The New Zealand Mathematical Society

NEWSLETTER

Contents

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Editorial

Time having slipped away from me (I board my flight in six hours), I must forgo the last chance of airing editorial prejudice. Instead, I wish my successor — as yet without a name — the success, fame and fortune that eluded me as Newsletter Editor. I can only report on long hours, relieved by the minor pleasures of learning how to make TEXtick a little, and regularly 'meeting' the contributors and (local) correspondents.

May you all — readers and writers — enjoy Christmas, New Year and the summer break; may the the joy of work, of doing and teaching mathematics infuse your lives; and may your pupils, your students, and most of all, the body politic, catch fire from your enthusiasm.

Mark Schroder.

Sub-Editorial

On behalf of the Council, I thank all of you who returned the **QUESTIONNAIRE** in the last issue. Your responses will be 'processed' over the summer; the results will be given to Council, and if Council agrees, they will appear in the next issue.

Nominations for the NZMS Council

The terms of three present members of the Council will expire in May 1988; they are those of Ivan Reilly (Out-Going President), Marston Conder and Brent Wilson (Council Members). Also, the Treasurer, John Shanks, wishes to resign as from May 1988. At the AGM in 1988 an Incoming Vice-President must be elected.

Nominations are invited for:

(i) Incoming Vice-President;

(ii) Two Ordinary Councillors;

(iii) A Councillor who is willing to become Treasurer.

Note: If the Incoming Vice-President is already a member of the Council, then a further ordinary Councillor will have to be elected.

Candidates must be financial members of the NZMS. They must be nominated in writing by two other financial members. Nominations must be accompanied by statements signed by the nominees that they are willing to accept nomination. Nominations should reach the Secretary of the NZMS by 1 March 1988. Candidates are invited to send thumbnail biograhies for inclusion in the April issue of the Newsletter.

D.R. Breach,
Hon Sec, NZMS.

Publisher's Notice

The Newsletter is the official organ of the New Zealand Mathematical Society. This issue was assembled at Waikato University and printed by the University of Canterbury Printery. The official address of the Society is:

The New Zealand Mathematical Society,
c/o The Royal Society of New Zealand,
Private Bag, Wellington, New Zealand.

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

Dr D R Breach,
Department of Mathematics,
University of Canterbury, Christchurch, New Zealand.

Victoria University

Congratulations to:

(1) Rod Downey, who has a well-deserved promotion to Senior Lecturer.

(2) Peter Love, the new Fellow in Meteorology. He was a VUW mathematics student, and is finishing his Ph.D. in Geophysics under Jim McGregor.

(3) Wilford Lie, who has been appointed to work with Mick Roberts's group at Wallaceville and has submitted his M.Sc. thesis supervised by Jim Ansell.

(4) Megan Clark and peter Donelan, whose baby Isabel was born on 11. November. All Well: exam marking not delayed much!

We are glad to welcome Ann-Lee Wang as a Visiting Fellow. She is on leave from the University of Malaya, Kuala Lumpur, until February, working on point processes and statistics education.

Frank Evison is to retire in the long vacation after 20 years' service as Professor of Geophysics. In these times of financial disasters we (especially the applied mathematicians) are delighted that his Chair will be advertised.

The lectureship vacated by Bernhard Flury has already been advertised; we (especially the statisticians) are delighted about that too.

In the absence of David Vere-Jones who is teaching the Chinese about multivariate statistics and the Italians about earthquake statistics, John Bibby (usually in Edinburgh) has been helping to hold the fort.

Megan Clark and David Vere-Jones's report on science teaching in the seventh form has caused a considerable stir. Megan has been very busy writing and speaking about it to an amazing variety of interested organizations all over NZ: the previous paragraph shows how impeccably timed David's absence was.

Rob Goldblatt was an invited speaker at the 8th International Congress on Logic, Methodology and Philosophy of Science at Moscow in August.

John Harper has been put by the Royal Society of NZ onto a subcommittee to produce ideas on what it can do for its member bodies. If you have any such ideas please tell him.

JFH

Ministry of Agriculture and Fisheries

GOINGS

Nigel Bingham (Biometrician) from Batchelar Agriculture Centre (Palmerston Nth) to Fay Richwhite.

John Jowett (Biometrician) from HO to teaching.

Hans Hockey (Biometrician) from Ruakura eventually to Applied Statistics Research Unit, University of Kent at Canterbury.

COMINGS

Max Wigbout (Biometrician) from Min of Energy to HO.

Trevor Atkins (Biological Modeller) from Canada to Batchelar.

TRIPPINGS

Roger Kissling back from China to HO.

Harold Henderson (Ruakura): six week Odyssey to Ithaca (and the American Stats Assoc conference in San Francisco.

Rob Pringle (Batchelar): fact-finding mission to US/UK followed by being tripped into a Science Manager role.

RELOCATING

Chris Darkey's system modelling group to Wallaceville.

RESTRUCTURING

Everyone.

RAL

D S I R

A M D, Wellington

Alex McNabb is in Australia by invitation for several months, having completed a month's work with Vincent Hart in Queensland, and is now working with Jim Hill in Wollongong.

Gary Eng has recently returned from a three month visit to Japan, China and Hongkong, where he presented papers on forestry. While overseas, Gary was successfully "scalphunted", and leaves to join Electricorp management in early December.

Kelly Mara is on a brief visit to Japan to attend a Quality Assurance conference, and to visit major Japanese factories.

David Rhoades has returned from attending the IUGG symposium in Vancouver.

Kit Withers has returned from a visit to Switzerland.

Malcolm Grant has been promoted as deputy to the Chief Director of the Industrial Divisions.

GJW

University of Auckland

Computer Science

Dr Werner Staringer, from the Vienna University of Technology, has been appointed as Lecturer, starting with this current 3rd term. His research interests are mostly in Expert Systems.

At the New Zealand Computer Society Conference, held at Christchurch in August, Bob Doran spoke on "Simulation in Computer Science Education", Richard Lobb spoke on "The Aliasing Problem in Computer Graphics", and John Hosking, Rick Mugridge & John Hamer presented a paper on "A Knowledge–Level Analysis of the DAMP Problem". The principal speaker at that conference was Prof Joseph Weizenbaum of MIT, one of the most profound critics of the way that computers are used. His conference address, "Not Without Us", was devoted to the moral responsibility of scientists for the military applications made of their research.

Seminars

Prof Charles J Colbourn (University of Waterloo) *"Single Processor Scheduling with Random Tasks".*
Prof Joseph Weizenbaum (MIT) *"Are Computers Really Good for Children?"* (with the NZCS, Auckland Branch), & *"What A.I. Really Can't Do and Shouldn't Even Try".*
Dr Brian Reid (Digital Equipment Corporation) *"Electronic Publishing".*
Dr Vilas Wuwongse (Asian Institute of Technology, Bangkok) *"A Frame–Based Database Design Support System".*
Mike Tibbetts (Marconi Simulation) *"Making a Business out of a New Technology".*
Dr Geoff Wyvill (University of Otago) *"Data Structures for Soft Objects".*
Dr Richard L Epstein (visiting the Department of Philosophy) *"Why was the Theory of Computable Functions FULLY Developed before there were any Computers?"*

GJT

Theoretical and Applied Mechanics

James Graham-Eagle has take up his appointment as Lecturer. James has a BSc and MSc in Mathematics from Vic and a PhD from Oxford. Before joining TAM, he was an Assistant Prof at Delaware, where he had been working with Ivar Stakgold on problems of diffusion and combustion theory.

Roger Nokes has also been appointed to a lectureship and will join the Department in February. Roger, a Canterbury graduate, is currently a Research Fellow in the Research School of Earth Sciences, ANU, where he has been working with Stuart Turner on problems of geophysical fluid dynamics.

Prof Reuven Rubinstein (Technion, Haifa, Israel) was a visiting professor for seven weeks in September/October. He works on the statistical analysis of computer simulation.

Drs Harry Schlanger and Lincoln Patterson (CSIRO, Geomechanics Division) have spent a few weeks visiting Mike O'Sullivan, working on geothermal and groundwater flows.

In August, Julie Falkner and Andrew Pullan visited Germany and Australia respectively, David Ryan visited a number of Asian universities, while Mervyn Rosser, Andy Philpott and Sue Byrne attended the ORSNZ Conference.

Ian Collins has been appointed to the editorial board of Int. J. Mech. Sci.

Sue Byrne and Ian Collins are on long leave for 1988. Sue is going to Adelaide and Lancaster, while Ian will be a Visiting Fellow of Clare Hall, Cambridge and will visit various centers in the USA. During Ian's absence, Mervyn Rosser is acting as H.O.D.

The Engineering Science Degree has been moderated by the IPENZ, and deemed to satisfy the academic requirements of the Institution.

Seminars

Dr J Astley (Mech Eng, Canterbury) *"The application of finite element methods to some accoustical problems".*
Ms Julie Falkner (TAM) *"Scheduling Kiwi Bus Drivers with a Set Partitioning Model".*
Prof P K Chatterjee (Ohio) *"Computer-aided Design for Surface and Underground Mining".*
Dr Roderick Ball (DSIR, Mt Albert) *"A Parallel Projective Method for Linear Optimization".*
Ms Rosemary Segedin (TAM) *"The Elastic Wrinkling of Rectangular Sheets".*
Mr Andrew Pullan (TAM) *"Quasi-linearised Infiltration and the Boundary Element Method".*
Dr H P Schlanger (CSIRO, Geomechanics) *"Hydrothermal Modelling Studies of a Geological Thermosyphon".*

Dr Caroline Fisk (Civil Engineering, Auckland) *"Congested Traffic Networks — an OR Perspective".*

Dr Peter Hunter (TAM) *"Introduction to GKS".*

Assoc Prof M J O'Sullivan (TAM) *"Geothermal Convection".*

Prof Reuven Rubinstein (Technion, Israel) *"Sensitivity Analysis in Computer Simulation", and "A Review of Stochastic Optimization Methods".*

DAN

Department of Mathematics and Statistics.

The long-anticipated report of the committee reviewing the Department arrived at about the same time as the Universities Review for the Vice-Chancellors' Committee and the Auckland review of the status of academic women. So in our spare time between marking exams we are reading reports and deciding on the best course of action.

There have been some long-term comings and goings of late: Glen Anderson returned home to Michigan via meetings in Helsinki and Joensuu; Don Taylor of the University of Sydney is here for 3 months on exchange with Marston Conder; Bill Jackson of Goldsmiths College, London, arrived in August and will be here for about a year; Richard Alldredge of the University of Washington is here until January; Jock Mackay of the University of Waterloo is here for about a year. Don and Bill are giving algebra and combinatorics a boost, while Richard and Jock work in statistics. John Kalman and Alastair Scott returned from leave at the end of term II having spent most of their time in the U.S., with Alastair also staying in the U.K. and visiting Finland. Marston Conder called in long enough to vote in the election on his way from Germany to Sydney. Jeff Hunter and Cathy Macken left at the end of term II to start their year's leave (each), Jeff in Virginia initially (including a lecture series which goes out on live TV), and Cathy in New Mexico to start. Joel Schiff and M.K. Vamanamurthy visited Finland for a conference in Joensuu and Vaman also gave lectures in Helsinki, and Margaret Morton spent a month touring the U.S. to attend the Girls and Science and Engineering Conference in Ann Arbor and observe how some American Institutions deal with the basic skills deficiencies of their entering students.

Seminars:

Professor G D Anderson (Michigan State University) *'Special functions of quasiconformal theory'.*

Professor Dan Coster (Purdue University) *'Systematic run orders of fractional factorial designs'.*

Professor Ray Carroll (University of North Carolina) *'The effect of estimating weights in a heteroscedastic regression model'.*

Dr Roderick Ball (D.S.I.R.) *'Multiaxial actions and the codimension 3 knot groups'.*

Douglas Rogers (Auckland) *'Old and new results on perfect systems of difference sets'.*

Professor Reuven Rubenstein (Technion, Haifa, Israel) *'The efficient score method for performance evaluation and sensitivity analysis of computer simulation models'.*

Dr Jock Mackay (University of Waterloo) *'The joy of copulas'.*

DBG

Massey University

Our most recent arrival was Ingrid Rinsma, who came from Canterbury to take up a UGC postdoctoral fellowship. She joins the group working with Mike Hendy on evolutionary trees and related matters.

Charles Little returned to us in August after a year on sabbatical, based at the University of Waterloo in Canada. Charles reports that he was able to develop several new lines of research

(integer flows, discrete Jordan curve theorems, constrained matching problems) and form a number of valuable collaborative relationships.

Howard Edwards took two weeks leave in August to present an invited paper at the second International Advanced Seminar/Workshop on Inference Procedures Associated with Statistical Ranking and Selection, held in Sydney. Howard's paper made use of Bayesian methods, and it was apparent from other papers at the conference that the use of Bayesian methods in this area is increasing.

Graeme Wake spent three weeks in Britain during October, pursuing his research on thermal ignition and giving a lecture series at the University of Leeds.

An important new development in our teaching program is the introduction of a paper in Management Science for the Business Studies degree, covering a number of basic techniques of operations research with an emphasis on applications. The teaching responsibilities will be shared between John Griffin and Charles Lawoko.

Our seminar programme has been very active lately — and as the list below shows, combinatorics is well to the fore these days.

Seminars

Prof Rick Millane (Purdue) *Phase Problems*
Dr D G Rogers (Hawaii) *In Shapiro's Path*
Mike Steel (Massey) *Hunting for Evolutionary Trees in A Combinatorial Forest*
John Griffin (Massey) *Machine Configuration in Group Technology*
Gerard Palmer (Massey) *Semimodular Lattices — Zoological Aspects*
Mike Hendy (Massey) *A Simple Maximum–Likelihood Model for Phylogenetic Inference*
Prof Derek Holton (Otago) *Hunting Snarks*
Ingrid Rinsma (Massey) *Existence Theorems for Floorplans — a Graph Theoretic Approach*
Charles Little (Massey) *Discrete Jordan Curve Theorems*
Dr Bill Jackson (Auckland) *Compatible Tour Decompositions of Eulerian Graphs*
Prof Anne Penfold Street (Queensland) *Completing Latin Squares*

MRC

Otago University

It is a great pleasure to announce the arrival of the two newest members of our Department. In early September, our new Senior Lecturer in Statistics, Dr Malcolm John Faddy arrived; and in early October, our new Professor of Applied Mathematics, Prof Vernon Arthur Squire arrived.

Malcolm has his D Phil from the University of Sussex, and his main research interest lie in the applications of probability and statistics in Biology and Medicine. He came to use from the University of Birmingham in the UK, where he was a Lecturer in the Department of Statistics (since 1970). He has also held visiting positions at the University of Queensland (Australia) and Montana State University (USA).

Vernon has his PhD from the University of Cambridge, and came to us from the Scott Polar Research Institute at Cambridge University, where he was a Researcher for 12 years. His main mathematical interest lies in polar oceanography — specifically, "the mechanical properties of sea ice". He also has a mathematical interest in satellite remote sensing — and his research has taken him to Antarctica (3 times) and to the Arctic (12 times)! Also, readers of the NEWSLETTER may be interested to know that Vernon does not like to be called a "Wyngeing Pom"!

Dr Denis McCaughan has returned from his sabbatical year at the University of Manchester in the UK.

Next year both Dr John Clark and Prof Bryan Manly will be on leave: John will be visiting the University of Idaho (USA) and the University of Bristol (UK); and Bryan will be spending the year based at the University of Wyoming (USA).

Prof Derek Holton presented a Talk on "The Effect of Context on the Solution of Maths Problems (Form 2)", at a seminar in Wellington organised by he Education Department to consider research into Mathematical Education — and he noted, "There is particular interest at the moment in research in the early years of school".

