THE NEW ZEALAND
MATHEMATICAL SOCIETY (INC.)

NEWSLETTER

CONTENTS

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PUBLISHER'S NOTICE

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c/o The Royal Society of New Zealand,
P O Box 598, Wellington, New Zealand.

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

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LOCAL NEWS

CROWN RESEARCH INSTITUTES

Horticultural and Food (Auckland)

Rod Ball, Stephen Barnett and myself will join the Horticultural and Food Research Institute of New Zealand Ltd. At the same time we must farewell Tony Cooper. We expect to use the name 'Biometrics' for our small unit.

There will be pluses and minuses. The big plus is that we will have a more direct input to the management of Horticultural research and more intimate involvement in individual projects. Points that we have to make - the large savings in resources and/or improvements in precision that may flow from effective experimental design, and the large gains that modern statistical tools may offer in extracting from data a larger part of the information that it contains - may come with greater force within the organisation. We expect to establish stronger links with other biometricians, both in the horticultural and in other CRIs.

We will no longer have assistance from a Wellington Applied Maths group in maintaining and upgrading our equipment and software. Our access to the AMG library may be in jeopardy. We will need new channels of contact with crucial overseas research organisations. Closer contacts with other biometricians may be a partial substitute for Applied Maths contacts that will now be lost or be more difficult.

I am disturbed at the direction of the present system for funding science. Its use of current 'outputs' to constrain the allocation of research resources gives a conservative and backward-looking bias. It contains scientists to stay with the ideas about which they had felt able, ten months earlier, to tell the best story. It judges them, largely, according to objectives that they can guarantee to meet. Areas of science that are introspective and indisposed to input from other disciplines will tend to stay that way. There is too much risk that any innovation, even the innovation of bringing in a new area of expertise, will attract unfavourable peer comment. One unfavourable peer judgement will almost certainly, given present tight funding, damn a proposal. Arrhenius, Wegener and Ohm would never have been funded. In these circumstances there are substantial advantages from getting most of our funding as components of research proposals that come from other scientists. Our contribution is welcomed and valued.

John Maindonald.

Pastoral and Horticultural and Food (Ruakura)

The biometricians at Ruakura have survived the transition into Crown Research Institutes (CRIs) but are now divided between two of the five CRIs represented at Ruakura. Neil Cox, David Duganzich, Harold Henderson, Martin Upsdell, John Waller, Catherine Cameron and Dave Johnson are in the Pastoral Agriculture Research Institute (known as AgResearch) while Barbara Dow and Isabelle Gravett have been appointed to the Horticulture and Food Research Institute (known as Hort+Research). We still have the same postal address (Ruakura Research Centre, Private Bag 3132, Hamilton) but different phone and fax numbers. AgResearch: Ph: (07) 856 2836 Fax: (07) 838 5012 Hort+Research: Ph: (07) 856 2835 Fax: (07) 838 5507

Neil Cox

Industrial Research Limited (Wellington)

Well, DSIR Applied Maths no longer exists. On 1 July, DSIR was replaced by 10 Crown Research Institutes. Applied Maths is now part of the C.R.I. Industrial Research Limited, in the group Measurement Applied Mathematics and Analysis. Unfortunately only about half of the staff were offered jobs with IRL. Seven science staff, and 6 support staff were not reconfirmed. We were not particularly successful in the last funding round, and the CRI board decided that the group was not financially viable with the current staffing levels. So it is with much regret that we farewell Robert Davies, Selwyn Gallot, Elizabeth Bradford, Jean Thompson, Alex Neill, Barney Campbell, Clive Nicolson, Tricia Caughley, Cathy Eales, Eseta Wilson, Shah Taukal, Cathie Benson and Glenda Athea.

