufacturing, agricultural processing, and energy. Future projects are also likely to be in those areas. A feature of the work, however, is its variety.

Applicants should have a good honours degree and can be either a practitioner with several years experience or a recent graduate. They should have taken courses in one or more of: operational research, engineering, statistics, economics, mathematics or psychology. They should also be effective at oral and written communication, and be interested in problem solving, and working with other people.

The position is a challenging one with good prospects for further experience and advancement. Starting salary is dependent on qualifications and experience and is according to the government scientific scale (initial maximum up to $16,000 for new graduates, and up to $22,500 for experienced practitioners).

Please address enquiries to:

Dr. Hamish Thompson, Director, Applied Mathematics Division, DSIR,
Box 1335, Wellington.

VIDEOTAPE: PROFESSOR S. PAPERT - TOPICS IN MINDSTORMS

This tape of Professor Papert's invited address to the Second Australasian Mathematics Convention in Sydney last May is now available and is compatible with NZ video systems. A small hire fee of $3.99 covers outward postage and packaging and handling. Bookings, accompanied by the hire fee in cash or cheque (made payable to the NZ Mathematical Society), should be made with

Dr. W. D. Halford, Department of Mathematics & Statistics,
Massey University, Palmerston North.

Those who missed this extraordinary presentation at Sydney and who are unaware of Seymour Papert's work on computer techniques with children are referred to his recent book *Mindstorms*, which gives the background to the lecture.

RSNZ NATIONAL COMMITTEES FOR 1981/82

Mathematics (I.M.U.)
Prof. B. A. Woods (Convenor) (3), Prof. J. J. Deely (1)
Dr. D. B. Gauld (2), Mr. K. E. Jury (2), Dr. M. G. Roberts (3), Dr. E. Thornley (1)
Theoretical and Applied Mathematics (IUTAM)
Dr. I. G. Donaldson (Convenor) (1), Mr. A. L. Andrews (2), Dr. P. Bryant (3),
Dr. M. Fama (3), Prof. C. M. Segedin (1), Mr. P. C. Spearman (2).

THE CONGRESS AND GENERAL ASSEMBLY OF IMU, WARSAW, 11-19 AUGUST 1982.

At the General Assembly of the International Mathematical Union next year which will be held in Warsaw next August in conjunction with the International Congress of Mathematicians, elections will be held of the Executive Committees of the IMU, of ICMI (International Commission on Mathematical Instruction) and of the CDE (Commission on Development and Exchange). The National Committee for Mathematics has been invited to appoint a delegate, and we hope that again we will be able to find a representative. (Dr. Graeme Wake was our delegate to the 1978 Congress and Assembly: see his report in NZMS Newsletter No. 13, Dec. 1978).

We have also been invited to nominate candidates for the committees mentioned. The National Committee has no proposals at present on this matter, but would entertain suggestions from any New Zealand mathematician. Nominations are asked for not later than 31 December 1981. However, it appears from the revised rules for IMU elections that the possibility exists of later nomination. We would remark that these rules, although at first sight the very paradigm of Byzantine complexity, are by comparison with those they supersede a cautious step towards democratic process.

B. A. Woods, Convener, N.Z. National Committee.

PROBABILITY THEORY VINDICATED (JUST)

In Newsletter No. 20 it was reported that the Massey statisticians were to challenge the public to games of chance on Open Day, and we thought that the results might be of interest.

One game required a coin to be tossed until either the sequence HTT (win to the statisticians) or TTT (win to the public) appeared. Most people started tossing confidently, but rapidly lost confidence as they went on. The statisticians won only 84% of the games, almost one standard deviation fewer than the 87½% they might have expected. Apparently the gods thought the public were being conned.

A dice game where three standard dice were thrown to obtain a chosen number from 1 to 6 was rather more fair. A fair number of the public seemed to be a little puzzled that the statisticians won 56% of the time (when the number did not turn up), although this figure was below the 58% the statisticians might have expected.

More interesting was the game involving three non-standard dice. They were marked 1,2,3,4,5,6; 3,3,4,5,6,6; and 1,2,2,4,9,9. As they were cut from a piece of scrap wood, the subtleties of probability theory were barely relevant. The game was that the public chose one die, then the statisticians chose, and then both tossed, the winner being the thrower of the higher number. Although each die gave 3.5 on average, the statisticians reckoned they could gain an edge by never choosing the die with 9's on. It was a close thing, and the public were still winning after lunch. By the end of the day reason had prevailed, and the statisticians won 54% of the games.

Very few members of the public seemed particularly concerned about the theoretical odds though. They were quite happy just to play the games.

G.C.A.

SIXTH AUSTRALIAN STATISTICAL CONFERENCE

Preliminary Announcement: Organised by the Statistical Society of Australia. To be held at the University of Melbourne on 23-27 August 1982. Interested persons should contact the Conference Secretary: Mr. I. Gordon, Department of Statistics, University of Melbourne, Parkville, Victoria, Australia, 3052.

THE NEW ZEALAND ASSOCIATION OF SCIENTISTS

On December 6th and 7th, 1980 a conference entitled: "Freedom of Information and the State" took place at Victoria University of Wellington. The conference was supported by many groups and organisations and gained wide publicity. The opening discussion paper was presented by Sir Guy Powles. Conference attendants unanimously endorsed the following Declaration which was based upon seven major principles which the conference members considered essential to any proposed Freedom of Information legislation.

Members of NZMS are invited to send comments to our secretary, for consideration by the next A.G.M.

DECLARATION: PRINCIPLES FOR A FREEDOM OF INFORMATION LAW

FOR DEMOCRATIC GOVERNMENT to survive and adapt to an increasingly complex and technological world all citizens must have the power of knowledge, both as a safeguard to fundamental rights and freedoms, and as the prerequisite to effective participation in a working democracy.

Openness of government is essential for participatory democracy, and openness of government is likely to promote better government.

THEREFORE:

The time has come when the rights of each New Zealand citizen to have accesss to documents held by the various organisations of government must be established and protected by law.

Without pre-empting further public discussion experience shows that a strong and effective law must include the following features:

FIRST: It must unequivocally declare that a general principle of government administration is open public access to information and that secrecy is the exception. The burden of proof should be on government to show why information should not be released.

SECOND: It must provide for full and easy public access as a legal right, available to any citizen.

THIRD: It must list, narrowly and specifically, the types of documents that may be kept secret; must specify how long they are to be kept secret; must permit earlier release if this does not harm the public interest; and must require non-secret parts of documents to be released.

FOURTH: It must contain provisions for the enforcement of access, by limiting the time for handling requests and appeals, requiring written reasons for a refusal, as well as significant penalties for non-compliance.

FIFTH: It must provide an easy appeal to an independent authority, including a final binding appeal to the courts, and allow a successful applicant to recover costs.

SIXTH: The scope of the law should be broad. Unless separate laws are passed for the purpose it should allow citizens access to personal information on themselves and protection from a third party seeking information on an individual; require government departments to make available an index of the kinds of information they control; require open meetings of governmental bodies, and extend its scope to cover state and local government.

SEVENTH: Because many other laws contain provisions for secrecy, either the freedom of information law must override them or they must be effectively amended to conform with it in practice and spirit.

P.O. Box 1874, Wellington, New Zealand.

Local News

AUCKLAND UNIVERSITY

DEPARTMENT OF MATHEMATICS

Associate-Professor David B. Gauld has been promoted to Professor, and appointed the Head of Department for a 5 year term, commencing 1 June 1981.

Associate-Professor Gordon A. Hookings, former Head of Department, spent 6 weeks at Brunel University, attending a Conference on Finite Elements and Applications. During his absence, Professor George F. Seber was Acting Head of Department.

Professor Tim Holt (University of Southampton) is a visitor in the Statistics Unit for the second term.

Associate-Professor Don Field is on leave at the University of Minnesota.

Professor John Hunter has returned to Glasgow University.

At the Second Australasian Mathematics Convention, held at the University of Sydney from 11 to 15 May, the following members of the Department presented papers:
Robert P.K. Chan: "Nearness - an approach to continuity and limits".
A-Prof. David B. Gauld: "Recent results in quasi-conformal unknotting".
A-Prof. Peter J. Lorimer: "Some special collineation groups of finite projective planes".
Dr. Ivan L. Reilly: "On non-symmetric topological structures".
Dr. Joel L. Schiff: "Some new results in potential theory".