At a recent meeting of the ORMSC (Otago Regional Mathematics Syllabus committee), both Mrs Liz Milne (HOD at Queens High School) and Mrs Jeanette Trotman (HOD at Columba College) reported on their investigations into some overseas experimental programs in mathematics. Liz spent 3 weeks in Australia as a Woolf-Fisher Visitor — in Melbourne and Brisbane — and attended the fourth Southeast Asian Conference on Mathematical Education. She learned about "Problem Solving Kits", the elimination of external examinations in various schools, and some current research in mathematical education. Jeanette visited various schools in the UK. and was introduced to "FLEXI–STUDY" (which is based on "flexibility" and no formal classes) as well as the "SMILE" program.

Seminars

Dr Malcolm Foster (Philosophy Department of the University of Wisconsin and a mathematics graduate from the University of Otago) *"Newton's Argument for Universal Gravitation".*

Dr Les Jennings (University of Western Australia) *"Numerical Analysis Applications in Human Movement Modelling".*

Janelle J Harms (PhD student at the University of Waterloo) *"Reliability of Assignment Problems".*

Paul van Mulbregt (PhD student at MIT and mathematics honours graduate from the University of Otago) *"Triangles and their Areas".*

Prof Mel Henriksen (Harvey Mudd College, California) *"The Boolean Order on a Commutative Ring".*

Dr Peter Thomson (ISOR, VUW) *"Irregular Sampling of Stationary Processes with Reference to Oceanograhic Profiles".*

Dr John Stillwell (Monash University) *"Elliptic Curves for Beginners" and "A Core Curriculum".*

Dr Malcolm Faddy (Otago) *"Using Spline Smoothing to Help Fit Multi- -Compartment Models to Data".*

GO

Waikato University

So much is happening here, that nobody has had time to record it for me. [Editor]

Seminars

D Willcock (Grad Student) *"Factorisation of Polynomials".*

Dr M Jorgensen (Waikato) *"A Bayesian Approach to an Expert System for Bacterial Identification" — in the Cognitive Science Seminar Series.*

Dr R L Epstein (Berkeley) *"Why Was the Theory of Computable Functions Developed before there were any Computers?" — with Computer Science.*

Prof L R Foulds (Management, Waikato) *"Designing a One-Way Street System".*

Dr B Jackson (London) *"Euler Tours and Cycle Decompositions of Eulerian Graphs".*

Dr J Scott (Management, Waikato) *"Lagrangian Relaxation and its Use in Integer Programming".*

The Toposophy Seminars — with Computer Science

Prof E V Krishnamurthy (C S, Waikato) *"Categories and the Theory of Programming" — three introductory seminars.*
Dr M Schroder (Waikato) *"Fuzzy Sets are not Fuzzy Enough"* and *"The Beginnings of Synthetic Differential Geometry"*.
Mr B Vickers (C S, Waikato) *"A Categorial Basis for Data-Bases"* — two introductory seminars.

University of Canterbury

Electrical and Electronic Engineering

Dr Gabor T Herman, one of the best known mathematicians in the medical imaging business, and at the same time, a Prof of Radiology in the Hospital of the University of Pennsylvania at Philadelphia, will be visiting this department as an Erskine Fellow during the first term of 1988.

RHTB

Mathematics

Peter Bryant visited Tokyo during the August vacation as a participant in two symposia organised by IUTAM. He was the only New Zealander among about 100 attending from about 20 countries.

Kevin O'Meara attended an international conference on Rings, Modules and Radicals held in Hobart in August. There were two New Zealanders among the 35 participants from 13 countries.

Graham Wood has been promoted to Reader.

The department, including spouses and visitors, came together for a very convivial dinner to farewell two retiring members, John De la Bere and Bob Long.

Prof Anne Penfold Street, University of Queensland, is here for here months as an Erskine Fellow, and has given a series of seminars on coding theory.

Profs Charles Chui, Texas A and M University, was here for one month, and gave a series of seminars on multivariate splines.

Prof Norton Starr, Amherst College, Massachusetts, is spending three months of his sabbatical with us. His interests are computer graphics and functional analysis.

Seminars from other visitors

Prof Raymond J Carroll (University of North Carolina) *"The Effect of Estimating Weights in a Heteroscedastic Regression Model"*.
Dr Rod Ball (AMD, Auckland) *"A Parallel Projective Method for Linear Optimization"*.
Prof C C Lindner (Auburn University) *"Perpendicular Arrays"*.
Prof K T Phelps (Georgia Institute of Technology) *"Coding Theory"*.

Departmental seminars

B A Woods (Canterbury) *"Gravity Flows of Very Viscous Fluids"*.
J Hannah (Canterbury) *"Products of Idempotents"*.
W B Wilson (Canterbury) *"REDUCE — Another Symbolic Algebra Package"*.
I D Coope (Canterbury) *"FORTRAN 8X, the next FORTRAN Standard"*.
T J Connolly (Canterbury) *"Computational Aspects of the General Tomography Problem"*.

RSL

Mathematical Visitors in New Zealand

Compiled on 22 October 1987

The information is arranged as follows: name of visitor; home institution, whether accompanied; principal field of interest; dates of visit; principal host institution; principal contact; comments.

Definite Visits

Prof B F Gray; School of Chemistry, Macquarie University; mathematics of chemistry; November 1987; Massey University; Prof G C Wake.

Dr William Jackson; University of London; graph theory; 1 September - 30 November 1987; Auckland University; Prof D B Gauld.

Prof Michael J Kallaher; Washington State University; finite projective planes; January - July 1988; University of Auckland; Peter Lorimer.

Dr Grant Keady; University of Western Australia; non-linear partial differential equations; July or August 1988; Massey University; Prof G C Wake.

Dr John Nash; University of Ottawa; computational methods, management applications; January 1988 - June 1988; DSIR/AMD Mt Albert Research Centre; Dr J H Maindonald.

Dr M Nyman; Alma College, Michiga; wife and 2 children; modelling; February - August 1988; University of Otago; Prof D A Holton.

Dr D E Taylor; University of Sydney; algebraic structures; 30 August - 1 December 1987; Auckland University; Prof D B Gauld.

Dr Ann-Lee Wang; University of Malaya; Statistical education, point processes; 12 October 198 - February 1988; Victoria University; Thora Blithe.

Prof Lee Peng Yee; National University of Singapore; wife; integration theory; University of Auckland; Peter Lorimer; New Zealand Mathematical Society Visiting Lecturer.

Very Likely Visits

Dr C G Gibson; Liverpool University; wife; singularity theory, geometry of robotics; March/April 1988, Victoria University; Peter Donelan.

Dr Franz Rendl; Technische Universitat Graz; wife and 2 children; applied graph theory, optimisation; July - August 1988; Massey University; Charles Little.

Notes

This listing is intended to enable workers at other institutions to invite visitors to spend time with them. Please channel invitations through the principal contact listed above.

The production of these lists and the coordination of visits depend upon my receiving information. When you have information about a visit, even if it be indefinite, please forward it to me as soon as possible.

Gillian Thornley
NZMS Visitors Co-ordinator
Dept of Maths and Stats
Massey University

Conferences

—1988—

January 4–6 (Haifa, Israel)

Fourth Haifa Matrix Conference
Contact D. Hershkowitz, Department of Mathematics, Technion — Israel Institute of Technology, Haifa 32000, Israel.

January 4–8 (Cave Hill, Barbados)

Fifth Caribbean Conference in Combinatorics and Computing
Contact C. Cadogan, Department of Mathematics, University of the West Indies, PO Box 64, Bridgetown, Barbados, West Indies.

January 6–8 (San Antonio, Texas)

American Statistical Association Winter Conference: Statistics in Biotechnology
Contact American Statistical Association, 806 15th Street Northwest, Washington, District of Columbia 20005, USA.

January 7–8 (Loughborough, England)

IMA Conference on Mathematical Modelling of Semiconductor Devices and Processes
Contact IMA, Maitland House, Warrior Square, Southend-on-Sea, Essex SS1 2JY, England.

January 11 – February 5 (Miramare - Trieste, Italy)

College on Variational Problems in Analysis
Contact International Centre for Theoretical Physics, College on Variational Problems in Analysis, PO Box 586, I-34100 Trieste, Italy.

January 18–22 (Minneapolis, Minnesota)

Workshop on Application of Combinatorics and Graph Theory to the Biological and Social Sciences
Contact A. Friedman, Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street Southeast, Minneapolis, Minnesota 55455, USA.

January 20 – February 5 (Newcastle, NSW)

28th Summer Research Institute of the Australian Mathematical Society
Contact Dr R Eggleton, Department of Mathematics, Statistics and Computer Science, University of Newcastle, Rankin Drive, Shortland, NSW 2308, Australia.

February 1–5 (Sydney)

1988 Mathematics–in–Industry Study Group
Contact Dr N G Barton, Director 1988 MISG, CSIRO Division of Mathematics and Statistics, PO Box 218, Lindfield, New South Wales 2070, Australia.

February 3–6 (Berlin)

Model Optimization in Exploration Geophysics
Contact Prof A Vogel, Institut fur Geophysikal. Wiss. Mathem. Geophysik, FU Berlin, Podbielskiallee 60, D-1000 Berlin 33, Federal Republic of Germany.

February 7–11 (Leura, NSW)

1988 Australian Applied Mathematics Conference
Contact R Grimshaw, School of Mathematics, University of New South Wales, Box 1, Kensington, New South Wales 2033, Australia.

February 8–12 (Berkeley, California)

Workshop on Representations of p-adic Groups and Applications to Automorphic Forms
Contact I Kaplansky, Mathematical Sciences Research Institute, 1000 Centennial Drive, Berkeley, California 94720, USA.

February 15–19 (Baton Rouge, Louisiana)

Nineteenth Southeastern International Conference on Combinatorics, Group Theory and Computing
Contact K B Reid, Chairman, Department of Mathematics, Louisiana State University, Baton Rouge, Louisiana 70803, U.s.a.

March 14–18 (Aachen, West Germany)

Second International Conference on Hyperbolic Problems
Contact R Jeltsch, Institut für Geometrie und Praktische Mathematik, RWTH Aachen, D-5100 Aachen, Federal Republic of Germany.

March 16–18 (Tanpa, Florida)

Twenty-first Annual Simulation Symposium
Contact S Witenhafer, Program Chairwoman, 848 Levitt Parkway, Rockledge, Florida 32955, USA.

March 21–25 (Oxford)

ICFD Conference on Numerical Methods in Fluids
Contact ICFD Secretary, Department of Mathematics, Reading University, PO Box 220, Reading RG6 2AX, England.

March 21–25 (Athens, Ohio)

International Conference on Theory and Application of Differential Equations
Contact A. Aftabizadeh, Department of Mathematics, Ohio University, Athens, Ohio 45701, USA.

March 21–25 (Minneapolis, Minnesota)

Workshop on Invariant Theory and Tableaux
Contact A Friedman, Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street Southeast, Minneapolis, Minnesota 55455, USA.

March 28–30 (Rome)

International Meeting on the Analysis of Multiway Data Matrices
Contact Multiway '88, Dipartimento di Statistica, Probabilitá e Statistiche Applicate, Universitá La Sapienza, P. le A Moro 5, 00185 Rome, Italy.

April 10–14 (Atlanta, Georgia)

ICES 88: International Conference on Computational Engineering Software
Contact ICES-88 Secretariat, c/- Prof S N Atluri, Centre for the Advancement of Computational Mechanics, Mail Code 0356, Georgia Institute of Technology, Atlanta, Georgia 30332, USA.

April 17–30 (Banff, Canada)

First Canadian Number Theory Society Conference
Contact R Mollin, University of Calgary, Department of Statistics, 2500 University Drive NW, Calgary, Alberta, Canada T2N 1N4.

April 23–28 (Ho Chi Minh City, Vietnam)

ICOMIDC Symposium on Mathematics of Computation
Contact Huynh Ngoc Phien, Computer Science Division, Asian Institute of Technology, GPO Box 2754, Bangkok 10501, Thailand.

May 16–20 (Canberra)

1988 Mathematical Sciences Congress and 32nd Annual Meeting of the Australian Mathematical Society
Contact Prof C C Heyde, Department of Statistics, Institute of Advanced Studies, Australian National University, GPO Box 4, Canberra, ACT 2601, Australia.

May 16–20 (Canberra)

Ninth Australian Statistical Conference
Contact Prof C C Heyde, Department of Statistics, Institute of Advanced Studies, Australian National University, GPO Box 4, Canberra, ACT 2601, Australia.

May 23–27 (Chiangmai, Thailand)

Conference on Mathematical Methods and Applications
Contact Prof Suwom Tangmanee, Faculty of Science, Kasetsart University, Bangkok 10900, Thailand.

May 29–31 (Madrid)

Eighteenth International Symposium on Multivalued Logic
Contact E Trillas, Consejo Superior, Investigaciones Cientificas, Serrano 117, 28006 – Madrid, Spain.

May 30 – June 3 (Singapore)

International Conference on Numerical Mathematics
Contact Secretary, International Conference on Numerical Mathematics, Department of Mathematics, National University of Singapore, Kent Ridge, Republic of Singapore 0511.

May 30 – June 3 (Kalamazoo, Michigan)

Sixth International Conference on the Theory and Applications of Graphs
Contact Directors, Sixth International Graph Theory Conference, Department of Mathematics and Statistics, Western Michigan University, Kalamazoo, Michigan 49008–3899, USA.

June 5–12 (Peñiscola, Spain)

Third International Symposium on Differential Geometry
Contact Departamento de Geometría y Topología, Facultad de Matemáticas, Universidad de Valencia, Burjasot (Valencia), Spain.

June 11–14 (Columbus, Ohio)

International Conference on Almost Everywhere Convergence in Probability and Ergodic Theory
Contact G Edgar, Department of Mathematics, Ohio State University, Columbus, Ohio 43210, USA.

June 12–18 (Minneapolis, Minnesota)

Workshop on Coding Theory and Applications
Contact A Friedman, Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street Southeast, Minneapolis, Minnesota 55455, USA.

June 13–17 (Talence, France)

Nonlinear Hyperbolic Problems Conference
Contact A Polzin, D Département de Mathématiques Appliquées, Université de Bordeaux I, 351 cours de la Libération, 33405 Talence Cedex, France.

June 19–25 (Minneapolis, Minnesota)

Workshop on Design Theory and Applications
Contact A Friedman, Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street Southeast, Minneapolis, Minnesota 55455, USA.

June 20–24 (Lisbon)

International Algebra Conference
Contact Centro de Algebra, Universidade de Lisboa, Rua Ernesto Vasconcelos, Bloco C1, 30 Piso, 1700 Lisboa, Portugal.

June 20–24 (Shanghai, China)

BAIL V — Fifth International Conference on Boundary and Interior Layers — Computational and Asymptotic Methods
Contact Pauline McKeever, Conference Management Services, PO Box 5, 51 Sandycove Road, Dun Laoghaire, Co. Dublin, Ireland.

June 24–30 (Sapporo, Japan)

International Conference on Radicals — Theory and Applications
Contact S Kyuno, Department of Mathematics, Tohoku Gakuin University, Tagajo, Miyagi 985, Japan.

June 25–30 (Xian, China)

International Conference on Biomathematics
Contact Prof Lansun Chen, Mathematical Institute, Chinese Academy of Sciences, Beijing, People's Republic of China.

June 27 – July 15 (Berkeley, California)

Microprogram on the Structure of Banach Spaces
Contact Mathematical Sciences Research Institute, 1000 Centennial Drive, Berkeley, California 94720, USA.