The staff who were reconfirmed have joined with the Physical Standards group from Gracefield (the Measurement part) and two small groups (4-6 staff) from Auckland and Christchurch (the Analysis part, I think). Applied Maths now consists of 4 statisticians, 4 operational researchers and 5 mathematical physicists. The staff are Graham Weir, John Burnell, Warwick Kissling, Stephen White, Roger Young, David Rhoades, Sarah Harper, Donal Krouse, Kit Withers, Hugh Barr, Rona Bailey, Bruce Benseman, Karen Garner, and Peter McGavin. In September we will be leaving our offices at Victoria University and moving to Gracefield.

The cuts have been particularly severe on our Statistics Section, where the numbers have been cut from 9 to 4. Additionally the statisticians in our substations at Auckland, Palmerston North and Lincoln have also parted with our group. Most of these staff have been appointed to one of the local CRI's that they have worked with.

Many of you have offered assistance and support to Applied Maths in our struggles over the last few years. We appreciate all the efforts that you have made, and hope that we can still play a role in New Zealand Mathematics in the years to come.

The events of the last few months have rather overshadowed the mathematical activities in the group. Graham Weir and Roger Young had a successful visit to China and Tibet. They presented a workshop on geothermal reservoir modelling, and visited some geothermal fields. In May, many of the staff attended, and gave talks to, the Colloquium held at Victoria.

John Burnell

UNIVERSITY OF AUCKLAND
Engineering Science

David Ryan has been appointed to a Chair in Operations Research, a joint appointment in the Departments of Engineering Science and Management Science and Information Systems Since David has retained his old office there has been little superficial change, but losing even half of David leaves a substantial gap in our Department.

Seminars

Prof. James P. Ignizio (U.Houston) "Hybrid models and methods: an overview and assessment."
Prof D.M. Ryan (Eng.Sci.) "Optimization methods for scheduling and rostering problems."
Nyree Weichel (Eng. Sci.) "A simulation and scheduling study of the inventory control between the slabcastor and the hot strip rolling mill at New Zealand Steel Ltd."
Champa Uka (Eng.Sci.) "Capacity expansion planning in a telecommunications network using stochastic programming."
Prof Stephen M Samuels (Purdue U.) "Secretary problems as a source of benchmark bounds."
Prof A.P.S. Selvadurai (Carleton U.) "Mechanics of a fragmentation test involving an embedded fibre."
Andrew Stamp (A.N.U.) "Internal solitary waves."

D.A. Nield

Mathematics and Statistics

Vaughan Jones has accepted a permanent part-time appointment here as Professor! He will continue to be based at Berkeley (where he has been appointed as one of the 6 Miller Research Professors for 1992-1993), but he will spend some time each year in this Department. At a Convocation of the University of Auckland

on April 13th, the honorary degree of Doctor of Science was bestowed on him. He had been interviewed that morning on Access Radio Varsity Programme, and on April 14th the 6th and 7th form students at Auckland Grammar School were stimulated by his visit.

Following Gaven Martin's promotion to a Personal Chair in Mathematics, some newspapers have published articles (with photographs) about him.

Dr Vivien Kirk, who has gained her PhD at Cambridge, is now a Lecturer in the Applied & Computational Mathematics Unit; and Dr Norman Levenberg, from Wellesley College (Massachusetts), is now a Lecturer here.

Mrs Jill Reid BA, LLB, DipCrim, had previously been Senior Administrative Assistant for our School of Commerce. On the first day of Term 2 she was offered the position of Senior Administrative Assistant for this Department. She accepted that offer, and commenced her duties the following day.

Marston Conder was interviewed on Access Radio Varsity Programme (April 6), about the use of E-mail in mathematical research. He has gone on leave to Waterloo, St. Andrews and Oxford. Margaret Morton has gone on leave, to the University of Western Australia and the University of North Texas. Peter Danaher has gone on leave, to The University of Lancaster. John Butcher has gone on short leave, to attend conferences at Dundee and other places.

Peter Lorimer, travelling on his Claude McCarthy Fellowship, was stranded in Bangkok during the recent massacres there.