Seminars:

Dr. Stuart Scott (University of Auckland) gave a series of seminars on -
Near-rings, including topological consequences of algebraic geometry, and geometric consequences of Near-fields.
Gavin J. Martin (University of Auckland) gave a series of seminars on -
"Hausdorff separation of space-time".
Dr. Lee Kaiser (University of Auckland):
"Approximate degrees of freedom tests in linear models with unequal error variances".
Prof. C.T.C. Wall (University of Liverpool):
"The shape of a piece of bent wire", and "Classification of cubic curves".
Prof. John Hunter (University of Glasgow):
"Algebraic integers on the unit circle".
Prof. S.R. Searle (Cornell University):
"Estimation in the general (cell mean) linear model".
Dr. C.S. Withers (AMD DSIR):
"Bias reduction for functionals of the c.d.l."
John Maindonald (AMD DSIR):
"Analysis of data for tests on chemicals to prevent grass-grubs from feeding".
Peter Metcalf (University of Auckland):
"245-T and birth defects".
Len Couch (Dept. of Statistics, Wellington):
"Errors in surveys and the effects of data analysis".
Dr. J.F. Rigby (University of Cardiff):
"Configurations of circles and points; or, Forty-five tangent circles".
Prof. Ross Unwin (M.I.T.):
"Group representation and geometric quantisation".

Professor Ivar Stakgold, of the University of Delaware, is the NZMS Visiting Lecturer for 1981. He delivered an expository lecture on "Classical and Modern Optimization" on 18 June, and a research seminar on "Bifurcation Theory" on 19 June.

DEPARTMENT OF COMPUTER SCIENCE

As part of the M.Sc. course, the 4 students and the department staff are giving a series of seminars on various topics in computing.

A series of seminars on numerical methods for Ordinary Differential Equations has been given by Professor Graeme Cooper, Professor John Butcher and Dr. Kees Dekker.

John Whale and Garry Tee attended the Second Australasian Mathematics Convention, at the University of Sydney in May 1981. John Whale gave a half-hour lecture on "Graph searching techniques and parallel computations"; and Garry Tee a 1-hour lecture on "The Heritage of Charles Babbage in Australasia", describing the many relics of Charles Babbage which he has found in New Zealand and in Sydney.

Professor John Butcher is away for most of July, attending a conference at Oberwolfach on Stiff Ordinary Differential Equations. He will also give seminars at Humboldt University (East Berlin), at the universities of Aachen and Tübingen (West Germany) and the universities of Geneva and Fribourg (Switzerland). Soon after his return, he is scheduled to deliver his Inaugural Address on 30 July; entitled "Down with computers".

G.J.T.

DEPARTMENT OF COMMUNITY HEALTH, SCHOOL OF MEDICINE

Lynne Gilmore and Judith Maderasz presented a Departmental Seminar on the analysis of the Comedca Survey.

Peter Mullins presented a talk entitled, "Making Medical Decisions".

P.R.M.

DEPARTMENT OF THEORETICAL AND APPLIED MECHANICS

Professor Ian F. Collins has recently taken up his position as Head of Department, replacing Professor Cecil Segedin who retired at the beginning of the year. Professor Collins studied mathematics at King's College, Cambridge, and was awarded a BA with First Class Honours in 1962. For the next three years he was a Scientific Officer at the Admiralty Research Laboratory, Teddington, working on new ship propulsion systems and other classified studies. Returning to Cambridge to complete a Ph.D, he undertook research into the mechanics of glaciers, in collaboration with members of the Scott Polar Research Institute and the Cavendish Laboratory.

Professor Collins joined the staff of the University of Manchester Institute of Science and Technology in 1968, and since then he has been concerned especially with the engineering applications of plasticity theory, and has developed analytical and numerical methods for solving problems in this area. These are of value in many branches of mechanical and civil engineering, including metal-forming processes, design of structures, theories of friction and wear, and soil mechanics. In 1979 he spent six months as a Visiting Scientist at the U.S. Steel Research Laboratories near Pittsburgh, applying theoretical models to a number of production problems.

Mr. Robert McKibbin has joined the staff as a full lecturer, although shared with the Geothermal Institute. Robert has been a Junior Lecturer for the past year and is continuing his work on the fluid mechanics of geothermal systems.

The Department is at full staff strength this year and is maintaining its student numbers in the Engineering Science course with about the nominal quota of 15 at each of the three Professional years, and a graduate complement of six ME, two MPhil and six Ph.D enrolments. In addition there are the major service courses to all other Engineering departments at the first and second professional years, as well as third year and masters papers and involvement with Operations Research in collaboration with Science and Commerce Faculties.

M.R.

MASSEY UNIVERSITY

The applied statistics strength of the department has been increased by the arrival of two new members of staff with interests in this field.

Hugh Morton studied at Rhodes University in South Africa, the University of Wales and Cambridge University; he then moved to Australia, where he taught at the University of New England and at the Canberra College of Advanced Education. His main field of interest is the design and analysis of experiments. He has a wife and two children, and enjoys squash and bridge.

Dr. Tom Hassard is a graduate of Queen's University, Belfast, and was on the staff of the Department of Medical Statistics there from 1974 to 1980. His research interests are in multivariate statistics, especially as applied to biological and ecological problems. He is married with a small son, and is a keen fisherman.

Susan Byrne has just returned from a short leave in the U.K. During her leave she acquired a Singapore germ which put her in hospital for a week, a Ph.D. from London University, and some research time at Imperial College where she continued her work on quadratic programming.

Seminars:

"Agreement between two Raters" (Dick Brook)).
"The Shape of a Bent Piece of Wire" and "Classification of Cubic Curves", (Prof. C.T.C. Wall, FRS, University of Liverpool).
"The Great Mathematical Sputnik of 1979", (Les Foulds, University of Canterbury).
"Residual Plots for Continuous and Discrete Data", (Douglas Stirling).
"Intersecting Diagonals of Regular Polygons", (Dr. J.F. Rigby, University College, Cardiff).

M.R.C.

VICTORIA UNIVERSITY

Rob Goldblatt has been promoted to a personal Chair of Mathematics.

Ken Pledger has been awarded a Ph.D. by the University of Warsaw for his work on the foundations of projective and elliptic geometry involving notions from modal logic.

At the time of writing there are three overseas mathematical visitors in Wellington: Prof. Ivar Stakgold (University of Delaware), this year's NZMS Lecturer, Prof. Roy Leipnik (University of California at Santa Barbara) whose current interest is in strange attractors and who is visiting Applied Mathematics Division DSIR, and Mrs. Betty Cumming (Monash University) who is visiting the University Teaching and Research Centre and is particularly interested in Keller Plan teaching of mathematics.

The Logic Conference in May was a success, drawing many participants in both mathematics and philosophy from Australia, N.Z. and even the U.S.A. and Sweden.

So was a day of applied mathematics seminars organized by A.M.D. to mark Professor Stakgold's visit, with talks given by him and various members of the Mathematics Department, AMD, Physics and Engineering Lab. DSIR, and the Ministry of Agriculture and Fisheries.

J.F.H.

DSIR, AMD

WELLINGTON

Gillian Allott has joined the division from the Stats. Dept. John Reynolds has accepted an appointment at Wellington AMD (formerly Massey University., and currently at North Carolina). Peter La Roche has left AMD and is job seeking in the U.S.

AMD held a one day Stats. Seminar on July 2nd,
Speakers: J. Maindonald (AMD, Auckland), Ross Renner (VUW), Tim Holt (Southampton), Geoff Eagleson (CSIRO - DMS, Sydney), Robert Davies (AMD), Colin Cryer (Wellington Clinical School).

and a one day Maths - Physics Seminar is planned for July 16th,
Eleven speakers; principal speaker Ivar Stakgold.

G.W.

MT. ALBERT RESEARCH CENTRE

Tony Cooper, after completing the coursework for an M.Sc. at Massey University and after a short spell at A.M.D. in Wellington, has joined the substation. Tony's main responsibility is statistical consulting with biologists at the Centre.

Graeme Edwards has joined the substation following two years' leave in order to do a Ph.D. in the Department of Theoretical and Applied Mechanics at Auckland University. Graeme's work is in operational research, with Auckland industry and local bodies. A current project is passenger scheduling at Auckland International Airport.

Chris Triggs, currently at Nottingham University, is expected to join us around the beginning of October. He will do statistical consulting, both inside and outside the Centre.

J.M.

CANTERBURY UNIVERSITY

Professor John A. Baker arrived at the end of June to spend his sabbatical year in the department. He is a professor of pure mathematics at the University of Waterloo, Ontario, and an editor of Aequationes Mathematicae. His main interests lie in functional equations and analysis, including applications. He is giving a series of lectures on "Methods in Functional Equations".

Dr. Ivar Stakgold, the N.Z.M.S Visiting Lecturer for 1981, spent two days in the department at the end of July. He gave two talks, one to the Canterbury Mathematical Association on "Classical and Modern Optimization" and one to the department on "Methods of Nonlinear Analysis". He also joined the half-dozen departmental bridge fiends in their weekly dissipation at the Christchurch Bridge Club.

Paul Mathews, who is completing an M.Sc., has been awarded an 1851 Exhibition Science Research Fellowship. He will be leaving in September for the University of Dundee to work for a Ph.D in numerical analysis and optimization.