July (Beijing, China)

Eighth IFAC/IRORS Symposium on Identification and System Parameter Estimation
Contact Helle Welling, Secretary c/- IMSOR, Building 349, Technical University of Denmark, 2800 Lyngby, Denmark.

July 4–8 (Marseille, France)

Infinite Dimensional Lie Algebras and Groups
Contact Mme A Zeller-Meier, CIRM, Luminy Case 916, F-13288 Marseille, Cedex 9, France.

July 4–8 (Dundee, Scotland)

Tenth Dundee Conference on Differential Equations
Contact Dr R J Jarvis, Department of Mathematical Sciences, The University, Dundee DD1 4HN, Scotland.

July 5–8 (Bradford, England)

IMA Conference on Applications of Matrix Theory
Contact The Deputy Secretary, The IMA, Maitland House, Warrior Square, Southend-on-Sea, Essex SS1 2JY, England.

July 10–16 (Manchester)

Representation Theory and Group Theory
Contact RTGT, Department of Mathematics, Institute of Science and Technology, University of Manchester, PO Box 88, Manchester M60 2QD, England.

July 11–13 (Strathclyde, Scotland)

IMA Conference on Inverse Problems and Imaging Associated with Pattern Recognition
Contact The Secretary and Registrar, The IMA, Maitland House, Warrior Square, Southend-on-Sea, Essex SS1 2JY, England.

July 11–16 (Helsinki)

Twenty–Third International Conference on Actuaries
Contact 23rd International Conference on Actuaries, Congress Management Systems, PO Box 189, SF-00171 Helsinki, Finland.

July 13–15 (Manchester)

IMA Conference on Mathematical Structures for Software Engineering
Contact the Secretary and Registrar, The IMA, Maitland House, Warrior Square, Southend-on-Sea, Essex SS1 2JY, England.

July 13–20 (St Andrews, Scotland)

Edinburgh Mathematical Society's 1988 St Andrews Colloquium
Contact J Langley, University of St Andrews, Mathematical Institute, North Haugh, St Andrews KY16 9SS, Fife, Scotland.

July 17–27 (Swansea, Wales)

Ninth Congress of the International Association of Mathematical Physics
Contact A Truman, University College of Swansea, Department of Mathematics and Computer Science, Singleton Park, Swansea SA2 8PP, Wales.

July 18–22 (Paris)

International Association for Mathematics and Computers in Simulation: 12th World Congress on Scientific Computation
Contact the Secretary, 12th IMACS World Congress, IDN, BP 48, 59651 Villeneuve d'Ascq Cedex, France.

July 18–23 (Namur, Belgium)

Fourteenth International Biometric Conference
Contact IBC Conference Secretariat, Facultés Universitaires Notre-Dame de la Paix, Centre de Rencontres, Rue de Bruxelles 53, B–5000, Namur, Belgium.

July 25–29 (Pisa, Italy)

Third International Conference on Fibonacci Numbers and their Applications
Contact Gerald Bergum, Department of Computer Science, South Dakota State University, PO Box 2201, Brookings, South Dakota 57007–0199, USA..

July 25–30 (Leuven, Belgium)

International Congress on Computational and Applied Mathematics
Contact Prof Dr F Broeckx, R. U. C. A., Middelheimlaan 1, B–2020 Antwerpen, Belgium.

July 25–30 (Beijing, China)

International Symposium on Engineering Mathematics
Contact ISEMA–88, No 1 Lane 2, Baiguang Road, PO Box 2405, Beijing, China.

July 27 – August 3 (Budapest)

Sixth International Congress on Mathematical Education
Contact Dr M F Newman, Department of Mathematics, Research School of Physical Sciences, Institute of Advanced Studies, Australian National University, PO Box 4, Canberra ACT 2601, Australia.

August 4–11 (Budapest)

Algebraic Logic Conference
Contact I Németi, Department of Mathematics, Iowa State University, Ames, Iowa 50011, USA.

August 8–12 (Providence, Rhode Island)

American Mathematical Society Centennial Celebration
Contact H Daly, American Mathematical Society, Meetings Department, PO Box 6248, Providence, Rhode Island 02904, USA.

August 9–12 (Coleraine, N Ireland)

International Symposium in Real Analysis
Contact P Muldowney, University of Ulster, Northland Road, Londonderry BT48 7JL, Northern Ireland.

August 9–13 (Hong Kong)

First International Symposium on Algebraic Structures and Number Theory
Contact R F Turner-Smith, Department of Mathematical Studies, The Hong Kong Polytechnic, Hung Hom, Kowloon, Hong Kong.

August 12–14 (Madras, India)

International Conference on Mathematical Modelling in Sciences and Technology
Contact Prof P Achuthan, Indian Institute of Technology, Madras – 600 036, India.

August 14–27 (Brunswick, Maine)

Harmonic Analysis on Reductive Groups
Contact W Barker, Chairman, Harmonic Analysis on Reductive Groups, Department of Mathematics, Bowdoin College, Brunswick Naine 04011, USA.

August 17–24 (Canberra)

Functional Analysis/Optimisation
Contact Prof J R Giles, Department of Mathematics, University of Newcastle, New South Wales 2308, Australia.

Augut 20–26 (Pusan, Republic of Korea)

Groups — Korea 1988
Contact Prof A C Kim, Department of Mathematics, The Pusan National University, Pusan 607, Republic of Korea.

August 21–27 (Grenoble, France)

17th International Congress of Theoretical and Applied Mechanics
Contact D Caillerie, Secretary of the International Congress of Theoretical and Applied Mechanics 1988, Institut de Mécanique de Grenoble, Domain Universitaire, BP 68, 38402 Saint Martin d'Heres Cedex, France.

August 21–27 (Krens/Donau, Austria)

International Conference on General Algebra
Contact Rainer Mlitz, Institut für Angewandte und Numerische Mathematik, Techn Universität Wien, A–1040 Wien, Wiedner Hauptstr, 6–10, Austria.

August 22–26 (Prague)

Conference on Categorial Topology and its Relation to Algebra, Analysis and Combinatorics
Contact M Hŭsek, Math Inst of Charles University, Sokovolská 83, Prague, Czechoslovakia.

August 29 – September 2 (Copenhagen)

Harmonic Analysis in Lie Groups
Contact Niels Vigand Pedersen, Mathematics Department, University of Copenhagen, Universiteitsparken 5, 2100 Copenhagen, Denmark.

August 29 – September 2 (Tokyo)

Thirteenth International Symposium on Mathematical Programming
Contact Helle Welling, Secretary, c/- IMSOR, Building 349, Technical University of Denmark, 2800 Lyngby, Denmark.

September 26 – October 1 (Halle, East Germany)

Fifth International Conference on Complex Analysis
Contact Fifth International Conference on Complex Analysis, Martin-Luther University, Department of Mathematics, Universitätsplatz 6, DDR–4010, Halle, German Democratic Republic.

November 18–19 (Sydney)

Quantitative Approaches to Diabetes
Contact Dr A G Shannon, School of Mathematical Sciences, New South Wales Institute of Technology, Broadway, New South Wales 2007, Australia.

—1989—

January 8–11 (Trinidad)

First Caribbean Conference on Fluid Dynamics
Contact H Rankissoon, Chairman CACOFD 89, Department of Mathematics, University of West Indies, Saint Augustine, Trinidad, West Indies.

July 5–19 (Berkeley, California)

Microprogram on Noncommutative Rings
Contact Mathematical Sciences Research Institute, 1000 Centennial Drive, Berkeley, California 94720, USA.

August 1–9 (Hamburg and Munich)

18th International Congress of the History of Science
Contact Prof J Scriba, Institute für Geschichte der Naturwissenschaften, Bundestr 55, D–2000 Hamburg 13, Federal Republic of Germany.

August 28 – September 1 (San Francisco)

IFIP 89 — 11th World Computer Conference
Contact IFIP Secretariat, 3 Rue du Marché, CH–1204 Geneva, Switzerland.

August 28 – September 1 (Canberra)

Third International Conference on the Theory of Groups and Related Topics
Contact J Cossey, Mathematics Department, Faculty of Science, Australian National University, GPO Box 4, Canberra ACT 2601, Australia.

October 16–20 (Beijing, China)

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

M R Carter,
Massey University.

Notes and Comment

Basic Mathematical Skills Programme at Auckland

Margaret J Morton

Auckland University

Over the period since 1983 the Department has evolved a Basic Skills Programme to assist students whose mathematical background does not enable them to cope with first-year mathematics courses. The programme was expanded in 1987: for the first time, running the programme and developing further resources was considered equivalent to teaching a stage 1 course. However, the University still does not recognise this activity formally, in terms of equivalent full-time students. The maths department has set up a Basic Skills Room which is open from 9–5 every day. It contains two microcomputers, books and written materials, which the students are encouraged to use.

A diagnostic test on basic algebra is given to the appropriate classes in the first week of lectures. Students grade their own tests. Each class is informed about the Basic Skills Programme, and those students with marks below about 75% are advised to obtain an information handout and attend the Basic Skills Programme.

Lecture/workshops are held twice weekly during lunchtime. "Basic skills in Mathematics", by Sharleen Forbes was the text. This book is generally well received by the students, but unfortunately there are a number of errors in it which upset poorer students. We had to preface a lot of the sections in this book with simpler material, and to supply handouts for material that wasn't covered. Students were encouraged to work in small groups with others from the same course. Although the material (at least in the first term) was not directly course-related, we hoped (and found) that working in groups would encourage the students to discuss amongst themselves, problems arising from their course. This was particularly valuable for mature students, who did'nt always have the advantage of knowing others in the course who might have come from the same school. We kept no formal record of students attending the basic skills workshops, nor did the students have to be enrolled in any maths course. There seemed to be a fairly even split of the sexes, though the mature students tended to be female. The students were not formally tested at any time during the year.

As well as the lectures, I was available during specified hours for consultation, and there was some software available for independent drill on two Apple 11e microcomputers in the basic skills room. Many of the students seemed to find doing drills on the computers particularly attractive. Some students would repeat the drills they had mastered just because this gave them a positive feeling!! It is a pity that good maths software is so hard to obtain. Using the computer had the added advantage for some students, in that they had never used one before and this gave them some confidence in that area too.

During the first term, there were usually about 30 students at a workshop, though not always the same people each time. The extra handouts were greatly appreciated by students who had to miss a workshop. The material taught was basic algebra, and it was needed by all students. I personally felt that those students who hadn't grasped these basic skills by May were by that time so far behind in their coursework that there was little hope of their passing the course at the end of the year. During the May break (when extra workshops were held) and for the rest of the year, there was a demand for reinforcement of material being taught in the various courses. This made real problems for me, trying to cover up to 4 different topics in an hour. Having the students together in course study groups helped a little, but the management of the Basic Skills Programme for terms 2 and 3 in 1988 requires further thought.

Whilst in the USA this year, I visited the Student Learning Centers at the University of Maryland and University of California at Berkeley. Both are well funded and run strong remedial maths programmes which are directly tied to specific maths courses. The organisers are convinced that this is the most effective way to help the students. Records are kept for each student and they must demonstrate competence on each topic before they are allowed to proceed. Possibly some of these features need to be considered for use in the 1988 Basic Skills Programme at Auckland.

Fibonacci Association News

The Fibonacci Association does not, in fact, date back to the days of Leonardo Fibonacci of Pisa (1170? – 1250?); but it can claim an existence of nearly twenty-five years, since its formation in December 1962 by a group of mathematicians* in San José, California. They had a common interest in studying properties of integer sequences, and in order to disseminate their ideas, they decided to publish **The Fibonacci Quarterly.** The first issue was published in 1963, and since then it has evolved into a research journal of full international status. By 1972,

* The founding fathers were Prof Verner E Huggett Jr, of San José State College, and Br Alfred Brousseau, of St Mary's College. A short history of the Fibonacci Quarterly appears in Fib. Qtly., 25.1 (1987), 2–5.

the **Quarterly** was listed regularly in both **Mathematical Reviews** and **Zentralblatt für Mathematik**, and its papers are listed in the **Science Citation Index.**

The primary function of **The Fibonacci Quarterly** is "to serve as a local point for the widespread interest in the Fibonacci and related numbers, especially with respect to new results, research proposals, challenging problems, and innovative proofs of old ideas". The latest issue, in November 1987, includes 16 papers and sections on elementary and advanced problems. Subscription membership fees are US$25, to be sent to Mr R Vine, Fibonacci Association, Santa Clara University, Santa Clara, California 95053.

It is fitting that the Association is to hold its Third International Conference on Fibonacci Numbers and their Applications next year in Pisa, the home of Leonardo himself. It will be at the Department of Mathematics, University of Pisa, Italy, 25–29 July 1988. For details, see Fib. Qtly., **25**.4 (1987), 290, or write to Gerald Bergum, Department of Computer Science, South Dakota State University, PO Box 2201, Brookings, South Dakota 57007–0199, USA.

I intend to be at the Conference, and I am going to make a bid to bring the fourth international conference to Waikato University in 1990. Are there any Fibonacci enthusiasts in New Zealand? I'd be pleased to have blessings and support for my bid.

John Turner,
Waikato University.

Guess Who?

Age 43.
Employed as a senior lecturer in a university somewhere in New Zealand.
Obtained PhD in 1970.
Spends about one third of working time on research.

This, according to the survey recently conducted through the Newsletter, is a profile of the "typical" NZ research mathematician. There were only 30 responses, unfortunately, so we cannot claim to have a complete picture of the NZ research scene, but you may nevertheless be interested in what emerged from the survey.

The age range is fairly small — two thirds of respondents were between 38 and 48 years old, the youngest was 31 and the oldest 53. This excludes two respondents who were unwilling to admit their ages, and two overseas respondents, both very senior mathematicians in every sense, whose responses have not been included in the NZ data.

Only four respondents were employed outside the universities, but this may reflect the distribution of the Newsletter rather than the distribution of mathematicians.

Time spent on research varied very widely. The minimum was 10%, but quite a few university staff were able to spend half their time on research.

There was a very wide range of research fields: given the small number of respondents, it was difficult to identify any areas of particularly strong activity. The area mentioned most frequently (7 respondents) was combinatorics (including graph theory).

Interestingly enough, the questions about the adequacy of support facilities did not provoke a chorus of complaint. The greatest perceived need is clearly for the provision of more research assistants, although even there, about half the respondents felt no need for such help. Computing facilities were generally regarded as adequate, and secretarial and library facilities reasonably so, though there were complaints about the slowness of the interloan service. We seem, generally speaking, to be satisfied with our lot — but perhaps only just!

Thanks to those of you who took the time to respond to the survey.

MRC

Grantees' Reports

Report: Dharmendra Sharma

Earlier this year, the NZMS awarded a travel grant from its South Pacific Fund to Dharmendra Sharma (Mathematics Department, University of the South Pacific), to help him attend the Colloquium and two conferences in Australia. Members should be interested in his [slightly edited] report —

I had the privilege of attending three conferences over the two weeks from 9 May to 23 May 1987.

(i) *Simulation Society of Australia Conference (SSA–87)* This 3 day conference (11–13 May) included papers on the rôle of modelling and simulation techniques in engineering, mathematics, the physical and biological sciences, economics, agriculture, and even ecology, all demonstrating the common themes arising from the use of these techniques in predicting the behaviour of complex systems. The conference was held at the Royal Melbourne Institute of Technology..

(ii) *STATCOMP–87* This symposium of statistical computing, statistical packages and mathematical text processing, held at Latrobe University on 14–15 May, had two major themes —

— statistical graphics and image analysis, and

— regression analysis.