M. K. Vamanamurthy has returned from leave at the University of Michigan – East Lansing.

Dr Steve Thompson (of the University of Alaska – Fairbanks), who is on a long-term visit to the Statistics Unit, has received the Alaska Chapter Award from the American Statistical Association.

Paul Turner, Simon Marchant, Tim Surendonk and Shona Lamoureaux, on vacation from their post-graduate studies in the USA, are temporary tutors here for the 2nd term.

The NZMS Lecturer Professor John Loxton (of Macquarie University) delivered 3 seminars on April 27th & 28th.

The Careers Day was attended by about 300 secondary school-girls, who met various women scientists who spoke about their work. As on some previous occasions, Dr Rachel Garden's account was particularly well-received. She explained how it is possible to combine a research career in logic with raising a family and operating a successful software business.

Many members of this Department attended the 1992 NZ Mathematics Colloquium at VUW. Gaven Martin gave an Invited Address on "Geometric function theory in higher dimensions", and Alastair Scott gave an Invited Address on "Fitting binary regression models in case-control models". Contributed papers were presented by Paul Bonnington on "The relative maximum genus of a graph" and (with D. Archdeacon & C. H. C. Little) on "Cycles, cocycles and diagonals: a characterisation of planar graphs", John Butcher on "The numerical solution of ordinary differential equations on parallel computers", Marston Conder & Margaret Morton on "Classification of trivalent symmetric graphs of small order", Colin Fox on "Modelling acoustic scattering from surfaces", David Gauld on "An embellishment of a result of Volterra", Horst Gerlach "On the number of witnesses (a mod n) providing a proper divisor of n", Peter Johnston on "Local truncation error estimation and dense output for Runge-Kutta methods", John Kalman on "Lattices of polynomials under substitution", Zbigniew Piotrowski on "Separate continuity, Namioka and Sierpinski spaces", Ivan Reilly on "Still decomposing", and Garry Tee on "Ruder Boscovic S.J., F.R.S., 1711-1787".

Seminars

Prof. Zbigniew Piotrowski (Youngstown State University, Ohio), "Continuity on product spaces".

Prof. M. J. D. Powell (Cambridge), "A direct search method for small constrained optimization calculations".

Dr Jianbe An (Auckland), "Alperin's weight conjecture" (2 seminars).

Prof. Tohru Ozaki (Institute of Statistical Mathematics, Tokyo), "Nonlinear time series analysis in macroeconomics".

Prof. Peter Collins (Oxford) "Maximal extensions", and "The point-countable base problem and the CHI-space problem".

Prof. Hiroyoshi Yamaki (Tsukuba), "On the Frobenius conjecture and related topics".

A-Prof. Marston D. E. Conder (Auckland), "Determining equivalence of weighting matrices".

Dr Myra Samuels (Purdue), "Simpson's paradox and related phenomena".

Prof. Sandy Thayer (Colorado State University & Massey), "Predicting the mean time to failure from field

data".

Prof. Vaughan Jones FRS (Auckland & Berkeley), "Spin models from the Ising model to Jaeger's Higman-Sims model", and "Some recent developments in algebraic quantum field theory".

Dr Margaret Morton (Auckland), "Classification of trivalent symmetric graphs of small order".

Prof. John H. Loxton (Macquarie University), "How to keep a secret", "Automata and transcendence", and "The remarkable dilogarithm".

Dr Constance Brown (Auckland), "Assessing association within a bivariate time series".

Prof. Karen Parshall (University of Virginia – Charlottesville), "The life and work of Joseph James Sylvester".

Prof. Brian Parshall (University of Virginia –Charlottesville), "Representations of algebraic groups".

Within the Department there are continuing series of Departmental Seminars in Algebra, Combinatorics and Geometry, in Analysis and in Numerical Analysis. On some Fridays there have been pairs of mini-seminars presented on a wide range of topics.