Thirteen members of the department attended the Second Australasian Mathematics Convention in Sydney, in May, and between them presented ten papers. Dr. Graham Wood went on to present papers at Flinder's University in Adelaide and the University of Western Australia in Perth.

Seminars:

Visiting speakers included:
Professor R.E. Rosenthal (University of Tennessee).
"A Nonlinear Network Flow Algorithm for Maximization of Benefits in a Hydroelectric Power System".
Professor C.T.C. Wall, F.R.S. (University of Liverpool).
"The Shape of a piece of bent wire".
Dr. H.F.H. Reuvers (Eindhoven).
"An Introduction to Galois Theory".
Dr. Peter D. Eades (University of Queensland).
"Integral Quadratic Forms and Orthogonal Designs".
Dr. Bruce Weir (North Carolina State University).
"Statistical Analysis of Genetic Data".

Department members gave the following seminars:

Dr. A.W. McInnes, "Approximation by interpolating polynomials".
Dr. D.J.N. Wall, "Numerical solution of an integral equation from electromagnetism".
Mr. S.P. Matthews, "Calculation of best linear discrete Lp approximations, $1 < p < 2$".
Dr. I.D. Coope, "Sparse optimization".
Dr. G.R. Wood, "Compact convex sets and mixture identifiability".
"Extreme points of convex sets of measures". "Automorphisms of semigroups of functions".
Dr. M.H. Smith, "Minimax stopping rules".

R.S.L.

OTAGO UNIVERSITY

Professor C.T.C. Wall of the University of Liverpool and Professor E.R. Harrison of the University of Massachusetts at Amherst visited recently, both giving Seminars (listed below). Professor Harrison also gave a Science Faculty Open Lecture entitles "Physics and Philosophy of Cosmology".

Our 1981 postdoctoral fellow, Dr. Marston Conder, has been awarded a fellowship from the (British) Royal Society, under the European Science Exchange Programme. He plans to work with Professor Olaf Tamaschke and others on permutation groups and Schur-rings, spherical functions, etc. at the Mathematische Fakultät, Universität Tübingen, Federal Republic of Germany, for nine months (commencing January 1982).

The major activities of the Otago Mathematics Association are described below (by John Rayner who is on the Committee of the OMA).

After attending the 2nd Australasian Mathematics Convention in Sydney, Mr. John Rayner walked part of the way home. To be precise, he walked 50 kilometres around Cambridge in the Waikato and, in so doing, took the New Zealand road walk championship! His time was 4 hours 45 minutes, which was 2 minutes faster than the runner-up.

The latest weekly seminars have included:

Dr. J.A. Shanks, "A First Byte at the Apple".
Dr. M.J. Curran, "Converse Lagrangian Groups".
Dr. J. Clark, "Local Rings and Flat Ideals".
Prof. E.R. Harrison (Department of Physics and Astronomy, University of Massachusetts at Amherst), "Fusion by Brute Force".
Prof. C.T.C. Wall (University of Liverpool), "Catastrophes: Elementary, Simple, and Advanced".
Dr. G.F. Liddell: "Moving Around the Sphere".
Prof. W. Davidson, "Consequences of Dirac's Large Numbers Hypothesis".
Dr. G.F. Liddel, "Structured Programming and Apple Pascal".
Dr. Terry Crooks (of Higher Education Development Centre), "Computer Aided Instruction".
Dr. J.H. Harris, "What's So Logical about the Logical Axioms?"
Dr. D.J. McCaughan, "Forty Years of Coalescence".

G.O.

OTAGO MATHEMATICS ASSOCIATION

O.M.A's two main projects of the year are the parallel papers and Maths Games. The parallel papers are examinations (and solutions) paralleling School Certificate, University Entrance and Bursary Mathematics papers. These have all been printed. Orders have closed and exceed last years by roughly 20%. Over 1500 papers have been requested, indicating enthusiastic support by teachers for this service.

Organisation of our Maths Games, scheduled for October 9th and 10th, is well in hand. Last year some 900 pupils from forms 1 to 6 participated. Activities include relays, a university-challenge type quiz, and project display.

J.R.

STAFF EXCHANGES

At the May 1980 Subject Conference in Mathematics held in Auckland interest was expressed in the possibility of exchanges of staff between universities and other institutions. This article presents a brief history of the matter together with a synopsis of current provisions within the universities for such exchanges.

For the benefit of the scanning reader the gist is this: if you have in mind a possible exchange and gain approval by your department head, followed by university council, then the exchange may go ahead. Time spent on such an exchange will generally count as service for the purposes of study leave. It would appear that only Victoria University has funds available for assisting such exchanges.

THE HISTORY

Current attitudes to staff exchanges are the result of three events which occurred in 1975:

1. July 1975. Professor Wilf. Malcolm of the Mathematics department of Victoria University produced a paper outlining a scheme for staff exchanges. It was to be considered by the executive of the local branch of the A.U.T.

2. October 1975. The A.U.T. proposed a staff exchange scheme, based on Prof. Malcolm's paper, to the Vice Chancellor's Committee. The proposal was as follows:

INTRODUCTION:

The Association of University Teachers sees the declining mobility of academic staff in New Zealand universities as having a significant influence on the general life of the New Zealand university system. One harmful consequence of the static staff composition of university departments is the lack of opportunity for the flow of new ideas, attitudes and practices through the life of the department. Fresh approaches invariably result from new people being appointed to the academic staff.

It is in this context that the Association submits that consideration should be given to establishing an exchange scheme for permanent academic staff in New Zealand universities along the lines of a paper produced by Professor W.G. Malcolm of the Mathematics Department at Victoria University.

INITIAL SCOPE OF EXCHANGE SCHEME:

Professor Malcolm's scheme examines the possibility of a two-way exchange of staff, i.e. where staff at two universities decide to exchange their positions. There is a mention too of a possible extension of this to include a three-way exchange of staff. The proposal at this stage however, does not include staff with temporary status only.

It is not proposed that an exchange be restricted to persons of the same academic status, or that their teaching and research interests match exactly. The general principle underlying any exchange would be that the two (or three) departments involved could see their way clear to release their own staff members to other departments and also incorporate visiting staff members into the life and work of the home department for the term of the exchange.

PURPOSE:

There are compelling reasons for proposing an inter-university staff exchange scheme and these relate largely to the advantages that accrue to individual staff members and to the departments in which they work. On the individual level the Association submits that staff exchanges would result in a general enlargement of a person's experience within New Zealand through sharing in the teamwork of another department in another university. In particular this close working contact with other colleagues in neighbouring universities could serve to strengthen the commitment of academics in a national setting by extending their view of their role as university teachers and scholars. From the department's point of view the new ideas, attitudes and methods that are facilitated by staff exchanges can only help to diversify and broaden the general strength and well-being of university departments.

TERMS OF EXCHANGE:

It is proposed that the exchange scheme be for a short term of one year, possible dates being from February 1 to December 20 in the year in which the exchange operates. Staff members on exchange would be paid by the home university, as if they were working in that home university, i.e. at the normal rate. Also, for considerations of university service the time

spent on exchange would be held by the home university to be time spent in one's normal position. This would be particularly so in regard to leave eligibility. Staff members on exchange while they would be eligible to enjoy the general staff facilities available in the host university, would not be able to approach that university for research grants or travel grants to attend conferences.

On accepting an exchange position a staff member would undertake teaching and research duties under the direction of the head of department in the host university in exactly the same way in which other members of the academic staff would undertake such duties. These duties would of course be in areas appropriate to the experience and academic interest of the staff member concerned.

EXISTING STAFF EXCHANGE SCHEMES:

While the Association sees an inter-university scheme as being particularly innovative, it is not entirely without precedent either in the university system or within the wider community. The question has been discussed in Australia and the U.K., the latter situation being outlined in Appendix 1 of this paper. The Faculty Exchange Centre in America co-ordinates an international university exchange scheme, which has been in operation for two years. It boasts an international membership of some 400, including some from New Zealand.

ADMINISTRATION:

An exchange scheme for university staff could be co-ordinated by the Secretariat of the New Zealand Vice-Chancellors' Committee. The Association invites the Committee to recommend the proposal to each of the University Councils with a view to seeking their cooperation in such a venture.

A list of departments and individuals could be forwarded to the Secretariat of the New Zealand Vice-Chancellors' Committee for cataloguing and circulating to all participating universities. Arrangements for individual exchanges would then be the responsibility of individuals and their departments. After initial negotiations had taken place between the two individuals concerned and their respective departments (in a two person exchange) a recommendation from heads of departments would be forwarded to respective Vice-Chancellors for their final approval. The Secretariat of the New Zealand Vice-Chancellors' Committee could then be advised of successful agreements and at the end of the exchange year a list of any exchanges that might be planned for the next or succeeding years could be forwarded to that Committee for their records.

COSTS:

The New Zealand Vice-Chancellors' Committee would need to take no part in the actual negotiations preceding an exchange. It is envisaged that their function would be as a central co-ordinating body for distributing information relating to potential exchanges.