(iii) *Colloquium 87* The New Zealand Mathematics Colloquium ... included papers from all branches of mathematics, and was held at the University of Waikato over 19–22 May.

I attended and participated in most of the sessions of the conferences. At *STATCOMP–87* and the *Colloquium*, I presented papers on my MSc research, *Computer-Based Modelling in Polymodal Marine Population Analysis.* I made several contacts, especially with researchers interested in similar research areas and participants keen to know about the University of the South Pacific and particularly, the activities of our Mathematics Department. The informal discussions were very useful.

Besides the conferences, I took the opportunity to visit and meet members of Maths and Computing staff of some universities and colleges — University of Melbourne, Latrobe University, Royal Melbourne Institute of Technology, University of Sydney, University of New South Wales, University of Auckland, the Auckland Institute of Technology.

I visited the computing laboratories at Latrobe, RMIT, NSW, Auckland and Waikato.

In conclusion, I would like to thank the NZMS for its financial support and the members for their kind hospitality. The experiences gained from the visits were stimulating and very rewarding.

Dharmendra Sharma,
The University of the South Pacific,
Suva, Fiji.

Margaret J Morton

Auckland

Earlier this year, I spent several weeks in the US, visiting institutions and people concerned with the position of women in maths and science. During this time, I also looked at how computers have been integrated into mathematics courses, sought interactive computer software for the Macintosh, and visited a couple of student learning centres to see how they helped students in need of remedial maths.

I began by participating in the five day Fourth International Girls and Science and Technology Conference (GASAT4) in Ann Arbor, Michigan. There were about 150 participants from 30 countries. Three volumes of papers were published before the conference started, summarised into three main groupings — intervention, evaluation and research. The conference consisted mainly of small discussion groups on topics such as

'Why do we want more women in science and technology?',

'How do we make sure that the technology we develop benefits women and generations to come?'

'Subject specialization / career orientation',

'Is there conflict between freedom of choice and the recommendation to make science mandatory for all?',

'Should labour market opportunities play as significant a role with women's career choices as with men's?'

'How do we break the vicious cycle of the stereotyped image of science's attracting certain personality types, who then reinforce the stereotype?'

Individual exchange of information, perspectives, problems and hopes were invaluable for helping participants clarify their ideas about some of the questions raised, but by no means can it be assumed that there were/are clearcut answers. Further directions will be pursued at GASAT5 in Israel in 1989.

I should mention some other people, also concerned with similar problems, whom I visited later in my trip.

Prof Alice T Shafer, currently at Simmons College in Boston, runs a Sonia Kovalesky High School Mathematics Day there, hoping to interest students in mathematics as a subject and then as a career. Alice has since sent me some very useful outlines of the workshop materials — they will be most helpful when we run our "Careers in Mathematical Sciences" day at Auckland University again next year.

Dr Rebecca Lubtekin works at the Consortium for Educational Equity, Rutgers, New Brunswick. This is one of ten such centres in the USA. While they cover all subject areas, they lean strongly towards encouraging more girls and racial minorities into maths/science. They have an impressive library, which includes a lot of the research material from this area as well as practical material for classroom use. They also run "Futures Unlimited" career days for girls.

Dr Ellen Mappen is the Director of the Douglass Project for Rutgers Women in Math and Science, aimed at encouraging the persistence of young women in maths and science majors. It provides women students with role models of women achievers in these subjects, with academically orientated peer support groups, with career option workshops, with mentor relationships with mathematicians and scientists from academia and industry, with internship placement, and with the opportunities to present their own research in a supportive environment.

Margery Fels Palmer (Office of Opportunities in Science, American Association for the Advancement of Science, Washington) is in charge of the mathematics equity program 'Middle School: Years of Choice', which has just been started. Most of our time was spent in

discussion of the IEA mathematics study, NZ and the US having just published the reports for their respective countries. We also discussed strategies of employing cooperative learning in maths.

Dr Linda Barnett works in the Centre for the Advancement of Academically Talented Youth (CTY), John Hopkins University, Baltimore. This resource centre identifies and works with highly able junior high and high school students, and with their parents, teachers and high school administrators, to provide challenging educational experiences. It offers summer residential programs in mathematics, humanities and sciences for selected high school students, and it runs a series of Saturday morning workshops for elementary school pupils.

Nadine Hinton (the Ohio Academy of Science, Ohio State University), is one of the organisers of the state-wide workshops for girls considering a career in maths or science. Talking with her was of particular interest, because of her recently completed research project into the effectiveness of such workshops: girls who attended the workshop, intended to take more maths/science at school than those in the control group, who did not attend. She hopes to follow this initial study up with a longitudinal study.

My search for computer software for the Macintosh was less than successful. At a later stage of my trip, I talked with Prof Howard Penn from the Annapolis Navel Academy, Maryland. He does a lot of reviewing of mathematics software for companies who are considering publishing it, and he confirmed that there still wasn't much commercial mathematics software for use on the Macintosh at the tertiary level. However this doesn't mean that computers aren't being used in mathematics learning. Prof Tom Shemanski at Dartmouth College has been quite active in this area. Over the past four years, in the rather Utopian situation where every student has ready access to a Macintosh computer, he has trialled various programs for incorporating computers into the first year maths courses. He now believes the most effective usage, is having the students write several programs during a semester. They use the True Basic language (developed at Dartmouth) and the programs are usually algorithmic in nature; instructions on using the language are given as part of the maths course. No mathematical content has been dropped, the added programming assignments being seen as valuable in enhancing the students' understanding of every details of some particular concept. I also visited the Technical Education Research Centre, Boston. This is a non-profit organisation, mainly funded by NSF grants. One large part of their work at the moment is directed towards developing creative software coordinated with curriculum material for all levels of education. For the Macintosh, they currently have a large mathematical modelling project underway. It will introduce the concepts of why one needs calculus, before calculus is actually taught. This project should have a working program later this year.

I visited the student learning centres at the University of Maryland and the University of California at Berkeley. Dr Elizabeth Shearn, Univ of Maryland, works with students with maths difficulties due to anxiety or to lack of skills. Under her guidance, students come to the facility and work on written maths modules or play videos of maths lectures. The latter have written material to go with them and have proved most successful; the students like both the novelty and the fact that the videos can be rerun as often as they like. Dr Shearn has found in various studies that the only really effective way to help a student is with work that relates directly to a maths course that they are taking (as opposed to general maths anxiety courses). She has developed a three way approach which works simultaneously on poor maths self-image, maths avoidance and maths deficiencies. In the most elementary maths course, which **all** students at the university must be exempted from or pass, students can elect to take a section which meets for 5 hours per week instead of the normal 3 hours — the extra time is used to build extra confidence and skills. While students don't receive extra credit for the extra hours, it is taken

into account in their course load for the semester. Other qualified students receive 1 credit towards an education course for acting as tutors for these remedial students.

At Berkeley, there is a very strong, well financed centre that caters to over 25% of the freshman students, with an emphasis on women and racial minorities. They have also found that the most effective maths help is course-oriented, and for each first year maths course, it is available in four ways — workshops for about 15 students, self help study groups of about 6 students, a drop-in room for asking a few specific questions, and for some students, a program of individual tuition. The students are monitored and must pass a small test on each skill before they progress to another skill. Other competent maths students can receive some credit and are paid for tutoring at the SLC. Their teaching skills are carefully monitored by the staff at the SLC, and workshops are held on how to be a good and effective tutor.

The Hamburg Scheduling Workshop and four University Visits

Julie Falkner

Department of Theoretical and Applied Mechanics

University of Auckland

At the end of July, I attended the fourth International Workshop on Computer-Aided Scheduling of Public Transport, held in Hamburg, Germany. There were just over one hundred participants from seventeen different countries, and I was the only New Zealander. The conference began on Monday evening with a "Get-Together" party and finished on Friday afternoon with a visit to the impressive Hamburg bus and underground control centers. The intervening hours were completely filled with papers, software presentations, and well-organised social activities. It was an exhausting but extremely profitable week.

The conference brought together researchers from England, Canada, and the United States, who have been working in the scheduling field for many years and have developed commercial systems, as well as researchers who are relatively new to the field from, for example, Portugal, Yugoslavia, and Australia. The state of the art in computer-based scheduling was presented, and the progress which has been made since the third workshop (held in 1983) is impressive. I am currently a PhD student and my thesis topic is "Bus Crew Scheduling Using a Set Partitioning Model". I found that the specific nature of the conference made it particularly rewarding. I had never before had the opportunity to meet other researchers in my field and during the week we had many interesting discussions.

The papers covered a wide range of topics, including planning shift work for airport handling personnel, scheduling railway motive power, and Dial- A-Bus systems. The mathematical approaches to crew scheduling were particularly interesting. These included column generation techniques, a heuristic based on Lagrangian relaxation, and the set covering method used by the successful IMPACS system. The three papers given by users of bus crew scheduling systems were also a highlight, as they presented the difficulties and the achievements from a different perspective.

My paper was the last one on the first day. I spoke about the bus crew scheduling method which has been developed for the New Zealand problem. I discussed the difficulties associated with the application of a mathematical model and how they are overcome, and presented the results of a feasibility study performed for the Christchurch Transport Board. my paper was very well received. Being the last speaker of the day proved to be an advantage, as there was

an unlimited time available for questions. I had many to answer — a sign of the interest in the New Zealand research.

On my way back to New Zealand, I visited four Universities. These included the University of Leeds in England, the University of Maryland in the United States, and the Université de Montréal in Canada. These are the three main centres of research into bus and crew scheduling and the visits were definitely worthwhile. I was invited to present seminars at Leeds and Maryland. Because I arrived during the University holidays, my audiences were small — but they were very interested. I also visited Stanford University, where there are researchers who share my interests in linear optimisation and in particular, the problems which can be caused by degeneracy in the simplex method. While there, I had a thought-provoking discussion with Professor George Dantzig. He is the originator of the simplex method and it was a privilege to meet such a distinguished researcher. I also renewed my acquaintance with Professor Michael Saunders, co-author of the well-regarded MINOS optimisation package.

While I was in England I was able to spend a day at London Buses Ltd. The schedulers there are currently using the IMPACS system developed in Leeds for most of their bus crew scheduling. It was a fascinating visit as the scheduler's view of the system is quite different from the researcher's view. I now have a greater awareness of the problems involved in gaining acceptance of a computerised system. This is important as the ultimate goal of my own work is implementation at the Christchurch Transport Board.

I have returned from overseas feeling stimulated and enthusiastic. I have a number of new ideas to investigate and many papers and theses to read. I am pleased that I was able to meet so many people and intend to maintain the contacts so that an on-going exchange of ideas and information will be possible.

Report On Canberra Trip, August 1987

Andrew Pullan

Department of Theoretical and Applied Mechanics

University of Auckland

The main reason for my two week visit to Canberra was to attend the International Symposium entitled 'Flow an Transport in the Natural Environment : Advances and Applications', organised by the Environmental Mechanics Division of CSIRO. This symposium was held in the Australian Academy of Science, a unique building featuring a copper shelled concrete dome resting on arches set in an annular pool, and occupied the entire second week of my stay. The first two days of my first week were spent attending a conference organised by the Research School of Earth Sciences at the Australian National University, "The Application of numerical Techniques in Earth Sciences'. The emphasis was to be on various numerical techniques and modelling methods. However, most of the speakers focused on the results they had obtained in various problems they had investigated. Hence this conference was somewhat disappointing, but I now have a greater understanding of the extreme difficulties involved in modelling geological processes.

The next three days were probably the most profitable, in terms of insight into possible future employment. I was given the opportunity to work in the Pye Lab at CSIRO, where the Environment Mechanics Division is located. The chief of this division, Dr. John Philip, is the founder of the field of quasilinear infiltration, the topic on which my PhD is based, and may of his staff are actively involved in this field. I consider it a great honour to have been able to see

at first hand the workings of this Lab and to meet the scientists behind the Lab's reputation. Although many of the staff were very busy finalising details for their conference they still had time to discuss with me my thesis and job prospects. I am very grateful to the staff at the Lab for this time, in particular Dr John Philip for arranging my visit to the Lab and Dr John Knight for his kindness and hospitality during my visit.

The CSIRO conference attracted many people from all over the world and I was given a further opportunity to meet and talk to people whose work I had often quoted and used but whom I had never met. I have probably now met every top researcher in the field of quasilinear infiltration as well as many other world-renowned scientists in related fields. My exposure to these people has been very profitable. Through informal discussion I learnt more in that week than I could ever hope to learn through mail contact alone.

The conference itself was run on fairly unconventional lines. Only the invited speakers and animateurs gave formal presentations and lectures. The other participants displayed their work with posters and all present were given ample opportunity to view these. The animateurs' task was unclear, even to the animateurs. After each talk they were given half an hour in which to speak, the only necessity was to summarise the posters that were relevant to the preceding talk. This met with a variety of results — some animateurs provoked healthy discussion on the preceeding invited speaker's talk, some gave there own view of the topic for that session and some spent the entire time giving a masterly summary of the relevant posters. Each day was dedicated to a different topic in soil physics, so the posters were changed daily. My poster drew a small but highly interested audience. The discussions I had with this group were very enlightening and I left the conference not only with answers to some of the questions I had, but also with many more interesting problems to investigate. I am particularly grateful to Dr. Peter Raats from the Netherlands for his special interest in my poster and his wealth of ideas.

Minutes of the Twenty-Second Council Meeting

of the New Zealand Mathematical Society

30th October 1987

The meeting was held in the Mathematics Department of the University of Canterbury and began at 10.00 a.m.

1. PRESENT: Brian Woods (in the Chair), Derrick Breach, David Gauld, Robert Goldblatt, John Shanks, Alfred Sneyd, Gillian Thornley, Brent Wilson; in attendance for part of the meeting, Robert Broughton and Bill Ellwood.

2. MINUTES OF PREVIOUS MEETINGS: It was moved from the Chair that the Minutes the Twenty-First Council Meeting of 19th May 1987, and the Minutes of the Brief Meeting of the Council on 21st May 1987, be taken as read and confirmed.

carried

3. MATTERS ARISING FROM THE MINUTES:

(i) Relating to item 7(v) of the previous Minutes, in reply to a question from DRB, BAW said he had heard nothing further from Professor Butcher about a prospective visitor from overseas.

(ii) DBG in connection with item 12 noted that the celebratory Australian Congress of Mathematical Sciences in 1988 would displace the Australasian Mathematics convention. It would be feasible to have such a convention in Auckland in 1991 or 1992.

It was moved by BAW, seconded by DBG that:

The NZMS liaise with the Australian Mathematical Society to explore the possibility of having an Australasian Mathematical Convention at the University of Auckland in 1992.

carried

It was noted that the present arrangement are that the Colloquium should be in Auckland in 1991 and Wellington in 1992. Since the Convention would absorb the Colloquium it was agreed that Auckland and Wellington should swap the dates of their Colloquia.

(iii) DBG asked if anything had been done about offering reciprocal rights to the Local Mathematical Associations. DRB replied that this was on his conscience but he had had some difficulty in finding all the addresses. However he had recently noticed a complete list in the New Zealand Mathematical Magazine and hoped to have a letter circulated by the end of the year.

4. CORRESPONDENCE

(i) In reply to a letter from Adragon Eastwood De Mello, aged 10, a recent graduate with honours of Cabrillo College, Aptos California, asking for membership of the NZMS, the Secretary said that, following the policy of offering recent graduates favourable terms, he had written to De Mello to say that his name had been added to the membership list with a free subscription for the next few years.

(ii) As a consequence of the debate at the AGM about possible South African representation at ICME–6, arising from a letter from the Association of Teachers of Mathematics in the UK, the secretary had written to the ATM(UK) informing them of the AGM's decision. He had also written a letter to Professor Poletti, the International Secretary of the RSNZ (with a copy to the National Committee on Mathematics), conveying the same information.