The long and glorious tradition of mathematics in Alexandria ended with the first woman mathematician Hypatia, who was lynched by Christians in 415. Dr Stanley Friedman, Principal Trumpeter of the NZ Symphony Orchestra, has composed the tragic opera "Hypatia", part of which was given its first public performance in Wellington at the NZ International Festival of the Arts, on 1992 March 17th. On Friday April 10th he gave a seminar organized by this Department and the School of Music, on "Hypatia: the Mathematician and the Opera".

G. J. Tee

MASSEY UNIVERSITY
Mathematics

Our most significant item of news is that we have been given permission to advertise a new Chair in Pure Mathematics—the advertisement appears elsewhere in this issue. This is a development we have been looking forward to for a long time. Once an appointment has been made, Graeme Wake's Chair will be renamed the Chair of Applied Mathematics (at present, it is just Mathematics).

The 1992 Workshop of the Quantitative Problem Solving Consultancy was held on 22 May with a good number of participants who brought problems from animal husbandry, food technology and epidemiology.

Graeme Wake has been invited to give a paper on "Time to ignition in spontaneous combustion" at the 1992 International Combustion Symposium. Graeme is working on this topic with Brian Gray (who recently visited us from Australia for a short while). The Symposium is being held in the Southern Hemisphere for the first time, at the University of Sydney in July, and Graeme and Brian are the only invited speakers from the Southern Hemisphere.

Robert McKibbin has been invited to give a keynote address on "Mathematical modelling of hydrothermal eruptions" during a session on rapid transient processes at the American Geological Society's Penrose Conference on Fluid-Volcano Interactions. This conference will take place in Oregon during October, and Robert will be taking advantage of an opportunity to visit the crater of Mt St Helens.

Seminars

Dr Michael Vynnycky (East Anglia), "Mathematical modelling of welding processes"

Dr M. G. Roberts (Wallaceville), "The dynamics and control of bovine tuberculosis in possums"

Dr Ian Coope (Canterbury), "Curve interpolation with non-linear splines"

Professor Sandy Thayer (Colorado State), "The development and promotion of mathematical and statistical consulting"

Michael Charleston (Massey), "Neighbours: a comparison of heuristic tree building methods"

Professor Vincent Hart (Queensland), "Joined dissimilar elastic tubes with application to surgical problems"

Professor John Loxton (Macquarie), "How to keep a secret", and "The remarkable dilogarithm"

Dr Rodney Weber (University College UNSW, Canberra), "A survey of mathematical studies of reaction-diffusion"

Dr Bau Sheng (Otago), "Cycles through elements in graphs", and "Contractions and use of computers in inductive proofs"

Mike Hendy (Massey), "Hadamard conjugation: a versatile tool for modelling nucleotide sequence evolution"
Professor Warren Wong (Notre Dame), "Some finite p-groups, and bilinear and quadratic maps on vector spaces"
Professor Brian Parshall (Virginia), "Representations of algebraic groups".

Mike Carter.

VICTORIA UNIVERSITY
Mathematics

Rob Goldblatt and Rod Downey are both on sabbatical until Feb. '93: Rob to Hungary and Canada for conferences, then to a visiting fellowship at ANU until February; Rod to Cornell then Singapore. He has also been awarded a US/NZ binational grant to work with Profs. Lempp (Wisconsin), Shore (Cornell) and Stob (Calvin College), until 1995.

Michael Doyle (Hons. 1991 in Mathematics and Computer Science) has been appointed a Computer Consultant in the Mathematics Department.

Fiona Humphris (Hons. 1991 in Mathematics), has been accepted by Simon Fraser University, Canada, for graduate study in logic.

Apologies to Richard Johnson: when we reported his teaching assistantship in the April Newsletter we inadvertently accused him of being Richard Johnston.

J F Harper

UNIVERSITY OF WAIKATO

Since we missed the editorial deadline for the last Newsletter, I am including some news from the end of 1991.