Part of the commitment undertaken by participating universities would be the setting up of a fund to finance return surface fares for any staff member and dependent family. All other costs would be met by the individuals concerned.

Accommodation arrangements would be the responsibility of the staff member on exchange. An exchange of houses between staff would be one way over this problem, but of course it is not envisaged that this would be a necessary condition of any exchange. The acceptability of house exchanges could be gauged in the Committee's initial gathering of information for circulation to the universities.

EXCHANGE OF STAFF IN THE WIDER COMMUNITY:

While this proposal has been formulated in relation to the exchange of staff within the New Zealand university system it may be possible to consider extending such a scheme to other tertiary institutions, to government departments and even to the wider business community.

3. December 1975. The VCC discussed the proposal, *considered that it had merit and agreed to support the principle of exchanging staff.* However the VCC did not go along with the idea of a formal scheme with a procedural structure, as outlined in the proposal. Rather, universities were advised that the VCC *approved in principle the exchange of academic staff* on a university to university basis, with the *initiative being left to individual members of staff.*

(Note: i,j do *not* come from a map $V \to U$ - the only conditions are that j and F are transverse and the square a pullback.) An unfolding is *versal* if every other can be induced from it (i and j are not unique, so it is not universal; the word is also related to transversal). Versal unfoldings of minimum dimension (miniversal) are however essentially unique, and there is a recipe for constructing one which gives a normal form. This is quite easy to apply in practice.

Example: $A_k \quad f(\underset{\sim}{x}) = x_1^{k+1} + \Sigma_2^n \pm x_r^2$

Unfolding monomials: $x_1, x_1^2, \ldots, x_1^{k-1}$

$$F(x_1, \ldots, x_n, t_1, \ldots, t_{k-1}) = (x_1^{k+1} + \Sigma_1^{k-1} t_i x^i + \Sigma_2^n \pm x_r^2, t_1, \ldots, t_{k-1}).$$

In all cases, as here, F is linear in the t_s, and one need only list their coefficients: the unfolding monomials. Note that the A_2 case gives the 'cusp' listed earlier. The next few examples are as follows:

$D_k (k \geqslant 4) \quad f(\underset{\sim}{x}) = x_1^{k-1} \pm x_1 x_2^2 + \Sigma_3^n \pm x_r^2$.

Unfold with $x_2, x_1, x_1^2, \ldots, x_1^{k-2}$. Again $x_3 \ldots x_n$ are not relevant to the calculations. We omit such variables in further examples.

E_6	$f = x_1^3 + x_2^4$	unfold with	$x_1, x_2, x_1x_2, x_2^2, x_1x_2^2$
E_7	$f = x_1^3 + x_1x_2^3$		$x_1, x_2, x_1x_2, x_2^2, x_2^3, x_2^4$
E_8	$f = x_1^3 + x_2^5$		$x_1, x_2, x_1x_2, x_2^2, x_1x_2^2, x_2^3, x_1x_2^3$
P	$f = x_1^3 + x_2^3 + x_3^3$		$x_1, x_2, x_3, x_1x_2, x_1x_3, x_2x_3, x_1x_2x_3$

We now turn to the question of *density* of stable maps from n dimensions to p dimensions. This still holds for low values of p: assuming $n > p$, the normal forms are given by the above unfoldings (where the suffix is at most p): if $p = 6$, for example, we have

$$A_1, A_2, A_3, A_4, A_5, A_6, D_4, D_5, D_6 \quad \text{and} \quad E_6 .$$

For $p = 7$, however, stable maps are no longer dense: the difficulty arises mainly from case P above, where a correct listing of f involves a parameter $\lambda : f = x_1^3 + x_2^3 + x_3^3 + 3\lambda x_1x_2x_3$.

In fact the above is somewhat incomplete, as I have omitted discussion of unfoldings of maps into $\mathbf{R}^2$, and this leads to another breakdown of density of stable maps in the case $n = 8, p = 6$ (the only such when p is less than 7) as follows.

Consider a map $f : \mathbf{R}^8 \to \mathbf{R}^6$. The (first) derivatives at any point $\underset{\sim}{x} \in \mathbf{R}^8$ make up a 6×8 matrix. For such a matrix to have rank 4 imposes 8 conditions: if we partition it as $\begin{pmatrix} A & B \\ C & D \end{pmatrix}$ (where A has 4 rows and 4 columns) and A is nonsingular, the conditions reduce to $D = CA^{-1}B$. Imposing 8 conditions on the point $\underset{\sim}{x} \in \mathbf{R}^8$ allows (in general) certain isolated points $\underset{\sim}{x}_0$: we study one of them.

Near such an $\underset{\sim}{x}_0$, f can be considered an unfolding of a map $g : \mathbf{R}^4 \to \mathbf{R}^2$ whose first derivatives at x_0 vanish. So the Taylor series starts with terms of order 2, defining quadratic forms

$$y_1 = \underset{\sim}{x}^t M_1 \underset{\sim}{x} + \text{terms order} \geqslant 3$$

$$y_2 = \underset{\sim}{x}^t M_2 \underset{\sim}{x} + \text{terms order} \geqslant 3$$

The eigenvalues - solutions of $\det(M_1 - \alpha M_2) = 0$ - do not depend on the choice of coordinates $\underset{\sim}{x}$: in fact these 4 eigenvalues give directions $y_1 - \alpha y_2 = 0$ in $\mathbf{R}^2$. The cross-ratio λ of the four values of α does not depend on these coordinates either, and is intrinsic to g, and hence to f.

One can now see that f is not stable, and cannot be approximated by a stable map. For if g is near f, there is a point y_0 near x_0 where dg has rank 4: arguing as above gives a cross-ratio $\lambda(y_0)$. This can be changed by a small change in g, so g is not stable.

In practice one deals with such a failure of one's original ideas by changing the definitions. Weaken the notion of stability to topological stability (the smooth coordinate changes are replaced by homeomorphisms of $\mathbf{R}^n$ and $\mathbf{R}^p$ - note that even C^1 diffeomorphisms are not supple enough), then it turns out that topologically stable maps are always dense - another theorem of Mather, but needing very different methods. The basic idea (which is very hard to make precise) is to treat certain families such as

$$(x_1,x_2,x_3) \mapsto x_1^3 + x_2^3 + x_3^3 + 3\lambda x_1x_2x_3$$

or $$(x_1,x_2,x_3,x_4) \mapsto (x_1^2 + x_2^2 + x_3^2,\ x_2^2 + \lambda x_3^2 + x_4^2),$$

depending on one or more parameters λ, as a single class, and hence have a (topologically) versal unfolding needing fewer unfolding variables.

One can also show that (modulo some technicalities) topologically stable maps with $p \leqslant 6$ are stable in the first sense, and one can give effective normal forms as far as $p \leqslant 10$.

The reader who would like to know more is referred to two earlier surveys of the same area, which also contain fuller bibliographies.

J.N. Damon 'The relation between C^∞ and topological stability',
Bol. Soc. Bras. Mat. 8(1977) 1-38.
C.T.C. Wall 'Stability, pencils and polytopes',
Bull. London Math. Soc. 12(1980) 401-421.

Problems

Readers are invited to send problems for this section. Some indication should be given of how a problem has arisen and whether a complete solution is known and attribution of sources should be provided for problems that are not original. Attempts at solutions should be sent to the setter or to the Editor.

Problem 6. *(Polygon regions)*

Some elementary problems which came up in connection with the identifiability of mixtures of distributions:

a) Take a regular n-sided polygon and construct all the lines joining the n vertices. How many regions does this produce in the polygon? This problem has possibly been considered, so, alternatively, can anyone provide a reference to the solution?

b) Now consider two regions to be equivalent if some rotation of the polygon about its centre brings the first onto the second. How many equivalence classes does this produce? (For n even the solution will follow from a), but for n odd the problem seems interesting).

c) Having solved a) and b) now consider regions equivalent if they are congruent. How many equivalence classes are there now?

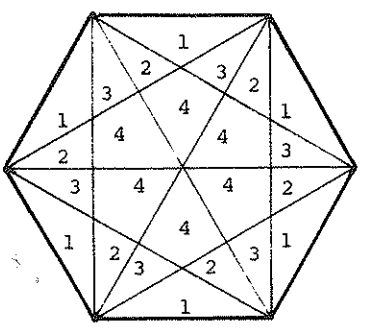
d) Finally, what's the answer to a) if we merely start with a convex (that is, not necessarily regular) n-sided polygon? (Presumably the same as a) if n is odd, but more than a) if n is even).

EXAMPLE: n = 6

a) 24 regions

b) $4 = (\frac{24}{6})$ rotation classes (labelled)

c) 3 congruence classes
(amalgamate rotation classes 2 and 3)



Graham Wood, Maths Dept., University of Canterbury.

[Stop Press: Massey's local news suggests they may have a head start!]