Professor Poletti's acknowledgement and comments were received. DRB reported that he had not had any further communication from the ATM(UK) about the matter.

(iii) The reply to BAW's letter to Dr Hatherton, President of the RSNZ, regarding under-representation of mathematicians in the Fellowship of the Society was tabled. There was a general discussion on the promotion of mathematicians as Fellows. BAW remarked that the composition of the Fellowship was unbalanced, with the lumping of physics and mathematics into one panel, whereas it seemed bio- chemists could be promoted by any of three panels. WBW said that there should always be two or three mathematicians up for nomination and GMT concurred, saying that it is important that nominations should always be seen to be going forward. DBG said the Council should be much more active in fostering nominations. DRB asked for better co-operation between the nominating groups with respect to particular nominations. BAW undertook to discuss the matter with Professors Butcher, Kerr and Vere-Jones. The Secretary will put a summary of the election procedure in the Newsletter.

(iv) BAW spoke about his letter of 3rd June 1987 to the Hon. C.R. Marshall, the then Minister of Education, in which great concern was expressed about the state of mathematics in the primary and secondary schools. This letter and the Minister's reply of 19th June 1987 was tabled. BAW did not think this exchange had been very valuable.

(v) The NZMS has received a copy of the report "Where Have the Mathematicians Gone" by Prudence M. Purser and Helen M. Wily. In their conclusions the authors write, *The declining number of mathematics graduates involved in school teaching is obvious. If the current trend continues, there will soon be no mathematics graduates entering the primary service and only a handful in the secondary service.*

(vi) BAW read a letter from Professor Zulauf expressing pleasure at accepting honorary membership.

5. TREASURER'S REPORT:

JAS in presenting a verbal report said that there had been no significant changes in the Society's finances since the AGM in May. The NZMS has $70,000 on term deposit and $28,000 in the current account. The assets of the Society amount to about $100,000. However it should be remembered that some of this should be flagged as finance for the publications operations. The 1986 balance has still not been audited. The auditor from Peat Marwick (who have been appointed official auditors) was still gathering information and had also been absent overseas. It is hoped that the audited accounts can be published in the December Newsletter.

WBW suggested that, as a matter of form, a letter should be sent to the President when the audit has been done. WBW said that ways of helping the Treasurer should be looked into. GMT raised the possibility of a separate publications account and said that having someone to look after the publications money would make the Treasurer's job much easier.

It was moved from the Chair, seconded by DRB, that:

The report be accepted.

carried

JAS tendered his resignation from the end of May 1988. The increasing amount of time that he has to spend as Treasurer is in infringing on his other committments. BAW in thanking JAS said he understood the reasons for his resignation. WBW asked that the Treasurer write notes on how to reduce the scale of the job.

(The meeting adjourned at 10.55 a.m. for coffee and resumed at 11.15 a.m. In attendance for the next session of the meeting were Bill Ellwood (for NZAMT) and Bob Broughton.)

6. PUBLICATIONS

(i) GMT presented a report from the Publications Committee (see appendix). This embodied three suggestions from a meeting of convenors of writing groups held in Wellington on 19 September 1987. the council was asked to consider the following points:

(1) Liaison with NZAMT over joint publications and their taking responsibility for some of the on-going tasks and their participation in decisions associated with the projects.

(2) Separation of the publications funds from the general NZMS funds.

(3) The setting up of a capital fund to support reprinting and new publications.

It was moved from the Chair that:

The report of the Publications Committee be received.

carried

In speaking to (1) GMT said that liaison with NZAMT was needed to establish a good market survey of future usage. It is important to know how many copies of a second printing are required. A wrong guess could be quite costly. The NZAMT could tell us about how the books are received. GMT had written Earl Irving about this asking for a reply by the end of October but had not had a reply. Questions were asked about the nature of NZAMT and the rationale of its sharing in the profits from the books. To some it was not clear that NZAMT was a representative body of Teachers. Bill Ellwood said that the Canterbury Mathematical Association had been trying to contact NZAMT for the past few years; he understood that with a new administration it had become more active. WBW said that it was his understanding that NZAMT was a co-ordinating body for the Mathematical Associations and perhaps had some money other than that it received from the publications. GMT undertook to write to the new President of NZAMT, Mrs Annette Joyce, about publications.

In reply to observations from Council members about the varying and seemingly high prices of the books as sold in bookshops, GMT explained that cost books were sold directly to schools at a price designed to cover costs and contingencies. Books were sold at a slightly lower price to booksellers who then added their mark-up of perhaps 40%. Consequently the books cost a lot more if bought from a bookshop.

Relating to point (2), that the publications account be separated from the general funds, there was much discussion about cheque- signing rights and control over such a separate account. BAW said that so long as the money belong to the NZMS it would appear somewhere on the annual balance sheet. WE asked if the NZAMT is aware that the NZMS is the body controlling the money. In reply GMT pointed out that while the agreement was that half the profits go to NZAMT they were also liable for half of any losses.

It was moved by GMT, seconded by JAS, that:

The publications money be kept in a separate account from the general funds as from the beginning of the next financial year and that the Council seek an Associate Treasurer to look after the publications money.

carried

In connection with point (3) GMT reported that 9,000 copies of 'Mathematics with Statistics' had been sold. Possibly a saturation point of 9,500 students was being approached. There are four titles currently on the market and three of these were being reprinted. A fund of $50,000 is needed to print on a year to year basis. It is more economical to print a run of 2,000 than 1,000. The expected life of a copy of one of the books is five years. GMT felt that a reprint of 2,000 copies would sell eventually.

It was moved from the Chair that:

The Council approve the reprinting of 'Mathematics with Statistics' with a run of 2,000 copies.

carried

The matter of producing books on word processors with contingent use of software was raised. Should the NZMS be purchasing copies of software to protect itself against accusations of piracy? If so, then there are problems since authors use a variety of machines. RLB pointed out that it is the operators of the machines who have to protect themselves, the Society's concern is with the text and not with the machinery used to produce it. It is like employing a typist to produce a document: the employer is not concerned with the patents on the typewriter used.

7. LIAISON WITH NZAMT

DRB said that the link with the NZAMT has been lost. This could possibly be due to his omission to read the Constitution on taking over the Secretaryship. The Constitutions of the NZMS and the NZAMT provide for a representative of each to be on the Council of the other. The meeting agreed that it could be a different representative each time there was a Council meeting.

The matter arose through DBG recently being called at short notice to attend as an NZMS representative, a NZAMT Council meeting, the first that had been held since 1984. He could attend only the first half of the meeting but got the impression that NZAMT is in good hands. The President is now Mrs Annette Joyce and there seemed to be much enthusiasm. The NZAMT is to hold a Biennial Conference and the Inaugural Conference is to be organized by the Waikato Mathematical association. The idea of a National Mathematics Week has been raised and a sponsor is being sought. DBG undertook to pass the papers from the meeting he attended to the Secretary. In reply to a question of WBW as to how the NZAMT spent its funds, DB reported that $2,000 had been given to the organizers of the NZ Math Olympiad team and that a loan of a further $4,000 had been made to the same group.

It was moved by DBG, seconded by WBW, that:

The Secretary write to the President of the NZAMT to renew the past co-operation between the two Societies.

carried

The meeting adjourned for lunch at 12.30 p.m. and reconvened at 1.50 p.m.

8. FURTHER PUBLICATION MATTERS

(i) DRB reported that the preparation of an updated pamphlet about the NZMS was in hand.

(ii) GMT reported that Mike Carter would do a new version of 'Careers in Mathematics' but would be happy to accept a replacement.

(iii) BAW referred to the data that Mike Carter had been collecting through the Graduate Information Scheme. There has been good feedback from participating recent mathematics graduates. A volunteer in each University is needed to do the local administration. It was suggested that Heads of Departments be written to in this matter.

(iv) Mark Schroder will cease being the Editor of the Newsletter from December 1987. It was felt that it was Auckland's turn to have the Editorship. DBG said he would try to find someone.

(v) The list of post-graduate topics in mathematics will be edited by Rod Downey from VUW.

(vi) WBW raised the possibility of publishing something other than school textbooks. GMT said that those with prestigious books usually have them published by a prestigious publisher. However there is the possibility of co-operating with the Cambridge University Press. RIG remarked that to have a series one needs to have a first. GMT said a number of members do write books and perhaps it was matter of putting out feelers.

(vii) DBG said that there had been criticisms from his Department of 'Calculus' by Carter et al. These could be the consequences of a committee production. GMT shared these reservations; Massey University finds it not suitable for its extramural students. Different universities have different requirements so maybe a new text should be considered. BAW suggested that detailed criticisms should be handled on a critic to author basis.

9. GRANTS AND AWARDS

(i) Travel reports were received from Andrew Pullan and Julie Falkner.

(A report from Margaret Morton arrived shortly after the meeting.)

(ii) It was moved by BAW, seconded by WBW, that:
Ingrid Rinsma be given $500 towards the costs of attending the Summer Research Institute at Newcastle.

carried

It was moved by DRB, seconded by DBG, that:
Sharlene Forbes be given $500 towards the costs of attending the Sixth International Conference on Mathematical Education to be held in Budapest.

carried

It was moved by RIG, seconded by DBG, that:
The sum of $5000 be earmarked for a combinatorics and graph theory workshop planned by Derek Holton for the beginning of 1989.

carried

In response to an application from Sharlene Forbes on behalf of the NZ Statistical Association for assistance with the Third International Conference on Teaching Statistics to be held at Otago University in 1990,

it was moved by BAW, seconded by RIG, that:
The Council ask for more detail on the planned projects and their estimated costs.

carried

Two other requests for financial assistance were not successful.

(iii) The idea of having a prize for the best presentation by a student at the Colloquium was discussed. This could be in place of, or as well as, the thesis prize offered every two years or so.

It was moved by BAW, seconded by RIG that:
The thesis prize be continued but the possible institution of a paper prize be deferred.

carried

10. CENTENNIAL YEAR OF THE AMERICAN MATHEMATICAL SOCIETY

The President had received a letter from the American Mathematical Society saying that 1988 will mark a hundred years of their existence. They invite the NZMS to send a representative to their celebrations in August. The representative would receive complimentary registration. They would also be honoured to receive greetings from the NZMS as being a Society with which they have a reciprocity agreement. BAW reported that he had written to various mathematics departments seeking someone who might be on leave in the United States at the time and who could be a suitable representative. This matter is

still in hand. BAW suggested DRB and DBG co-operate in the preparation of a bilingual formal address.

11. 1988 MATHEMATICAL SCIENCES CONGRESS IN CANBERRA

(i) This gathering in celebration of the Australian bicentennial will not rank as an Australasian Mathematics Convention. BAW has written to Professor Heyde saying that the NZMS would be happy to be actively involved. In response by telephone, Professor Heyde had suggested that the NZMS underwrite some of the expenses of a keynote speaker from New Zealand. BAW undertook the finding of such a speaker.

(ii) There being no NZ Maths Colloquium in 1988, the following two motions were put —

It was moved by JAS, seconded by WBW, that:

The 1988 AGM of the NZMS be held in Canberra during the Australian Mathematical Sciences Congress.

carried

It was moved by DRB, seconded by AS, that:

The next meeting of the Council of the NZMS be held in Christchurch in May 1988 and before the AGM.

carried

12. OFFER OF ADMINISTRATIVE SERVICES

Dr Peter Thomson of the Institute of Statistics and Operations Research, VUW, wrote to the NZMS for opinions of his proposal that member bodies of the RNZ contract out their administrative work, such as journal preparation, accounting and billing, to a central service to be set up by the RSNZ. It was the opinion of the meeting that the Council is happy with its present arrangements. The Secretary is to write to Dr Thomson conveying this sentiment.

13. PUBLIC RELATIONS

The President spoke of the present overcast climate in mathematics education. There is much unease about scientific and technological education in general with mathematics having its own problems. This is examplified by a number of recent reports such as the Beattie report, the Clark/Vere-Jones report, the Watts report on NZ Universities and the Purser/Wily report. The annual number of mathematics graduates is declining and the supply of qualified mathematics teachers is decreasing alarmingly. The NZMS should be more agressive in communicating its misgivings to the public and making known its support for greater recognition of mathematics in secondary schools. In primary schools there is a need to defeat the attitude that "It doesn't matter if a primary school teacher has only School Certificate mathematics". Indifferent teachers of mathematics convey their indifference to pupils, particularly in primary schools. BAW called for ideas.

In response, the following points were raised:

(i) The Society should send people around the secondary schools to talk to students about what a mathematician does. This has already been tried in some schools with a good response and a similar program is carried out at Waterloo in Canada.

(ii) Workshop days in mathematics and statistics have been successful in Auckland. Similar days should be held elsewhere such as in Christchurch.

(iii) There is a need for refresher courses for mathematics teachers.

(iv) Radio programs should be seriously considered.

(v) The universal applicability of mathematics should be emphasised. The NZMS should find out from the American Mathematical Society about the Math Week that they sponsor.

(vi) The writing of letters to the paper is all very well but a much better impact can be made by writing to the Minister of Education.

(vii) University mathematics departments should be providing better facilities for students and the Universities' Grants Committee should be made aware of this.

The President will write to the Minister of Education telling of the time bomb of extinction for mathematics teachers.

There being no other business the meeting ended at 4.10 p.m.

D.R. Breach,
Hon Secretary, NZMS

Appendix Publications Report to NZMS Council

October 1987

Meeting of convenors of writing groups

This was held in Wellington on 19 September. The group asks Council to consider the following:

1. Liaison with NZAMT over the joint publications. We would like them to take responsibility for some of the on-going tasks and participate in decisions associated with the projects.
2. The separation of publications funds from NZMS funds.
3. The establishment of a capital fund to support reprints and new publications (reprints of 3 books this year will cost about $50,000).

Textbooks

'Calculus' is selling about 1,000 copies a year.

'Mathematics with Statistics' has sold 9.5 thousand copies in 2 years. The new printing will include corrections.

'Mathematics with Calculus' has sold over 7,000 copies.

'Secondary School Mathematics' continues to sell but has more competition than the seventh form books.

New Publication

The 200-level linear algebra book will be class-tested in manuscript form during 1988 and should be published for 1989.

'Post-Graduate Topics in Mathematics'

Rod Downey from Victoria will edit this in 1988.

'Employment Opportunities in Mathematics'

Mike Carter has volunteered to rewrite this in the summer of 1988–89. Meanwhile he is gradually collecting material for it through the Graduate Information Scheme. At present there is a need for people in Waikato, Victoria and Canterbury to help with administering this scheme — it takes about one hour a year.

Publications Committee

Rod Downey (Victoria) has joined the Committee and Graham Wood (Canterbury) will join it next year.

Gillian Thornley

Nominations for the NZMS Council

The terms of three present members of the Council will expire in May 1988; they are those of Ivan Reilly (Out-Going President), Marston Conder and Brent Wilson (Council Members). Also, the Treasurer, John Shanks, wishes to resign as from May 1988. At the AGM in 1988 an Incoming Vice-President must be elected.

Nominations are invited for:

(i) Incoming Vice-President;

(ii) Two Ordinary Councillors;

(iii) A Councillor who is willing to become Treasurer.

Note: If the Incoming Vice-President is already a member of the Council, then a further ordinary Councillor will have to be elected.

Candidates must be financial members of the NZMS. They must be nominated in writing by two other financial members. Nominations must be accompanied by statements signed by the nominees that they are willing to accept nomination. Nominations should reach the Secretary of the NZMS by 1 March 1988. Candidates are invited to send thumbnail biograhies for inclusion in the April issue of the Newsletter.