We have had a number of research visitors lately: Hajime Ishihara came from Japan to work for three months with Douglas Bridges on constructive measure theory and spectral theory; Gerard Liddell took a few days out from Otago to talk symbolic computation with Kevin Broughan; Pavel Winternitz spent several weeks on leave from Montreal, working with Ernie Kalnins on maximal abelian subalgebra of the Euclidean group; and Sandy McClymont (a fairly regular visitor from Hawaii) enjoyed our summer months working with Ian Craig on magnetic reconnection.

In February we lost Hamish Spencer to the Zoology (!) Department at Otago; he and Abby are sorely missed. However, we were very pleased to welcome as his replacement Stephen Joe, once a protegé of Adrian Swift and latterly at UNSW. Stephen's expertise in numerical analysis greatly strengthens our activity in that area, and relieves Ian Craig of some of the teaching burden that he has borne almost single-handedly for a dozen years.

Ingrid (Rinsma) Melchert's infant son Julian has provided much entertainment for all of us during the tea-breaks. Mark Schroder, having recovered from last year's illness, has been back in hospital, this time for a happier purpose: to have a hip replacement.

Diane Koorey Wilcock completed her DPhil on *A parallel Lisp and multivariate polynomial gcd implementation*, under the supervision of Kevin Broughan.

Together with Alfred Sneyd, Kevin has negotiated a major research contract with the Electricorp Production North Island Hydro Group, which is based in Hamilton. The aim of the project is to model the flow of water down the Waikato and Waikaremoana river systems, to relate the flow to the power output from the several hydro schemes on those systems, and to predict the configuration for the next 48 hours. The model, which contains several thousand integer and real variables, is being developed and encoded in Fortran, in what will be called the *Water Management Software Package*. The project has two research assistants: Carolyn McKenzie and Dr Yang Wang, both recent graduates of the Faculty of Engineering at Auckland. Dr Wang's husband is a DPhil student of Alfred Sneyd, supported by Comalco and MERT.

Douglas Bridges has held discussions with several Heads of Departments of Mathematics in Hamilton secondary schools, with a view to enrichment of good pupils and stimulation of the not-so-good. As a result, several pupils from those schools have taken up the offer to study material from our first-year calculus course in parallel with their Bursary work. Douglas, Ingrid Melchert, and Jeff Knowlton also took part in a special camp organised by Hamilton Girls' High School for their talented third- and fourth-formers.

Seminars

Jeff Knowlton (Waikato) "The use of industrial experimentation to improve an epoxy coating process"
Rhonda Sutherland (Waikato) "The use of compositional data for process control"
Hajime Ishihara (Hiroshima) "Continuity properties in constructive mathematics"
Pavel Winternitz (Montreal) "Lie group theory and analytical solutions of nonlinear partial differential equations"
Sandy McClymont (Hawaii) "Linear theory of magnetic reconnection"
Diane Wilcock (Waikato) "A parallel Lisp and multivariate polynomial gcd implementation"
Stephen Joe (Waikato) "An introduction to lattice rules for numerical multiple integration"
John Loxton (Macquarie) "How to keep a secret", "Automata and transcendence", and "Cryptanalysis and random numbers"
Hamish Spencer (Otago) "Tests of the neutral hypothesis of evolution"
John Turner (Waikato) "Not knots" (a video presentation)
Douglas Bridges "An introduction to computability and complexity".

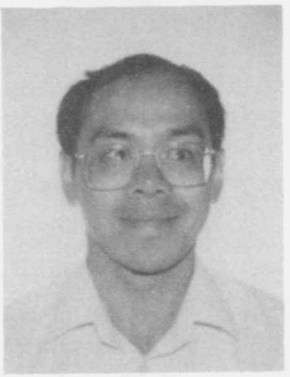
The Waikato Centre for Applied Statistics has become a unit within the School of Computing & Mathematical Sciences, with Ray Littler as full-time Director. This is the third time that Ray has taken up a position at Waikato! The Centre has had several visitors, including Alan Gleeson (NSW Agriculture), who presented the third autumn applied statistics workshop, and Patrick Shannon (Boise State University).