Book Reviews

DIGRAPHS: THEORY AND TECHNIQUES, by D.F. Robinson and L.R. Foulds.
Gordon and Breach Science Publishers, 1980.
XV, 256p. 23.5 cm. $55 N.Z. approx (hardback)

As the authors point out in their preface, a great many real life applications of graph theory are concerned with binary relations between elements. The purpose of this book is to study antireflexive relations on finite domains; such a relation can be represented by a loopless directed graph called a *digraph*.

The readership level aimed at is that of first or second year university student. The material would also be accessible to a good high school student, although in several of the earlier chapters he might be discouraged by the rapid introduction of new concepts, with strings of "definition/theorem/proof" interlacing them. It is hard to see how this could be avoided however, since graph theory is very thick on the ground with terminology and rather simple theorems, most of which are readily understood when referred to a diagram but tedious when written out. The authors provide useful sets of exercises throughout the text, giving readers plenty of opportunities to work with new ideas, and in places to extend them. In any section, students might profitably tackle the earlier exercises to get a soaking in the terminology, then go back to the theorems and proofs to check their understanding, and finally march forward confidently to the more difficult exercises and further concepts. The notion that theorems require proofs seems to be rare in students these days, and the ability to supply the proofs even rarer. Working through this book will certainly help instil the notion and foster the ability.

The authors have made valiant attempts to supply examples of applications of digraph theory, believing as they do that 'to miss the applications of digraphs is to miss a major part of their importance'. A random sample of topics they have used to place the mathematics in the real world is: description of the Carbon Cycle, traffic routing, study of subjects taken by University students, study of geological sites, activity networks. (No applications are given of the material of Chapter 8 - Matrices of Digraphs. This is rather surprising, as many could be found.)

The book begins with a quick trip (11 pages) through 'preliminary mathematics' (sets, functions, summation, linear algebra, maximum and minimum, induction). In the succeeding 56 pages it introduces the basic concepts of digraphs and their structure. There follow chapters on Acylic digraphs, Tournaments, Rooted trees, Networks, Activity networks, Matrices of digraphs and Graphs.

Solutions to selected problems are given, and an excellent classified bibliography for further reading is supplied.

The book is well produced, with clear typescript (photolithography, I believe).

I recommend this book as a text for any first course on Graph Theory, for mathematics students. Non-mathematics students, for example business studies, social sciences or engineering, would require a very good lecturer to help them over the symbolic hurdles. It is unfortunate that the hardback price is so high, as that will prevent its widespread adoption as a textbook.

J.C. Turner

MATHEMATICS IN NEW ZEALAND SECONDARY SCHOOLS, by Bevan W. Werry, New Zealand Council for Educational Research, Studies in Education No. 27, 1980.

There can be little doubt that, at the present time, mathematics is the subject of attention from all quarters, and in endeavouring to determine the future direction it is clear that information is required. Studies were made in the 1950's and a monograph *The Qualifications and Supply of Mathematics Teachers* was written by M.A. Bull and published in 1960. This of course leaves a considerable gap until the present time and when it is realised that the intervening 20 years cover the introduction of the 'new mathematics', the incredible growth of computing, and the development of such subjects as statistics and numerical mathematics, then the appearance of Bevan Werry's analysis must be greeted with considerable interest. To quote the foreword 'In this monograph Bevan Werry sets out to clarify our view of what is happening in mathematics education in New Zealand by summing the observations of a large and representative sample of teachers'. The monograph presents 'a factual account of what has been happening as seen through the eyes of teachers'.

The reviewer found the book extremely interesting although needing several bites for digestion. It contains a wealth of information in the way of tables and charts and the data are well supported by the accompanying text. The text includes an historical perspective on the school system, in itself interesting to outsiders, whilst the survey results show an abundance of trends and attitudes and give an insight into the current system. Throughout the discussion Werry relates, where possible, his results to those of Bull. This itself leads to some intriguing points. The monograph seeks to give the reader a picture of the nature of the subject, the students taking it, the teachers, and the relationship of mathematics and various types of schools. Chapters are devoted to the qualifications, training and supply of mathematics teachers; to the teachers' approach to mathematics; and to the running of a mathematics department. The monograph opens with a survey of mathematics in the schools and ends, perhaps predictably, with a chapter on the 'Future' where an author traditionally can indulge himself. In fact this chapter contains some excellent suggestions and the tenor is very moderate considering what might be said.

Amongst the many issues arising from the data, is that of the situation of girls and women in mathematics. The evidence here supports many of the claims made in articles in a recent New Zealand Mathematics Magazine. Another example, which the reviewer found disturbing, although he already knew the problem existed, was the serious shortfall in mathematics teachers. It appears that a significant amount of mathematics is being taught by non-specialists whose commitment is to other subjects. This even extends to heads of mathematics departments. The matter arises time and time again throughout the text, and is something that should give serious cause for concern and demand action.

Computing is also discussed. It is also clear that computing will have to stand on its own although it has been the dedication of the mathematics teachers that has enabled computing to gain any ground in the absence of policy from on high. The situation as discussed in the monograph gives a picture of computer usage at the time, and is interesting in itself. In a subject which is changing rapidly, Bevan has described the current situation well.

As already noted, the survey was wide ranging and Bevan Werry has compiled the results in such a way as to give the reader a full background, an interesting and detailed discussion of the results and clear summaries together with discussions at the end of each chapter. There is much to stimulate the reader interested in the teaching of mathematics and where the subject is going. This monograph is thus recommended to anybody, (not just the professionals), with an interest in mathematics. Parents should be encouraged to read it in order to understand the situation in the schools, and it should be compulsory reading for employers.

Certainly congratulations are due to Bevan Werry for such an exhaustive report.

ISBN 0-908567-13-8. Available from - New Zealand Council for Educational Research, P.O. Box 3237, Wellington, New Zealand.

R.L. Broughton

1982 AUSTRALIAN MATHEMATICAL SOCIETY APPLIED MATHEMATICS CONFERENCE

Bundanoon, 7th - 11th February

This annual gathering is an informal meeting of scientists, engineers and mathematicians all of whom have interests in the mathematical solution of problems. We wish to encourage the attendance and participation of all sections of the community who believe they may have problems which will interest mathematically oriented scientists. The meeting also provides an ideal opportunity for employers of mathematically trained personnel to talk with and influence the teachers of future employees. In an attempt to encourage participation from the Commercial and Industrial Sectors one day of the conference (Wednesday, 10 February) will be devoted entirely to the theme of MATHEMATICS IN INDUSTRY.

All persons willing to give a Contributed Paper are encouraged to respond to the first circular for the conference which will be sent out in mid-August. Persons wishing to receive the first circular or wishing further information should contact:

Dr. James M. Hill (Conference Director),
Department of Mathematics, University of Wollongong,
Wollongong, N.S.W. 2500.

Conferences

*** 1981 ***

August 23 - 28 (Montréal)
Tenth Conference on Stochastic Processes and their Applications
Details from A. Joffe, Centre de recherche de mathématiques appliquées, Université de Montréal, Case postale 6128, Montréal, Québec, Canada H3C 3J7.

August 24 - 27 (Parkville, Victoria)
Conference on Numerical Solutions of Partial Differential Equations
Details from Dr. F.R. Barrington, Mathematics Department, University of Melbourne, Parkville, Victoria 3052, Australia.

August 24 - 28 (Marseille-Luminy, France)
International Symposium on Stochastic Processes and Applications to Differential Operators in Mathematical Physics
Details from René Carmona, Department of Mathematics, Université de Saint Etienne, 25 rue P. Michelon, 42023 Saint Etienne, Cedex, France.

August 24 - 28 (Prague)
Fifth Symposium on General Topology and its Relations to Modern Analysis and Algebra
Details from Josef Novák, Chairman, Organising Committee, Matematický ústav ČASV, Žitná 25, 115 67 Praha 1, Czechoslovakia.

August 24 - 28 (Szeged, Hungary)
Third International Conference on Fundamentals of Computation Theory
Details from F. Gecseg, Bolyai Institute, University of Szeged, H-6720 Szeged, Hungary.

August 24 - 28 (Koszeg, Hungary)
International Colloquium on Stochastic Programming
Details from Secretary, Bolyai Mathematical Society, Budapest, Anker Koz 1-3, H-1061, Hungary.

August 30 - September 6 (Kiev)
Ninth International Conference on Nonlinear Oscillations
Details from Organising Committee, Institute of Mathematics, Repin Str. 3, 252004, Kiev-4, U.S.S.R.

August 31 - September 4 (Wroclar, Poland)
Fourteenth European Meeting of Statisticians
Details from W. Klonecki, Institute of Mathematics, Polish Academy of Sciences, 18 Kopernika Street, PL 51-617 Wroclaw, Poland.

August 31 - September 4 (Stanford, California)
Workshop on Computational Problems in Complex Analysis
Details from Gene Grolub, Computer Science Department, Stanford University, Stanford, California 94305, U.S.A.