D.R. Breach,
Hon Sec, NZMS.

Fellowship of the Royal Society of New Zealand

The Royal Society of New Zealand elects up to seven Fellows each year at the AGM of the Fellows in May. Nominations should be sent to the Executive Officer by 15 November of the previous year. Candidates must be resident in New Zealand and must have been so during at least three years of their scientific careers.

Nominations can be made in two ways: either by member bodies (of which the NZMS is one), or by a group of not less than three Fellows. Nominations stand for five years. Candidates who have not been elected after this time cannot be renominated until a further three years have passed.

A nomination should be supported by a curriculum vitae and a full bibiliography. The nominators should name a candidate's six most important papers. Supporting documents written by the candidate are not acceptable. The fellowship selection advisory panels are: Animal Sciences; Biochemical, Cellular and Molecular Biology; Chemical Sciences; Earth Sciences; Engineering and Technology; Human Sciences; Medical Sciences; Mathematical and Physical Sciences; Plant Sciences.

Those in the mathematical community of New Zealand who wish to be nominated or who have suggestions for others to be nominated should write to the Secretary or President of the NZMS.

Problems and Queries

Your patient PQ Editors remain keen to learn of your favourite problem or query. We set out the problems from this year's Olympiad in Cuba, with thanks to Derek Holton. Next July in Canberra, a New Zealand team will take part, for the first time ever.

G C Wake,
M D Hendy,
Massey University.

28th International Mathematical Olympiad, Havana, 1987

Problem 1

Let $p_n(k)$ be the number of permutations of n objects which fix k objects. Prove that

$$\sum_{k=0}^{n} k\, p_n(k) = n!$$

(A permutation is a 1:1 onto mapping. A permutation fixes an object if it does not change it. The permutation $1 \to 2,\ 2 \to 3,\ 3 \to 5,\ 4 \to 4,\ 5 \to 1$ fixes 4 .)

Problem 2

Let ABC be an acute angled triangle. The bisector of the angle A cuts BC at L and meets the circumcircle of ABC again at N. Let K and M be, respectively, the feet of the perpendiculars from L to AB and AC.

Prove that the area of the quadrilateral $AKNM$ equals the area of the triangle ABC.

Problem 3

The real numbers $x_1, x_2, \ldots, x_n$ satisfy

$$x_1{}^2 + x_2{}^2 + \ldots + x_n{}^2 = 1.$$

Let k be an integer greater than or equal to 2.

Prove that there exist n integers $a_1, a_2, \ldots, a_n$, not all zero, which satisfy

(1) $$\text{for all integers } i,\ 1 \le i \le n, \quad |a_i| \le k - 1,$$

(2) $$|a_1x_1 + a_2x_2 + \ldots + a_nx_n| \le \frac{(k-1)\sqrt{n}}{k^n - 1}.$$

Problem 4

Prove that there is no function f from the set of non-negative integers into itself such that $f(f(n)) = n + 1987$ for every n.

Problem 5

Let n be an integer greater than or equal to 3. Prove that there is a set of n points in the plane such that the distance between any two points is irrational and each set of three points determines a non- degenerate triangle with rational area.

Problem 6

Let n be an integer greater than or equal to 2. Prove that if $k^2 + k + n$ is prime for all integers k such that $0 \leq k \leq \sqrt{n/3}$, then $k^2 + k + n$ is prime for all integers k such that $0 \leq k \leq n - 2$.

Time: 4.5 hours — each problem is worth 7 points.

IMO 87 — Rough Solutions

Editor's Disclaimer — As you will see, I have tried from time to time to make these Cuban translations into English resd better, without much success. I hope I have not introduced error by so doing — I had no time to check them.

Problem 1

Clearly, $\sum_{k=0}^{n} p_n(k) = n!$. Let $S = \{1, 2, \ldots, n\}$ be our n objects. To each permutation of S, we assign an n-vector $(e_1, e_2, \ldots, e_n)$ such that $e_i = 1$ if i is a fixpoint and $e_i = 0$ if i is not a fixpoint, for $1 \leq i \leq n$. Hence there exist $p_k(n)$ such n-vectors having exactly k components "1" — in other words, $\sum_{k=0}^{n} k\, p_n(k)$ counts all the "1"s occuring in all the n-vectors assigned to the $n!$ permutations. But for each i between 1 and n, there exist $(n-1)!$ permutations of S having fixpoint i, and for all of these, $e_i = 1$. Hence there occur exactly $n.(n-1)! = n!$ components "1" in the n-vectors.

Problem 2

We carry out the auxiliary constructions shown in the figure. Let P be the second point of intersection of segment BC and the circumscribed circle to quadrilaterial $AKLM$. Then $\angle BCN = \angle BAN$, because they are angles inscribed in the same arc of the circle. For the same reason $\angle MAL = \angle MPL$. Since AL is a bisector, $\angle BCN = \angle BAL = \angle MAL$. Therefore $\angle MPL = \angle BCN$, and consequently $PM \parallel NC$. Similarly, we prove $KP \parallel BN$. Since the quadrilaterials $BKPN$ and $NPMC$ are trapezoids, $S_{BKE} = S_{NPE}$ and $S_{PNF} = S_{CFM}$. Thus $S_{ABC} = S_{AKNM}$.

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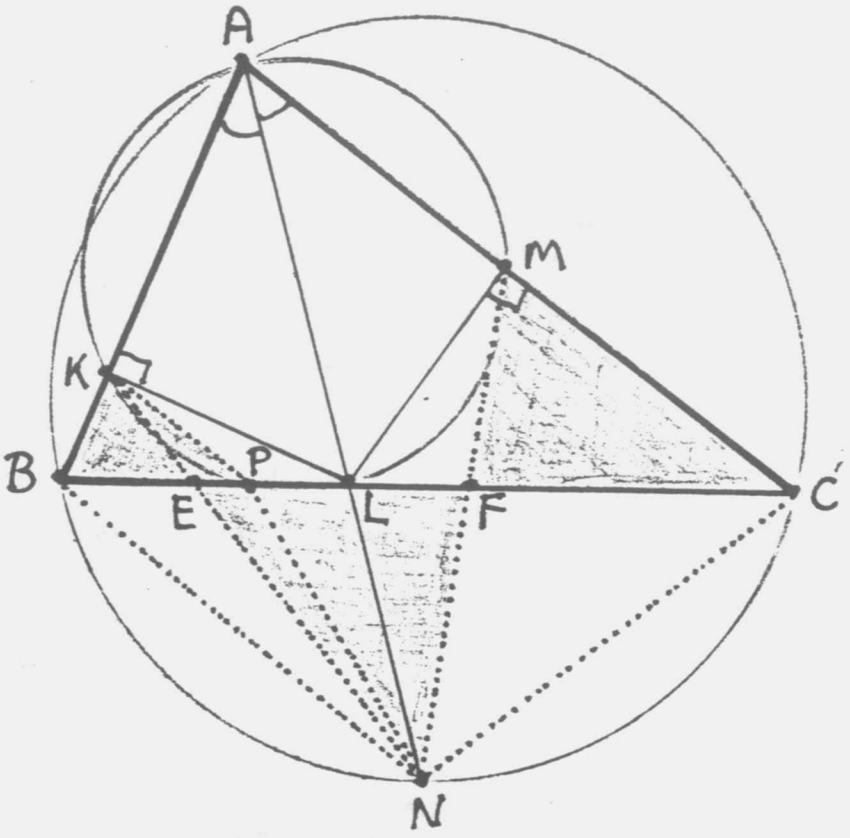
Problem 3

Since $x_1^2 + x_2^2 + \ldots + x_n^2 = 1$, the Cauchy inequality shows

$$|x_1| + |x_2| + \ldots + |x_n| \leq \sqrt{x_1^2 + x_2^2 + \ldots + x_n^2}\,\sqrt{n} = \sqrt{n}.$$

Hence all sums of the form $a_1x_1 + a_2x_2 + \ldots + a_nx_n$ with $a_i \in \{0, 1, 2, \ldots, k-1\}$, must lie in some closed interval $\mathcal{I}$, of length $(k-1)\sqrt{n}$. This interval can be covered with $k^n - 1$ closed sub-intervals of length $(k-1)\sqrt{n}/(k^n - 1)$.



By the pigeon-hole principle, two of these sums must lie in the same sub-interval. Their difference cannot exceed the length of the sub-interval, so there exist $a_i = 0, \pm 1, \pm 2, \ldots, \pm(k-1)$ for which

$$|a_1 x_1 + a_2 x_2 + \ldots + a_n x_n| \leq \frac{(k-1)\sqrt{n}}{k^n - 1}.$$

Problem 4

Indeed, suppose that such a function exists. Then

$$f(n + 1987) = f(f(f(n))) = f(n) + 1987, \text{ for all natural } n.$$

Thus, by induction,

$$f(n + 1987t) = f(n) + 1987t, \text{ for all natural } n, t.$$

On the other hand, take a natural number $r \leq 1986$. Then

$$f(r) = 1987k + l, \text{ for all natural } k, l \text{ with } l \leq 1986.$$

Therefore

$$f(f(r)) = r + 1987, \text{ and}$$
$$f(f(r)) = f(l + 1987k) = f(l) + 1987k.$$

In particular,

$$\text{if } k = 1, \text{ then } f(r) = 1987 + l \text{ and } f(l) = r, \text{ and}$$
$$\text{if } k = 0, \text{ then } f(r) = l \text{ and } f(l) = r + 1987.$$

In both cases, $r \neq l$. In this way the set $\{0, 1, 2, \ldots, 1986\}$ is divided by pairs (a, b) such that $f(a) = b$ and $f(b) = a + 1987$, or $f(b) = a$ and $f(a) = b + 1987$. [Editor's Note — Without going into 'math mode', I don't know what this means, and I have no time left to figure it out.]

But the set $\{0, 1, 2, \ldots, 1986\}$ has an odd number of elements, and thus it cannot be divided in such pairs. Contradiction!.

Problem 5

For $i = 1, \ldots, n$, the points $P_i(i, i^2)$ satisfy the conditions.

To prove this, suppose first that

$$\overline{P_iP_j} = |i - j|\sqrt{1 + (i + j)^2} = |i - j|\frac{p}{q},$$

with the rational fraction in its lowest terms. Since $p^2/q^2 = 1 + (i + j)^2$, a natural number, and since p and q are co-prime, $q = 1$. But that means $1 + (i + j)^2 = p^2$, a perfect square. Contradiction, as $1 + m^2$ can never be a perfect square.

Next, if $i < j < k$, the area of the triangle $P_iP_jP_k$ is

$$\frac{i^2 + k^2}{2}(k - i) - \frac{i^2 + j^2}{2}(j - i) - \frac{j^2 + k^2}{2}(k - j),$$

a rational number.

Problem 6

Let y be the smallest non-negative integer less than $n - 1$, such that $f(y) = y^2 + y + n$ is composite, and let q be its smallest prime divisor.

Then $q > 2y$. Suppose not: $q \leq 2y$. Now consider $f(y) - f(x) = (y + x + 1)(y - x)$. As x varies from 0 to $y - 1$, the factor $y - x$ takes the values 1, 2, ..., y and $y + x + 1$ takes the values $y + 1$, $y + 2$, ..., $2y$. Hence q divides $f(y) - f(x)$, for some such x. Further, as $f(x)$ is prime and q divides $f(y)$, $f(x) = q$.

On the other hand, $y - x \leq n - 2 < n + x + x^2 = f(x)$ and $y + x + 1 \leq n + x + 1 < n + x + x^2 = f(x)$. Therefore $f(x)$ cannot divide $(y - x)(y + x + 1)$. Contradiction.

Since q is the smallest prime divisor of $f(y)$, $f(y) \geq q^2$, and so $y^2 + y + n = f(y) \geq (2y + 1)^2$. Thus $y < \sqrt{n/3}$, contradicting the statement of the problem.

Book Reviews

Computation and Proof Theory (Proceedings, Logic Colloquium '83, part II), edited by M.M. Richter, E. Borger, W. Oberschelp, B. Schinzel and W. Thomas; Springer Verlag, Lecture Notes in Mathematics, **1104** (1984), 475 pages.

Logic Colloquium '83 was held in Aachen and, by the evidence in this volume, must have been a very interesting conference. This volume contains a series of technical papers covering a wide cross section of areas that might loosely be described as computation and proof theory. In many ways this volume also represents a tribute to the continued interaction of logic and computer science. Indeed, many of the papers could easily have appeared in computer science journals. It is volumes like this which will help to ensure that both areas remain enriched by exposure to each other, rather than drifting into separate, isolated areas where only specialists can converse.

Now for some details. There are several papers concerned with classical recursion theory and applications of recursion theory to mathematical structures. In "Contiguous r.e. degrees", Ambos-Spies gives a beautiful analysis of constructions and applications of contiguous r.e. degrees. These degrees were discovered by Richard Ladner and have many important applications to definability results in the r.e. degrees. Most of these applications have been found subsequent to Ambos-Spies' giving the comprehensible constructions to be found in this paper. It should be remarked that contiguous degrees are not analysed in Soare [12] and so this paper is required reading for all interested in the structure of r.e. degrees.

[Editor's Apology — I wasn't able to put these tildes underneath, where the reviewer, Rod Downey, had placed them. Please move them down.]

Chong and Jockusch in "Minimal degrees and 1-generic degrees below $\tilde{0}'$" contribute to our understanding of the complex interactions between Sacks forcing and Cohen forcing. The authors show that no 1-generic degree below $\tilde{0}'$ bounds a minimal degree. In later work, Chong [2] has shown that some minimal degrees below $\tilde{0}'$ can however be recursive in some 1-generic degrees, although Chong and Downey [3] have shown that some minimal degrees below $\tilde{0}$ are recursive in no 1-generic degree. Below $\tilde{0}'$, in her Cornell '85 thesis Haught gave the complete answer by showing that if $\tilde{0} < \tilde{a} < \tilde{b} < \tilde{0}'$ and $\tilde{b}$ is 1-generic, so too is $\tilde{a}$. A number of difficult questions remain. Foremost amongst these is: is there a fixed-point-free minimal degree?

Crossley and Remmel, 'Undecidability and Recursive Equivalence, II', modify a technique of Manaster and Nerode [9] to prove the undecidability of various theories of constructive order types. In a later paper they attack similar questions on matroids. Carstens and Pappinghaus, 'Abstract Constructions in Recursive Graph Theory', give a general result which subsumes various constructions in recursive combinatorics. However, as with several results from recursive model theory it is probably easier to perform a direct construction than to verify the hypotheses of the general result. The papers of Kreitz and Weihrauch, 'A united approach to constructive and recursive analysis' and Spreen and Young, 'Effective operators in a topological setting', are concerned with attempting to get a general setting for recursive analysis. The Spreen-Young paper presents a uniform generalization of the Myhill-Shepherdson and Kreisel-Lacombe-Shoenfield theorems on effective operators in certain effective T_0-spaces. Simultaneously, the authors obtain various generalizations of these theorems due to Moschovakis and Ceitin. As is well known, such continuity results are basic in computer science when studying the λ-calculus via the continuous partial orders of Scott and of Ershov. (See Scott [11], for example.) The Kreitz-Weihrauch paper presents an approach to constructive/recursive analysis based on type 1 and type 2 recursion theory and on the theory of numerations. The basic idea is to study these areas under some classical logic rather than intuitionism. For other such approaches the reader should see Beeson [1].

The last essentially recursion-theoretic paper is Hinman's "Finitely approximable sets". In this paper Hinman generalizes the study of continuous or countable functionals — objects which are essentially described by a set of hereditarily finite approximations — to a more general class of finitely approximable objects (sets, functions and relations).