Statisticians in the Department of Mathematics & Statistics, the Centre, and Ruakara have been busy with preparations for the 16th International Biometric Conference, which will be held at Waikato University in December. Statisticians and others who want more information about the Conference and associated satellite meetings should contact the Conference Secretary at Ruakura (email: IBC@Ruakura.maf.govt.nz).

Douglas Bridges

NEW COLLEAGUES

STEPHEN JOE



Dr Stephen Joe has recently taken up a lectureship in the Department of Mathematics and Statistics at the University of Waikato. Born and bred in Palmerston North, he did his undergraduate studies in statistics and master studies in mathematics at Massey University.

He went to Sydney in 1982 to do doctoral studies on the numerical solutions of second kind integral equations in the School of Mathematics at the University of New South Wales. After finishing his degree, he spent more time there as a lecturer and as a Research Fellow. His current research interests are in boundary element methods as well as lattice methods for numerical multiple integration.

NOTICES

MASTERS SCHOLARSHIP
Massey University

NZ Aluminium Smelters Ltd have provided funding for an annual (one-year) Masters scholarship to support research students to work in one or more of the areas of Applied Mathematics and Statistics at Massey University.

The research project will be on problems of interest to the Aluminium Industry.

Candidates should have completed (or be completing) an honours degree in Mathematics, Operations Research, Statistics or a related subject. The stipend for 1993 is $5,500pa (and is under review). Interested candidates should send their academic record and names of two referees to one of the following, from whom further details will be provided on request.

Professor Jeffrey Hunter, Department of Statistics, Massey University, Tel (06)350-5082, Email J.Hunter@massey.ac.nz

Professor Graeme Wake, Department of Mathematics, Massey University, Tel (06)350-5081, Email G.Wake@massey.ac.nz

INTERNATIONAL CONGRESS OF MATHEMATICIANS 1994
Zurich, August 3-11

The next International Congress of Mathematicians will be held in Zürich, Switzerland from August 3 to August 11, 1994, under the auspices of the International Mathematical Union. The lectures will be held at the Kongresshaus of the city of Zurich and in lecture theatres at the Federal Institute of Technology (ETHZ) and at the University of Zurich.

The Swiss Mathematical Society has entrusted a committee with the organization of the congress. The president of this committee is Henri Carnal, the secretary is Christian Blatter. The administration of the participants (hotel reservations etc.) has been delegated to a professional congress organizer.

The First Announcement containing further details and an application form will be distributed in July 1993.

Pleas write to the following address for further information: ICM 94, ETH Zentrum, CH-8092 Zürich, Switzerland.

EULOGY OF VAUGHAN JONES

At a Convocation of the University of Auckland on 1992 May 13th, 6 people were awarded Honorary Doctorates. Eulogies of those Honorary Graduates were recited by the University Orator, Professor P. N. Tarling.

It is one of the virtues of Universities - and one not to be cast aside by the impatient - that they do things with due deliberation. With Professor Jones we have overdone it. Others got there so much sooner. He was an Alfred P. Sloan Fellow in 1983, a Guggenheim Fellow in 1986. He became FRS at the age of 37, and then he was given the Fields Medal. Disliking his fellow Swede, Mittag-Leffler, the legend has it, Nobel omitted to establish a Prize for mathematics. The gap was filled as a result of the efforts of the Canadian mathematician J. C. Fields, and the first award was made in 1936. Since then, 30 medals have been given. Vaughan Jones received the first one to be given to someone from the southern hemisphere.