August 31 - September 6
First Romanian - GDR Seminar on Banach Space Theory

September 7 - 11
Seminar on Control Theory in Differential Equations
Details of both the above from Zoia Ceausescu, Mathematics Department INCREST, Bdul Pacii 220, 79622 Bucharest, Romania.

September 8 - 10 (Austin, Texas)
International Symposium on Semi-infinite Programming and Applications
Details from James Vick, Mathematics Department, University of Texas, Austin, Texas 78712, U.S.A.

September 8 - 11 (Lindfield, New South Wales)
Australasian Symposium on Stereology, Image Analysis and Mathematical Morphology
Details from Dr. A.F. Reid, Symposium Chairman, ASSIA, Division of Mineral Chemistry, CSIRO, P.O. Box 124, Port Melbourne, Victoria 3207, Australia.

September 13 - 20 (Varna - Golden Sands, Bulgaria)
International Conference on Complex Analysis and Applications
Details from Conference on Complex Analysis and Applications, Institute of Mathematics, Bulgarian Academy of Sciences, 1090 Sofia, P.O. Box 373, Bulgaria.

September 21 - 26 (Metz)
Journées Arithmétiques
Details from Georges Rhin, Département de Mathématiques, Université de Metz, Ile du Saulcy, 87000 Metz, France.

September 25 - 26 (Oxford, Ohio)
Ninth Annual Mathematics and Statistics Conference
Details from David Kullman, Department of Mathematics and Statistics, Miami University, Oxford, Ohio 45056, U.S.A.

September 30 - October 2 (Aachen, West Germany)
Fourth Aachen Symposium. Theory and Applications of Signal Processing
Details from H.D. Lüke, Institut für Nachrichtentechnik, Melatener Strass 23, D-5100 Aachen, West Germany.

October 6 - 8 (Braunschweig, West Germany)
Dedekind-Tagung (algebra and number theory)
Details from Heiko Harborth, Technische Universität, D-3300 Bräunschweig, West Germany.

October 6 - 8 (Burlington, Ontario)
International Conference on Time Series Methods on the Hydrosciences
Details from A.H. El-Shaaravi, Aquatic Physics and Systems Division, National Water Research Institute, Canada Centre for Internal Waters, P.O. Box 5050, Burlington L7R 4A6, Ontario, Canada.

October 9 - 10 (Evanston, Illinois)
Third Midwest Conference on Probability
Details from Michael B. Marcus, Department of Mathematics, Northwestern University, Evanston, Illinois 60201, U.S.A.

October 9 - 10 (Fargo, North Dakota)
Tenth Annual Midwest Conference on Ordinary Differential Equations
Details from R.M. Mathsen, Department of Mathematical Sciences, North Dakota State University, Fargo, North Dakota 58105, U.S.A.

October 20 - December 11 (Trieste, Italy)
Autumn Course on Variational Methods in Analysis and Mathematical Physics
Details from International Centre for Theoretical Physics, P.O. Box 586, I-34100, Trieste, Italy.

October 26 - 28 (Cincinnati, Ohio)
SIAM Fall Meeting
Details from Hugh B. Hair, Society for Industrial and Applied Mathematics, 117 South 17th Street, Suite 1405, Philadelphia, Pennsylvania 19103, U.S.A.

October 28 - 30 (Nashville, Tennessee)
1981 IEEE Symposium on Foundation of Computer Science
Details from Arnold L. Rosenberg, Program Chairman, IBM Research Centre, P.O. Box 218, Yorktown Heights, New York 10598, U.S.A.

October 31 - November 2 (Washington, D.C.)
Annual Meeting of the American Society for Cybernetics
Details from Stu Umpleby, George Washington University, Washington, D.C. U.S.A.

November 9 - 13 (Singapore)
First South-East Asian Conference in Mathematical Logic
Details from C.T. Chong, Department of Mathematics, National University of Singapore, Singapore 0511, Republic of Singapore.

November 16 - 19 (Tuscon, Arizona)
SIAM Conference on Mathematical and Computational Methods in the Exploration and Extraction of Deep Mineral Resources
Details from Hugh B. Hair, Society for Industrial and Applied Mathematics, 117 South 17th Street, Suite 1405, Philadelphia, Pennsylvania 19103, U.S.A.

*** 1982 ***

January 11 - 16 (Mexico)
Fourth International Conference on Universal Algebra and Lattice Theory
Details from Octavio C. Garcia, Instituto de Matemáticas, Universidad Nacional Autonoma de Mexico, Cindad Universitario-Circuito Exterior, Mexico 20, D.F., Mexico.

August 8 - 13 (Montréal)
Tenth IMACS World Congress on Systems Simulation and Scientific Computation
Details from S. Sankar, Tenth IMACS Congress Chairman, Department of Mechanical Engineering, H929-12, Concordia University, 1455 Maisonneuve Boulevard West, Montréal, Canada H3G 1M8.

August 8 - 13 (Sheffield)
First International Conference on Teaching Statistics
Details from Conference Secretary, Department of Probability and Statistics, The University, Sheffield 8S3 7RH, England.

August 11 - 19 (Warsaw)
International Congress of Mathematicians
Details from Czeslaw Olech, Institute of Mathematics, Polish Academy of Sciences, Sniadeckich 8, P.O. Box 137, 00-950 Warszawa, Poland.

August 23 - 27 (Bonn)
XI International Symposium on Mathematical Programming
Details from Math. Progr. Secretariat, C/- Institute for Operations Research, Nassestrasse 2, D-5300 Bonn 1, W. Germany.

M.R.C.

Secretarial

MINUTES OF THE TENTH COUNCIL MEETING

held in St. Paul's College, University of Sydney
on Sunday 10 May 1981

PRESENT: W.D. Halford (Chair), M.R. Carter, D.B. Gauld, G. Olive, G.M. Thornley.

I APOLOGIES were received from J.H. Ansell, R.S. Long, D. Harvie, H.S. Roberts and J. Turner.

II MINUTES: Carter/Olive moved that the minutes of the Northern and Southern Regional meetings be confirmed. CARRIED

III MATTERS ARISING FROM MINUTES:

(a) Books for Developing Countries. A list of books was sent in December but there has been no reply.

(b) Common Seal. This had not been purchased since the president and secretary had second thoughts about the standard variety, noting a more elaborate design may be appropriate for use on awards etc. David will approach the School of Fine Arts, Auckland, for a design suitable for both purposes.

Letterheads. Nothing has yet come of enquiries at Massey and Canterbury for a new design.

(c) National Consultative Committee on Mathematics. Bevan Werry has written about this in the April Newsletter and also sent us minutes of their last meeting. There was some discussion as to whether NZMS should ask to be represented on this committee, and it was suggested that the secretary discuss this with Bevan. W.B. Wilson arrived.

(d) Diggle's paper has been passed on to the editor of "The Statistician" for publication.

(e) Conference on statistics education (August 1982). David Vere-Jones is looking for somebody to attend this.

(f) Council Personnel File. Fifteen replies have been received. Gillian will send a reminder letter and try to gather more replies before handing the file over to the new secretary.

(g) Policy Committee. Dean reported on the letter sent to the Statistics, OR and Computing societies. David Vere-Jones (Statistics) and Mervyn Rosser (OR) had reacted favourably. Dean and David (or his representative) were nominated to represent NZMS at the meeting on 31 July. It was suggested that we arrange for the meeting to be held at the Science Centre (RSNZ).

IV CORRESPONDENCE: Thornley/Olive moved that we confirm the inward and outward correspondence. CARRIED

The secretary reported that we made two nominations to the National Committee for Mathematics (Brian Woodsand Mick Roberts) and one to the committee on Theoretical and Applied Mechanics (Mary Fama).

V TREASURER'S REPORT: Olive/Thornley moved that we approve the report as printed. CARRIED

There was some discussion about whether we should aim to increase our reserves. It was generally agreed that subscriptions should cover bread and butter services to members and we should not expect to build up reserves from them.

Olive/Gauld moved that we recommend to the Annual General Meeting that the subscription for ordinary members for 1982 be $20 with a discount of $2 for payment before 31/3/82. CARRIED

Carter/Olive moved that the student subscription remain at $2 for 1982. CARRIED

Dean moved that the subscription for institutional members remain at a minimum of $25 for 1982. CARRIED

The idea of a special subscription rate for retired people was discussed. Halford/Thornley moved that we approve in principle the idea of a life subscription to be purchased on retirement and ask the president and treasurer to bring a firm proposal to the regional meetings. CARRIED

David reported on the difficulty he was having in seeking an honorary auditor. It was suggested that we ask whether RSNZ can supply an auditing service to member bodies.

ACCOUNTS: Halford moved that we approve secretarial expenses of up to $36 to Massey University and $8 to the secretary for postage. CARRIED

VI OTHER REPORTS:

(a) Publications. Halford moved that we receive the printed report.