In "Between constructive and classical mathematics", Feferman gives an interesting philosophical comparison of constructive, recursive and classical analysis. (In view of the recent interest in fragments of second order arithmetic, such a study would now also include some "reverse mathematics".) However, in view of the philosophical implications of constructivism, Feferman remarks "what remains to be done is to demonstrate the actual computational significance of theoretical constructive mathematics". There has been some recent progress in this area — Sasaki [10], say.

The papers of Denenberg and Lewis, "Logical syntax and computational complexity", Dennis-Jones and Wainer, 'Subrecursive hierarchies via direct limits", Slessenger, "On subsets of the Skolem class of exponential polynomials" and Gurevich, "Toward logic tailored for computational complexity", are all concerned with various aspects of the theory of computational complexity. The Dennis-Jones/Wainer one is devoted to the subrecursive classification problem: find "natural" ordinal assignments for classes of recursive functions which reflect their computational complexity. Instead of using the Grzegorczyk hierarchy, the authors study an extremely refined version of this hierarchy called the slow growing hierarchy, extending ideas of Girard [7]. The Skolem class T is defined as the least class of functions on ω containing 0, x and closed under sum, product and exponentiation (that is, $f(x)^{g(x)}$). Using the notoriously fast growing well-quasi-ordering results of Kruskal, Ehrenfeucht [5] showed that T is well ordered by eventual domination. Slessenger's paper produces certain rather technical results concerned with explicit bounds for relevant subclasses. The Denenberg-Lewis paper gives a survey of what might be deemed "natural" fragments of predicate calculus which give example of problems (along the lines of say, [4]) of specified degrees of computational complexity.

Gurevich's paper addresses the following very important (as yet unresolved) problem made by computer science: logics — such as first order logic — were developed to study infinite structures, whereas for computing one needs a logic devoted to the study of finite structures. The paper discusses the first order theory of finite structures and then analyses alternatives such as polynomial time logic. Gurevich's paper and Moschovakis' paper below are essential reading for anyone interested in these issues.

Moschovakis' very long and deep paper "Abstract recursion as a foundation for the theory of algorithms" describes an abstract axiomatic theory of recursion strongly connected with foundational questions of computer science. The models of this theory include most generalized recursion theories as well as providing natural structures in which to interpret higher level programming languages. The approach here is somewhat along the lines suggested in Kleene [8], for instance.

Three further papers are concerned with logical questions arising from computing. In "A star finite relational semantics for parallel programs", Farkas and Szabo address (one of the main problems to be overcome in) developing a reasonable semantics for parallel programs; namely that for a single input, a parallel program can produce both finite and infinite computations. The authors attempt to solve this problem by using nonstandard methods and replace all computations by 'star-finite' ones. Germano and Mazzanti, "Partial closures and semantics of while", propose a generalization of closure theory. The authors use this technique to study computability on inductive and non-inductive data types by iterative methods. Rodding, "Some logical problems connected with modular decomposition theory of automata", deals with connections between normal network theory and logic. This theory is the theory of modular decomposition of sequential automata by networks over special basis automata.

The last set of papers are devoted to classical proof theory. Hajek, "On a new notion of partial conservativity", introduces a new indicator-like class of formulae of Peano arithmetic and shows how it may be used to obtain various technical extensions of Gödel's second incompleteness theorem. Linstrom, "On faithful interpretability", solves the question — implicit in Feferman, Kriesel and Orey [6] — of finding conditions that are necessary and sufficient for "faithful interpretability" (a sort of restricted notion of interpretability). Schmerl, "Diophantine equations in a fragment of number theory", uses proof-theoretic methods to give to conditions under which $r(x_1, \ldots, x_n) = s(x_1, \ldots, x_n)$, — a diophantine equation with r and s polynomials with coefficients in ω, is solvable in the fragments Z_0 of classical number theory. It is still open whether (solving such equations) is decidable. Uesu, "An axiomatization of the apartness fragment of the theory DLO^+ of dense linear orders", solves the question — of Symorski [13] — given in the title. The technique is proof-theoretic rather than model-theoretic — model-theoretic methods being used in [13].

Finally in "Generalized rules for quantifiers and the completeness of the intuitionalistic operators &, $\vee$, $\supset$, Λ, $\forall$, $\exists$", Schroeder-Heister gives a proof-theoretic framework for treating arbitary quantifers binding m variables in n formulae. This is done in a way that allows him to give a schema for introduction and elimination rules for such quantifiers. With respect to such rules, it is shown that the system of standard operators of intuitionistic quantifier logic is complete.

In summary, this volume is representative of many of the main areas of computation and proof theory. It is especially good with regard to the interface of logic and computer science. It would therefore be a very worthwhile purchase for anyone interested in these issues.

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R G Downey,

Foundations of Constructive Mathematics, by M J Beeson; Ergebniße der Mathematik und ihrer Grenzgebiete, 3. Folge (Modern Surveys in Mathematics, vol 6), Springer-Verlag, Berlin, New York (1985); 466 pages; ISBN 3-540-12173-0.

The heart of this book is an analysis and comparison of various formal systems meant to capture the notion of "constructive mathematics" (hereafter 'CM'). To make this statement any more precise, it is first necessary to (i) at least describe what CM is, and (ii) convince the reader that many different formalizations of CM are possible.

The idea behind any form of CM is that proofs should be algorithmic. Thus any proof that an object x exists (from initial data y) must explicity give a concrete algorithm which — in theory at least — would construct x (from y). In fact, from Bishop's [2] very influential point of view, to claim that an object x exists with property P one must produce a finite routine for constructing x **as well as** a finite routine to verify that x posesses property P. As we shall see later, this latter condition asks more. I should remark that there have also recently been some computer science driven investigations into that area of mathematics with **feasible** proofs such as polynomial time systems (see [5] or [15], say) but this should be regarded as 'subconstructive' mathematics rather than replacing CM, since the philosopies involved are so different.

Historically, CM — as an area — appeared only as a response to the introduction of set-theoretical nonconstructive methods into mathematics. Before the introduction of these methods, virtually all of mathematics was constructive. Although these nonconstructive ideas and methods began to appear in algebra in the latter half of the nineteenth century in the works of Dedekind and others (see Metakides–Nerode [17]), the real impact of the techniques probably was first seen in analysis with results such as the well ordering principle, etc. Brouwer completely rejected these methods and initiated a programme to develop all mathematics using only constructive methods. It is interesting that all of this occurred before Church's thesis and recursive functions appeared (you could possibly argue that recursive theory appeared as an outgrowth of the constructivist impact on the foundations of mathematics). Without Church's thesis, as to exactly what could be regarded as constructive, Brouwer stressed the role of the intuition; hence the name "intuitionism". (Strictly speaking, "Brouwer's intuitionism"). Even with Church's thesis, it is not at all clear what should be deemed constructive (as we shall see) and furthermore, some would say it is not even clear what a **proof** is (see Tymoczko [16]).

The power of nonconstructive methods lay in their ability to resolve many previously intractable questions; and doing so sometimes with short, elegant proofs. Often this was due to the fact that the older constructive techniques were not only attempting to establish the existence of some x, but to say how to construct x as well. The tradeoff, of course, is that (even classically) where successful the constructive methods give more information and so generally prove 'stronger' theorems. It is fascinating to note the impact of set-theoretic nonconstructive reasoning on texts. At one time, text books were filled with 'ugly' constructions. Now they are filled with the 'same' theorems all proved by the highly set-theoretic approach in the Bourbaki tradition.

The following oft-quoted examples are perhaps instructive. The first is a triviality but it gives an example of what — to my mind (and I'm not a constructivist) — is an unnecessary and undesirable nonconstructive proof of something that is constructively valid. We claim that there exist irrational numbers x and y with xy rational. To prove this, consider the numbers $u = \sqrt{2}^{\sqrt{2}}$ and $v = u^{\sqrt{2}}$. If u is rational, take $x = y = \sqrt{2}$, while if u is irrational, then $x = u$, $y = \sqrt{2}$ will do — one case must pertain. The second example is more serious, since it puts its finger on an essentially nonconstructive principle called by Bishop the 'limited principle of omniscience'.

If (a_n) is a sequence in $\{0,1\}$, then either $a_n = 0$ for all n or there is some m such that $a_m = 1$.

Each example is constructively false, since we have no routine which tells us **which** option pertains. Indeed the following is the classical intuitionist argument for the second example. Define (a_n) by setting $a_n = 0$ if $n = 1, 2$ or "Fermats last theorem" holds for all indices below n, and $a_n = 1$ otherwise. (Or use any other open conjecture.) If there were a routine to decide which option held, we could use it to solve the Fermat conjecture. This would seem intuitively false. Of course, if we identify via Church's thesis 'constructive' with 'recursive' the above can be formalized by encoding the halting problem into the sequence (a_n).

Before continuing, I should address a couple of critcisms usually directed at constructive mathematics. The first is that constructive reasoning is "unnatural". The historical evidence would immediately suggest that this is false. (After all, which came first?) A more important rebuttal is provided by the fact that almost all of applied mathematics, where mathematics is concerned with physical situations, uses only constructive reals. The point is that any reals with a 'natural' series approximation (such as e and π) will be recursive. The most probable reason for the 'unnaturalness' belief was that for a long time Brouwer's very unusual (unnatural?) version of constructivism was the only one around. Furthermore, constructive systems were mainly studied by logicians whose interests in the logic often differed from the working mathematicians' (see Feferman [7], say). Bishop [2] was very successful in addressing this latter point as well as the second criticism of constructive mathematics; that it lacks power. Bishop showed that, correctly interpreted, virtually all of anaylsis could be redeveloped in a constructive manner. For more on this, see [3] or [13].

At this point, I should remark that the other driving force hehind the recent interest in constructive reasoning is the influence of computer science on mathematics. For example, current automatic theorem provers give constructively valid proofs. One only has to see how discrete mathematics is displacing calculus in the U.S. and England, should the reader need other evidence of this impact.

The first section of Beeson's book is devoted to a general survey of CM. Although I do not think the entire book would be easy to read without some other background in some form of CM, this section gives a good account of many interesting recent developments in the area. Furthermore it is very nice to see (finally!) in one place a number of different approaches gathered together, rather than only representations one 'school'. For example, the work of Abeth [1], Bishop [2], Markov [8], Ershov [4], Pour-El/Richards [12] and Richman (see [13]) are all discussed. One does notice Bishop's influence on Beeson given the concentration on analysis. Also the Metakides-Nerode [10] modern development of the Frölich-Shepherdson [9] approach is not mentioned nor (surprisingly) that of Seidenberg. Neither is the work of the Friedman-Simpson-Smith [8] school, although perhaps this work is a little to recent to be included.

Also there is no mention of the work of the combinatorial group theorists who are surely interested in the constructive content of mathematics (although they differ significantly in philosophical outlook). I do suggest these points should be taken into account when reading Beeson's *Historical Appendix*. Such appendices are always very helpful, and always court disaster! Nevertheless Beeson's first section provides a nice platform for the main part of the book which is concerned with formalization.

Historically, the first approach to be adopted towards formalizing constructive mathematics was to retain the classical statements but only to give them constructive meaning. Thus "$A \vee B$" means that "it is constructively valid that $A \vee B$ holds". To do this, we change the underlying logic so that

$$A \vee B \text{ iff } (\exists n)[(n = 0 \to A) \ \& \ (n \neq 0 \to B)].$$

Here $(\exists n)$ is interpreted to mean we can constructively find an n and so $A \vee B$ means that A or B holds and we can **constructively decide which.** As Bishop's example shows, the **law of the excluded middle** $A \vee \neg A$ fails constructively. Similarly $(\forall y)(\exists x)A$ is interpreted to mean that given y, we can construct an x such that A holds for x. A natural way that this situation is formally viewed is to view continuity properties of the function taking the data y to x. For example in countable algebra, one usually endows the data and output (field operations, equality etc) with a product of discrete topologies. Then one interprets constructive failure as the nonexistence of a continuous constructive function taking the data y to the object x.

A large number of logical systems have been developed from the above approach. These include some constructive set theories such as classical intuitionistic set theory, results of Myhill, Feferman's systems of rules and Martin-Löf's type theories. I should point out that all of theses can be viewed in other ways and are closely related to, for example, axiomatic recursion such as that pursed by Moschovakis. I should also point out that in all of these systems it is possible to prove that — for example — the reals are uncountable. Viewed constructively, this says that there is no (constructive) map from w to the constructive reals. The reader might find this strange since — assuming Church's thesis — there are only countably many constructive reals. The explanation, of course, is that — like Skolem's paradox — all of the classical maps ("from the outside") from w to the constructive reals don't exist constructively ("from the inside").

Another natural viewpoint here is to replace statements A, B etc above by their (primitive) recursive analogues, and then to view constructive mathemtics. For example, $A \vee \neg A$ is valid again, but it is no longer interpreted to be constructively valid in the sense that we don't get an algorithm to verify it. Recursive counter-examples then become consistency results. Thus, for example, it is consistent that there are (recursive) vector spaces without (recursive) bases. (The consistency here is relative to some weak base system such as RCA_0). It is perhaps not surprising that the group of constructivists in the Brouwer-Bishop tradition often favour the first option (of changing the logic) — since theses often wish to **replace** classical mathematics with CM — whereas others who view CM as a part of mathematics tend to favour the latter.

In Beeson's book a huge collection of formal systems of for example Feferman, Myhill, Friedman, Aczel, Kriesel, Martin-Löf, Beeson himself and many others are studied proof-theoretically in great detail. Relative consistency, completeness, inter-derivability, conservation, and relative strength are the main considerations. The investigations are mainly carried out using model-theoretic methods and in particular realizablity models combined with (say) constructive forcing.

The reader might wonder as to why there are so many systems. To give some idea of the philosphical problems and to see why these systems must reflect a philosophy, we offer the following theorem due to Harvey Friedman:

> For all $n \in \omega$, there is a least number $c = c(n)$ such that if $T_1, \ldots, T_n$ are finite trees with T_i having $\leq i.c$ vertices, then for some $i \neq j$ with $i, j \leq n$, T_i embeds (as a graph) into T_j.

This is called Friedman's finite form of Kruskal's theorem (FKT). Although this example postdates the material in Beeson's book it is very interesting with regards to formalizing CM.

Even if we take the most simple minded approach and simply view constructive mathematics as a natural recursive fragment of "mathematics", the question arises, should FKT be constructively true? Certainly the function $f : n \to c(n)$ is (total) recursive, and so from one recursive mathematics point of view, FKT should be therefore constructively valid (it is certainly expressible in Peano arithmetic). However, it can be **proved** that any **proof** of FKT requires

nonconstructive reasoning. In other words, although f is recursive, to **verify that this is so cannot be done constructively.** Thus FKT is not valid from Bishop's point of view. In some of the formal systems, FKT is valid but in others, it is not.

I should remark that many of the considerations are much more subtle than this, particularly in the very complicated theories of Martin-Löf. Beeson's book is very wide in scope, covering a variety of nonclassical as well as classical first and second order logics. In this way it differs strikingly from classical proof theory texts; even ones concerned with calibrating the constructive content of mathematics (such as Simpson [14], for instance).

The message the reader should be getting is that the diversity of formal systems simply reflects the diversity of philosophical outlooks. In the maze of technical results one might easily lose sight of this fact but the author carefully ensures that this is not the case. He does so by including in many places lively discussions amongst several imaginary characters taking certain philosophical stances. These delightful characters are Scepticus, Pragmatist, Significus, Fyodor, Metamathematician, Prof. Tyes and Int. (uitionist). Each take their own views and — in the many discussion sections — argue the significance of the proceding matherial. Not only are they wonderfully amusing, but to my mind, they add greatly to the philosophical depth of the book.