Aitken Trust: Halford/Gauld moved that we refer the matter to the brief council meeting on Thursday and recommend that the incoming council give immediate attention to it. CARRIED

Syllabus Series: Wilson/Olive moved a vote of thanks to the authors, Graeme Wake and the people at Victoria involved in distribution. CARRIED

(b) Newsletter. Brent read the report which will be circulated in due course.

Wilson/Olive moved that the report be received. CARRIED

Dean expressed our thanks to Brent and his team for a magnificent job done.

(c) Education sub-committee. No report. Committee members have been involved in the education section of the Convention and in producing the Syllabus Series.

(d) Human Rights sub-committee. Gloria reported on letters written, and no replies received. The need for a sub-committee was questioned and it was decided to suggest to the incoming council that Bruce Calvert be approached to continue this work after he returns from leave.

(e) Convention. The secretary reported on the disbursement of the travel fund. C.T.C. Wall is the NZMS lecturer at the Convention. Olive/Carter moved that Brent, David Gauld, David Alcorn, Graeme Wake and Dean meet to discuss the publication of papers from the Convention. CARRIED

(f) NZAMT. No report.

(g) RSNZ. No report. Brent requested a newsletter article to publicise medals, prizes etc awarded by RSNZ.

(h) Visiting Lecturer. Olive/Halford moved that the report on the 1980 visiting lecturer be received. CARRIED

Stakgold has been selected as the 1981 visiting lecturer. Gloria expressed Otago's reservations about the suitability of his talks for a general audience and emphasised the need for summaries of these talks to be circulated together with an indication of the level of mathematical background assumed.

Dean ruled that the incoming council should determine the level of financial support for the 1982 lecturer and appoint the selector.

(i) Thesis Competition. The appointment of an organizer and the search for a sponsor was left to the incoming council.

VII AGM: The annual report was approved. (At this stage the meeting adjourned for lunch with the Council of the Australian Mathematical Society).

Auditor: David will explain the difficulties to the AGM and propose that the council undertake to find an auditor and publish the result in the September newsletter.

VIII NOMINATIONS for FRSNZ: Three names were suggested but it was agreed to ask the incoming president to form a small sub-committee to bring forward recommendations for nominations.

IX N.Z. ASSOCIATION OF SCIENTISTS' FREEDOM OF INFORMATION DOCUMENT: It was agreed that members should have the opportunity of considering this. It will therefore be published in the Newsletter and brought before the following AGM.

X BOOK PUBLISHERS' ASSOCIATION: We decided not to take up their offer of associate membership.

XI GENERAL BUSINESS: Reciprocity Agreements. It was suggested that the new secretary seek reciprocity agreements with the Institute of Mathematics and its Applications and with the Mathematical Association of America.

The president moved a vote of thanks to John Turner, Stan Roberts, Doug Harvie and Gillian Thornley who are retiring from council and extended best wishes for the future.

The meeting closed at 2.55 p.m.

Gillian Thornley, Secretary

MINUTES OF THE BRIEF COUNCIL MEETING

held at 6.30 p.m. on Thursday 14 May 1981 at the University of Sydney

PRESENT: D.B. Gauld (Chair), M.R. Carter, W.D. Halford, R.S. Long, A. McNabb, G. Olive, J. Schiff, G.M. Thornley, W.B. Wilson.

APOLOGIES: J.H. Ansell, D.J. Smith. Gauld/Wilson moved that the apologies be sustained. CARRIED

APPOINTMENTS: Secretary: David Smith, Treasurer: Joel Schiff, Newsletter Editors: Brent Wilson, Ian Coope, Graham Wood, Publications Sub-committee: Graeme Wake (Convenor), David Alcorn, David Vere-Jones, Gary Tee, Brent Wilson. Visiting Lecturer Selector: Gloria suggested that Kevin Broughan be approached. There was a brief discussion about the number of selectors and whether there should be a visiting lecturer every year. It was noted that the 1980 Council meeting recorded its intention to have a visiting lecturer each year. RSNZ Member Bodies Representative: Jim Ansell, Thesis Competition: Michael Carter, Human Rights: Outgoing Council suggested Bruce Calvert.

BANK ACCOUNTS:
The general account is to be transferred to Auckland with signatories any two of the President, Secretary or Treasurer (as provided for in the Constitution).
Newsletter account: David moved that the signatories be any two of W.B. Wilson, G. Wood, R.S. Long. CARRIED
Publications Account: It was suggested that a publications account be opened in Wellington with signatories any two of G.C. Wake, J.H. Ansell and D.B. Gauld. Dean thought a ledger account would be adequate. It was left to the Treasurer and G.C. Wake to sort out.

AITKEN TRUST: Copies will be distributed and considered over the next two months.

MATTERS FROM ANNUAL GENERAL MEETING:
1) Third Australasian Mathematics Convention: David to talk to the Australians.
2) Constitutional Amendment: Dean suggested the President and Secretary look into this.
3) Auditor
4) Assistance for Masters students from U.S.P.

AUSTRALIAN BANK ACCOUNT: Moved Halford/Long that a bank account be opened in Australia with the same signatories as the general account. CARRIED

Meeting closed at 6.50 p.m.

Gillian Thornley

MINUTES OF THE SEVENTH ANNUAL GENERAL MEETING

held at 4.30 p.m. on Thursday 14 May 1981
at the University of Sydney

PRESENT: Dr. W.D. Halford (Chair), D.P. Alcorn, K.A. Broughan, M.R. Carter, R. Chan, M. Conder, L.D. Copeland, S.D. Forbes, D. Gauld, D.C. Joyce, A.A. Lacey, R.S. Long, P.J. Lorimer, D. McCaughan, A. McNabb, B.H. Neumann, G. Olive, G.M. Petersen, J.C.W. Rayner, I.L. Reilly, J. Schiff, G.M. Thornley, R.W. Urwin, G.C. Wake, W.B. Wilson.

In welcoming members to the meeting Dr. Halford extended a special welcome to Dr. Neumann, who is an Honorary member of the Society.

I APOLOGIES: were received from Dr. J.H. Ansell.

II MINUTES of the Sixth Annual General Meeting were published in the August 1980 Newsletter. Carter/Olive moved that the minutes be taken as read. CARRIED

III MATTERS ARISING FROM MINUTES: It was noted that a donation of $50 had been made by the Society to the IMU Commission on Development and Exchange.

IV ANNUAL REPORT: The President read the annual report which will be published in the Newsletter. Dr. Halford moved the adoption of the report and invited discussion of it. There was no discussion and the motion was carried.

V TREASURER'S REPORT: This was presented by G.C. Wake who apologised for the absence of H.S. Roberts who has recently retired from Applied Mathematics Division and was not able to attend this meeting. It was pointed out that the publications account was included in the general account and consequently a donation of $500 for publications from Professor Campbell saved the accounts from showing a deficit balance. In fact publications were showing a net profit at 31/12/80 in addition to this donation.

In answer to question from P.J. Lorimer and D.C. Joyce the following points were made: 463 copies of the Andrews book had been sold, approximately 170 of these being overseas sales. The big increase in newsletter costs was due in part to increases in postage, but mainly to the increased number of pages printed. W.B. Wilson explained that the newsletter is now a registered publication so that it qualifies for cheaper postal rates.

D.C. Joyce noted that the income from subscriptions did not add up to the figure stated.

Wake/Reilly moved the adoption of the report subject to clarification of the points raised.

CARRIED

Subscriptions for 1982: Wake/Long moved that the ordinary subscription for 1982 be $20 reducible by $2 if paid by 31/3/82 and that the student subscription remain at $2. It was reported that Council had left the subscription for institutional members at a minimum of $25. There was some discussion and Carter/Rayner moved the amendment that the ordinary subscription be $18.
The amendment was put, requiring a show of hands, but was lost.
The original motion was put and carried.

It was announced that Dr. Neumann had made a donation of $100 to the Society.

D.C. Joyce questioned the number of institutional members in relation to subscriptions paid and it was pointed out that Burroughs and IBM who had funded the Employment Brochure ($450) and Thesis Competition ($150) respectively had not been asked for a further subscription.

VI CONSTITUTIONAL AMENDMENTS:

1. Moved Thornley/Broughan that in Article V lines 2-4 we delete "The six elected members of the Council shall normally serve for three years in such a way that the terms of office of two of them expire each year".
Substitute: "The elected members shall each serve for three years".

CARRIED

2. Moved Thornley/Gauld that we delete paragraph 2 of Article V and substitute: "The Council shall determine the policies of the Society and shall supervise the affairs of the Society." After some discussion K. Broughan moved the amendment "That the by-laws become separated from the Constitution". This was not acceptable as an amendment to the original motion. The motion was put and lost.

3. Moved Thornley/Joyce that the following be inserted at the end of paragraph 5, Article V "In the event of the Incoming Vice-President resigning during his/her term of office, the next President shall be elected at the following Annual General Meeting."

CARRIED

4. Moved Thornley/Halford that in Article VI paragraph 3, line 3 delete "membership" and in Article VI paragraph 3 line 5 insert "the records of membership and" so that the sentence beginning in line 4 reads "The Treasurer shall be responsible to the Council for the records of membership and the management of the financial affairs of the Society ...."

CARRIED

5. & 7. Moved Thornley/Olive that in Article VII paragraph 4 we delete "The above regulations shall not apply to the Inaugural Meeting" and in Article VIII paragraph 3 we delete "This regulation shall not apply to the amendments (if any) proposed and adopted at the time this Constitution is first ratified".

CARRIED

6. Moved Thornley/Reilly that in Article VIII, paragraph 1 be deleted and the following be substituted: "An amendment to the Constitution may be proposed by five members of the Society".

CARRIED

It was suggested that the incoming Council deliberate further on the By-laws.

VII ELECTION OF OFFICERS: Incoming Vice-President: Dr. J.H. Ansell was elected unopposed. Since Dr. Ansell was already a member of Council this left three vacancies on Council. Three nominations had been received in writing and the following were declared elected - Dr. J.L. Schiff, Dr. D.J. Smith, Dr. A. McNabb. Auditor: Dr. Gauld explained the difficulty encountered in finding an honorary auditor owing to a change in regulations concerning liability. Moved Broughan/Reilly that the Annual General Meeting delegate responsibility for appointing an auditor to the incoming Council.

CARRIED

VIII GENERAL BUSINESS:

Publications: Dr. Wake commented on sales of Status and the Syllabus Series. Orders for about 2000 books have been filled this year but a financial analysis is not yet available. Rules have been drawn up for a charitable trust to support the Aitken project and these have been submitted to Council for its consideration. Moved Wake/McNabb that the report be received.

CARRIED

Moved Reilly/Thornley that the meeting place on record its appreciation of the work of the publications committee.

CARRIED

P.J. Lorimer questioned whether the Society should be publishing books such as that of Andrews or the Aitken papers which were not written by New Zealand residents and would be read by very few New Zealanders.

G.C. Wake replied that an effort is made to confine activities to projects with New Zealand connections, pointing out that Andrews' essays were texts of his NZMS Visiting Lecture Tour and that this was the only non-text book venture tried. He also emphasised that the Aitken papers will not be a Society publication and our role is only as an intermediary in this project.

Report on Convention Travel Fund: Dr. Thornley reported that a total of $2855 had been paid out in 18 grants ranging from $50 to $350. The larger grants were made to people who did not qualify for travel money from other sources. This left a residue of $4 which was transferred to the general fund as a contribution to postal expenses.

Third Australasian Mathematics Convention: After some discussion it was moved (Thornley/Long) that the Incoming Council investigate this matter.

CARRIED

Colloquium Meeting: D.C. Joyce drew attention to the fact that the Second Australasian Mathematics Convention was incorporating the New Zealand Mathematics Colloquium. It was pointed out that in 1980 the Colloquium meeting resolved that there would be no business meeting in 1981 and that the next Colloquium would be held at Otago in 1982.

Visiting Lecturer: G.C. Wake mentioned that Professor I. Stakgold who is the 1981 Visiting Lecturer will be in New Zealand for two months and that Dr. Ansell is awaiting information from other centres before arranging his itinerary. D.C. Joyce indicated that the University of the South Pacific is interested in arranging stop-overs in Suva for visiting mathematicians.

Principles for Freedom of Information Law: Dr. Halford drew attention to the document prepared by the New Zealand Association of Scientists which will be printed in the Newsletter.

Assistance to the South Pacific: In response to a request for ways in which NZMS could assist mathematics in the South Pacific, D.C. Joyce pointed out that the University of the South Pacific does not offer Masters degrees in mathematics so that students must study abroad for this qualification. He asked the incoming Council to think about the idea of sponsoring a Masters student in New Zealand for two years at $500 a year. P.J. Lorimer suggested that we could help undergraduate students from the South Pacific who are studying in New Zealand now. K. Broughan suggested that NZMS might lobby the Government and the Department of Foreign Affairs to introduce scholarships. G. Olive suggested that institutional members may be willing to sponsor a scholarship in their name. D.C. Joyce also suggested that New Zealand universities could assist USP staff who were attending the New Zealand Colloquium by inviting them to give a lecture.

Retirements: W.D. Halford drew attention to H.S. Roberts' retirement and moved that our appreciation for his service as both Secretary and Treasurer be placed on record.

CARRIED WITH ACCLAMATION

D. Gauld/G.C. Wake moved a vote of thanks to the retiring President and Secretary.

CARRIED WITH ACCLAMATION

The meeting closed at 6.15 p.m.

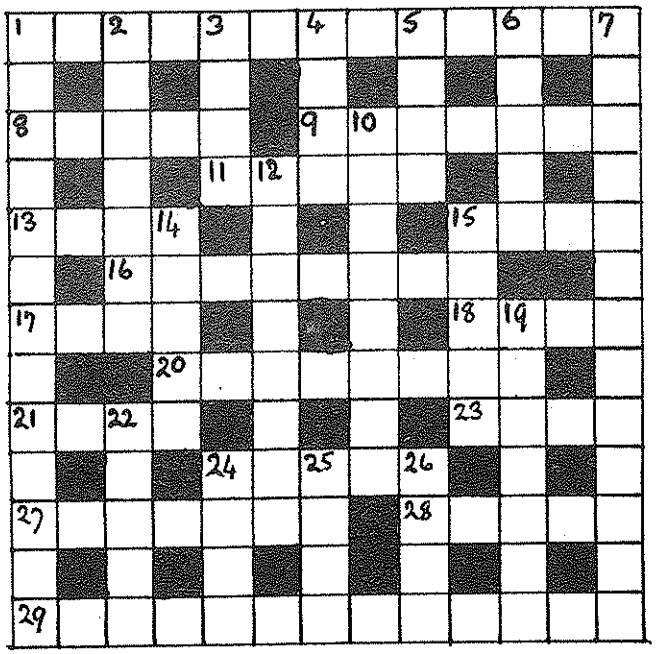
Gillian Thornley, Secretary

OFFICERS, JUNE 1981 - MAY 1981

President:	Prof. D. B. Gauld, University of Auckland
Incoming Vice-President:	Dr. J. H. Ansell, Victoria University
Immediate Past-President:	Dr. W. D. Halford, Massey University
Secretary:	Dr. D. J. Smith, University of Auckland
Treasurer:	Dr. J. L. Schiff, University of Auckland
Councillors:	Dr. M. R. Carter, Massey University
	Mr. R. S. Long, University of Canterbury
	Dr. A. McNabb, D.S.I.R., Wellington
	Dr. G. Olive, University of Otago
Editor:	Dr. W. B. Wilson, University of Canterbury
NZAMT Alternates:	Mr. N. J. Gale, Papanui High School.
	Mr. B. R. Stokes, Hamilton Teachers' College.

Crossword

N^{o} 4 LIPOGRAM by Matt Varnish



Across:

1. ∞. (6,2,5)
8. Cyclic song. (5)
9. Imperils the King for money? (6)
11. One of the elected king-controlling five. (5)
13. The end of Tom Bowling. (4)
15. Unworking. (4)
16. Nudging from the fiddling Don? (8)
17. Prep. encircled Northern Territory. (4)
18. To provide but not the right beginning. (4)
20. It provides openings throughout. (8)
21. ✓ : removed. (4)
23. Like mud. (4)
24. Keeper of the deep. (5)
27. $2 + 2 = 2^2$? (7)
28. With 24, I built. (5)
29. 2,2,4. (6,2,5)

Down:

1. Upright beginning. (5,8)
2. He superbly sups beginning like 6. (7)
3. Ill spoken untutored. (4)
4. Response to stimulus. (4)
5. For this is for keeps. (4)
6. Fruit of the divine round city. (5)
7. Kick or run. (2,5,2,4)
10. To give sermon. (8)
12. 1 to 15 found here. (8)
14. Type of design. (5)
15. Roundhouse? (5)
19. God in work unit is losing soil. (7)
22. Element compounded from (-δ,δ)? (5)
24. Words in fun. (4)
25. Fiery fiddler. (4)
26. E.g.XOS. (4)

CROSSWORD N^{o} 3 SOLUTION

Across:

1. Principia, 8. Ass, 9. Counterpart, 11. Widened, 12. Ideal, 13. Inroad, 15. Annals, 17. Eerie, 18. Uranium, 20. Weierstrass, 21. Apt, 22. Ramanujan.

Down:

2. Rho, 3. Cetin, 4. Parody, 5. Arabian, 6. Mathematica, 7. A small sum, 10. Undergrowth, 11. Whitehead, 14. Atelier, 19. Afton, 21. Spa.

* * * * *

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