In summary, I feel that the author has performed a great service by giving such a broad and deep treatment most of various schools attempting to formalize CM. Moreover it is a pleasure to see the author give a delineation of the philosophical merits of these attempts. I agree with the author's claims that the book would be of interest to any mathematician, philosopher or computer scientist interested in constructiveness in mathematics. However, be warned, the sheer volume of the technical results, the logical outlook, the sophistication of some of the methods used and the notational complexity of some of the systems would make this book tough going for the casual reader. I feel it is more likely to find its way on to the shelves of the specialist (mathematician, computer scientist, or philosoper) working in some area closely related to proof theory or constructive/recursive mathematics. It would, though, be a fine addition to any departmental library.

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Rod Downey,
Mathematics Department,
Victoria University,
Wellington.

Techniques of Admissible Recursion Theory by C T Chong; Lecture Notes in Mathematics **1106**, Springer-Verlag, New York (1984); 214 pages.

This work is an attempt to give an exposition of admissible ordinal recursion theory, also known as α–recursion theory. This is a generalization of ω–recursion theory to those initial segments of the L–hierarchy that admit Σ_1 (that is, r.e.) induction. A more general, albeit more difficult, extension to all initial segments of L is possible, using the Jensen J–hierarchy — this is known as β–recursion theory, but is not discussed in this work.

The main difficulty in obtaining results in this area is the failure of higher levels of admissibility, that is, an induction of a finite length may fail to terminate. Thus new techniques are required in order to show, for instance, that every requirement in a priority construction is attacked enough times to ensure that it will be satisfied. (The function going from a requirement to a stage where it is satisfied permanently is usually not Σ_1). The most common solution to this problem is due to Shore, and that is to arrange requirements in blocks, treat each block as a single requirement, and to have so few blocks that, for instance, Σ_2–inductions on initial segments of the sequence of blocks, are forced to terminate — hence guaranteeing that the construction will work. This blocking technique is perhaps the most important tool of the α–recursion theorist.

The book, after first giving a brief exposition of the technical preliminaries that are required in order to apply this method, gives a series of examples of extensions of classical arguments in ω–recursion theory, to α–recursion theory. It is virtually essential that the reader be familiar with the classical arguments before reading these, as the recursion-theoretic motivation is not always well explained. These examples include simple set construction, the Friedberg-Muchnik solution to Post's Problem, maximal sets, major supersets, Sacks splitting of r.e. degrees, Sacks density theorem for the r.e. degrees, a minimal pair construction, and minimal degrees. These essentially cover $0'$ and $0''$-arguments. Included in the discussion of these results are illustrations of remaining open cases and examples of failure of the results — for those examples where a complete solution is not given (see also [3]). These examples illustrate nicely the use of the blocking technique, although it is not always clear why a particular blocking was chosen.

The book, deliberately, does not consider α–recursion theory by configuration of projecta and cofinalities. It is however, extremely important to observe these — as they affect the techniques that can be used, and frequently the results that are obtainable. Substantially, what comes out of the examples given is that: Σ_1–admissibility is enough to generalize a typical

$0'$-argument (and in fact, frequently, weak admissibility suffices); Σ_1-admissibility, plus weak Σ_2-admissibility is enough to generalize a typical $0''$-argument; and that the failure of these conditions makes life difficult.

The density theorem (showing that if $D < C$ then for some B, $D < B < C$) may be seen to be an exception to this observation. Although it is an infinite injury argument, it should be viewed as a relativized single-jump (that is, D') argument, rather than a full $0''$-argument. Indeed, by an analysis of the relativized fine structure, we see that the structure $\langle L_{\alpha'}, D\rangle$ is weakly admissible, and so D is either hyperregular, or techniques of Maass in β-recursion theory [1,2] (using the fact that $C > D$ is tame r.e. and hence tame r.e. over D) give rise to a ${\Sigma_1}^D$ set B' with $D < B' < C$. Maass's techniques then readily enable us to convert B' to a Σ_1 set B of the same degree. The above argument sometimes works if D is hyperregular, but more importantly shows how β-recursion theory can illuminate α-recursion theory, and so a full understanding of α-recursion theory also requires a full understanding of β-recursion theory. It would have been helpful to anyone using the book to learn from, to have this pointed out more strongly.

The second to last chapter of the book deals with some interesting phenomena peculiar to α-recursion theory. The first of these is the existence of outright definable (so called natural) intermediate α-r.e. degrees, for α a singular "α-cardinal". The second is the failure of the generalized Post's Problem to have a solution — thus the degrees above $0'$ for $\alpha =$ are well-ordered, with successor being the jump. This amazing result comes about as a recursion-theoretic version of Silver's result concerning GCH at a singular cardinal of uncountable cofinality.

The last chapter is an exposition of an important result of Harrington, showing that a class generic, admissibility preserving extension of an L_α may have significantly different degree structure from L_α — in fact in this example, there are only two r.e. degrees in the extension. It follows that recursion theory in structures apparently very close to L_α's may be very strange, and so an extension of α-recursion theory to all admissible structures will prove very difficult.

This book is not a text to learn α-recursion theory from, and in fact there is no such text — a significant lack in the area. (However a forthcoming book by Sacks will also contain material on the subject.) It does, however, contain examples that are, and were, fundamental to the development and understanding of recursion theory on admissible L_α's and so is important for that reason.

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Colin G Bailey,
V U W.

Models and Sets, (Proceedings of Logic Colloquium Aachen 1983, Part 1); edited by G H Müller and M M Richter; Lecture Notes in Mathematics **1103**, Springer-Verlag (1984); 484 pages.

This volume consists of the first half of a two volume set of the proceedings of the Logic Colloquium held at Aachen in July, 1983. The second part deals with recursion theory and proof theory. This volume deals with a wide range of topics, fitting into the broad framework suggested by the title. A number of the papers seem aimed at specialists, but there are a number of interesting results to be found here, particularly amongst the more classical model-theoretic papers.

The first paper (Baeten — "Filter and ultrafilter over definable subsets of admissible ordinals"), and a later paper by Kranakis and Phillips ("Partitions and homogeneous sets for admissible ordinals") continue work begun by Kranakis in his thesis, examining recursive analogues of large cardinal properties. This material has been extensively applied to studying initial segments of models of PA.

Benninghofen's paper, "Superinfinitesimals and the calculus of the generalized Riemann intergral", applies machinery from nonstandard analysis to the generalized Riemann integral, and shows several (generally already known) connections with other integrals. A paper by Liu which also looks at nonstandard analysis is "A proof-theoretic approach to Nonstandard Analysis (continued)", in which an axiomatic extension to ZF is made, which enables on the directly deal with a nonstandard universe proof-theoretically, so avoiding the "problem" of choosing a universe.

There are several papers that look at the model theory of groups. The first by Hodges ("Finite extension of finite groups") extends work of Hall and Belegradek, showing any n-ary function on a finite group can be expressed as a polynomial over an extension group. He also looks at a universal group. The next group theory paper is by Lenski ("Elimination of quantifiers for the theory of Archimedean Ordered divisible groups in a logic with Ramsey quantifiers"), in which he shows that Ramsey quantifiers are eliminable and hence the theory is decidable in Ramsey logic. (A Ramsey quantifier is one which asserts that a formula has many solutions). Schmitt also has a paper on groups, "Model and substructure complete theories of ordered abelian groups", in which he gives necessary and sufficient conditions for a class of ordered groups to be model (or substructure) complete. He also introduces convexity completeness properties, dealing with convex subgroups.

Field theory is also well represented in this volume. Cherlin has one paper ("Decidable Theories of pseudo-algebraically closed fields") in which he describes the current situation in the study of PAC fields. And Weispfennig continues his work on valued fields with the paper "Quantifier-elimination and decision procedures for valued fields", which also contains an account of the current state of the art, together with a primitive recursive QE procedure for Hensel fields.

"On homomorphism types of superatomic interval Boolean algebras", by Bonnet, explores the class of superatomic Boolean algebras of size κ (where $\kappa \geq \omega_1$) and shows they sit densely (under embedding) in the class of all superatomic Boolean algebras of size κ. This result fails for other natural orderings on the class. In a very different vein, the paper by Font, "Monadicity in topological pseudo Boolean algebras", looks at the abstract properties of pseudo Boolean algebras with an interior operator. Many interesting examples are included.

Berner and Juhasz define a topological game in "Point-picking games and HFD's", and relate the winning strategies of the game to a dense-ness type of topological properties of sets. This follows a current trend amongst set theorists towards using games to reveal information. The other mainstream set theory paper in this volume (Welch - "On $\tilde{\Sigma}^1_3$ ") also is closely connected with games, although this technique is not used to prove his result bounding the lengths of $\tilde{\Sigma}^1_3$ wellorderings of reals. This improves (under stronger hypotheses) a similiar bounding theorem of Martin.

Structures arising naturally in quantum physics are used by D Mundici ("Abstract Model Theory and Sets of C*–algebras: Noncommutative interpolation and preservation properties") in an attempt to give a more algebraic description of properties of logic, for instance Craig interpolation. An alternative, less abstruse, view of logic is presented in the paper by Czelakowski ("Remarks on finitely based logic") in which logics with compactness are studied, and also related to a quite different algebraic structure, generated directly by the logic.

Cherlin and Volger study closure-like operators on classes of models, the operators being generated by partial orders. They show that there are essentially only two such operators.

In the realm of pure model theory, Marcja and Toffalori ("On Cantor-Bendixon Spectra containing (1, 1) - I") continue their work analysing theories by looking at the Boolean algebra of parametrically definable subsets of models of the theory (for complete, QE theories). This is done by using Cantor-Bendixon spectra, and this paper looks at the question of when rank one superatomic algebras are so realizable.

Manders ("Interpretations and the model theory of the classical geometries") shows how to put projective and affine geometry into the scope of model theory, and relates the model-theoretic properties of the resulting theories to those of the theory of the underlying field.

Van der Hoevan and Moerdijk ("Constructing Choice Sequences from Lawless Sequences on Neighbourhood Functions") use techniques adapted from topos theory to build a series of models to do the construction indicated in the title.

Second-order models of PA are the subject of Murawski's paper "A contribution to non-standard teratology", in which he addresses the problem of extending a model of PA to a model of second order arithmetic. The main result is a limitative one, and very interestingly, uses an arithmetic version of V = L.

As the above notes indicate, this volume covers a wide range of material. However, it is not a complete "description" of the trends in current research in either set theory or model theory (eg reverse mathematics, or indicator theory and models of arithmetic). However, the book is worth scanning because of the wide range, and the number of interesting techniques and ideas used by the contributors.

Colin G Bailey,
Department of Mathematics,
Victoria University of Wellington.

Victoria University of Wellington

New Zealand

LECTURESHIP IN MATHEMATICS

Applications are invited for a lectureship in statistics in the Department of Mathematics from men and women with a proven ability in statistics or applied probability. The successful applicant will be expected to play a full part in the Department's teaching, research and consulting activities in the general area of statistics and operations research.

The Department offers undergraduate and postgraduate courses in pure, applied and numerical mathematics as well as probability, statistics and operations research. The group in statistics and operations research works closely with the research/consulting staff of the VUW Institute of Statistics and Operations Research and contributes to the Institute's postgraduate teaching programme.

Professor D. Vere-Jones is responsible for probability and statistics in the Department of Mathematics. The current research interests of the Department's statisticians include stochastic point processes, applications of stochastic processes in geophysics, time series analysis, multivariate analysis, statistical computing and data analysis, population models, biometrics, decision theory and statistical inference. The University's main computers comprise an IBM 4381, a VAX 11/750 and a local area VAX cluster of MicroVAX II's. A wide spectrum of statistical packages is available on these machines. In addition the Department and the Institute have a number of microcomputers and an AT&T 3B2/400+ minicomputer.

Through the Institute, the group in statistics and operations research has good contacts with their colleagues in other University departments. Close links also exist with the groups in statistics and operations research in the Applied Mathematics Division of the Department of Scientific and Industrial Research, which is located on the University Campus, and other Government departments.

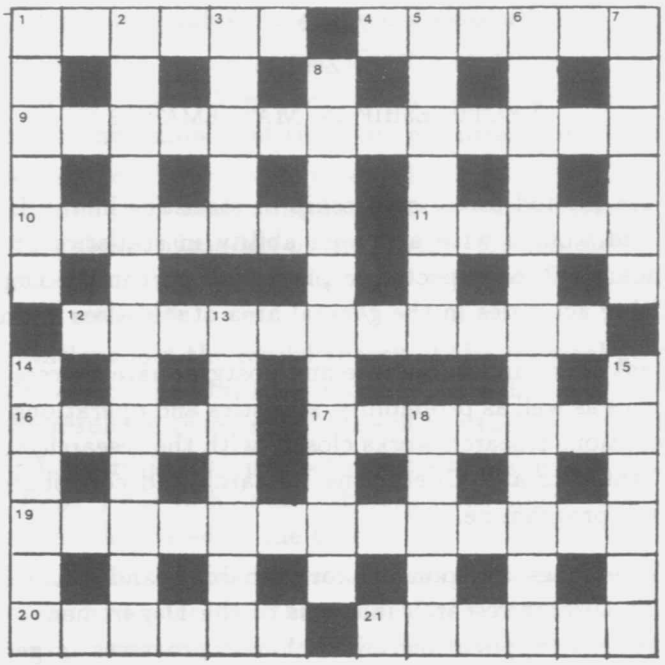
Enquiries concerning academic aspects of this position may be made to Professor D. Vere-Jones, Department of Mathematics.

Commencing salary will be within the range NZ$32,000-38,500 per annum. The closing date for applications is 31 January 1988.

For conditions of appointment and method of application, prospective applicants should write to the Administrative Assistant (Appointments), Victoria University, Private Bag, Wellington, New Zealand.

Crossword

No. 23 SEASONAL by Matt Varnish



Across:

1 Surely not a day of strife. (6)
4 *Pacem in terris*
not rite Sir to set up intent? (6)
9 Hear pep any way. (1,5,3,4)
10 Drink easy over when fried? (3-4)
11 Beyond decorum from the outer route. (5)
12 For inscriptions?
Try a finer kettle for an opener.(11)
16 Star flower. (5)
17 In general add fifty to please. (7)
19 Acted as lookout on the day of (1). (4,9)
20 Father's attempt could be puffed. (6)
21 How fasts are broken given the keynote. (6)

Down:

1 Brother! From beginning to end,
in opposite directions, its alloyed. (6)
2 Check mother's salutations of nativity.
3 Not a plane above India. (5) (4,9)
5 The just-arrived. (3-4)
6 Invitation sung as sleet defied. (6,7)
7 The Paraclete without tea
is present, perhaps. (6)
8 A pair of fiery beasts!
Burning in brandy? (11)
13 As a party giver worthier
I am not (no catch here). (7)
14 Stop working, get ready to go. (4,2)
15 Is song appropriate spririt? (4,2)
18 In the babel everyone has a tree. (5)

Crossword No. 22: Solution. Across: 7, octahedron; 9, room 10, pyramids; 11, wedges; 12, torus; 13, umbrella; 15, obelisk; 17, coltrop; 20, cylinder; 22, crore; 24, sphere; 26, snowball; 28, cube; 29, spacecraft.
Down: 1, scry; 2, bazaar; 3, pelisses; 4, frustum; 5, gradient; 6, cone; 8, nawab; 12, tubby,; 14, loose; 16, loitered; 18, anchored; 19, crystal; 21, duets; 23, Olbers; 25, plug; 27, loft.