The honour The University of Auckland confers is latest but perhaps not least. Though we honour ourselves in giving it, it is the highest award we can make. And we make it all the more readily, though no more rapidly, because of the generous acknowledgment Professor Jones has made, when receiving awards of global significance, of the help he received here in Auckland, at the Auckland Grammar School and in particular at the University. Not only has he modelled his All-Black shirt in Japan. He has mentioned our system, so

often criticised, so necessary to defend. "As a junior lecturer at Auckland University - while still only at the masters level, when my knowledge was nowhere near what it is now, and at a relatively young age - I was given the opportunity to do research. I remember when I first began research, I was so happy all of a sudden - I knew that this was what I wanted to do. Anywhere else but New Zealand, I would have been stuck in classes, taking notes, sitting exams for years longer..." And he has paid tribute to my colleagues, in particular Dr Michael Lennon, who introduced him to von Neumann algebras. Those colleagues indeed, it seems, are disputing among themselves in a rather unusual way. Who was it who had the honour of giving young Jones a B grade in the topology paper? David Gauld recalls giving a course in knot theory, which Jones did *not* attend.

The majority of our would-be PhD students in Mathematics have headed for the USA. Again as a result of the advice of a colleague, Paul Hafner, Jones chose a different route. He went to Geneva, which he again appreciated. It was a small school; he might have been swamped by being immediately plunged into the 300-strong pool of PhD students in California. If Professor Jones is a role model for New Zealand students of mathematics, his career is also helpful to those who advocate the study of foreign languages. The scholarship needed a foreign language and often went to students from the German Department. He knew French.

After he secured his doctorate, he occupied positions in the University of Geneva, UCLA, and the University of Pennsylvania. He took up his chair in Mathematics at Berkeley in 1985.

The year before, visiting Columbia, he had met the mathematician Joan Birman, who studied knot theory, which attempts to explain the properties of knots. Prompted by a colleague at Geneva, he thought there might be some connexion between their fields, hitherto unrecognised. At first the discussion depressed him. Then he made his discovery; he constructed an invariant polynomial for knots more effective than the Alexander polynomial of 1928. "I'm still thrilled", Professor Birman says.

Professor Jones' discovery was important to mathematicians. Several journal contributions promptly recognised this. It was important in other fields, too. It interested the physicists, with their Renaissance-style ambitions to find a single grand equation, a "theory of everything", and their belief that it might be the superstring theory. And it interested the molecular biologists. Electron microscope photographs of cells revealed that, during the reproduction of a cell, its DNA loop gets knotted and then unknotted, and the scientists had been baffled by the problems of distinguishing knots from photographs of the tangled loops. One of them, Professor Cozzarelli at Berkeley, realised that the Jones polynomial provided an effective technique, and front-page articles appeared on this application of mathematics to biology. It was then that Cozzarelli found that Jones had just come to his University, and had an office 200 yards away.

Mathematicians and scientists too often, it seems, dwell apart. Perhaps Professor Jones' gregariousness is another reason for his success in bringing them together. And may Auckland not claim a small share in promoting that gregariousness? It could be suggested that the plaque, now very properly hanging in the Mathematics & Statistics Department, could be duplicated and put up where the Kiwi once stood.

The Swiss years did something else for Professor Jones. It led to the tying of the knot that the sexist proverb describes as tying with the tongue what you cannot undo with your teeth: he met his future wife, skiing. A student herself, indeed to become a distinguished economist, she had also to put her interdisciplinary endeavours to work. Bear in mind that the figure of Archimedes is on the Fields medal, and he exclaimed from his bath. Professor Jones worked on von Neumann sub-factors in the bathroom and the polynomial came to him in bed.

Mathematics research, Professor Jones told the *Listener*, is like bashing your head against a brick wall. I recall the remark of Gustav Mahler, after years of difficulty at the Vienna Opera: "I have been banging my head on a brick wall, and I think I am beginning to make an impression." Professor Jones, in a decade indeed noted for the destruction of walls, knocked one down.

Mathematicians may indeed need to be a specially targeted group when the superannuation age is changed: they peak young and so will deserve mercy and not merely ruth. Deliberate though we are, I suggest we are not too late to urge Professor Jones to go on and knock some more down. True, we have no more degrees to offer, beyond the one which I now claim he is a fit and proper person to receive, the Doctor of Science, honoris causa.

COLLOQUIUM 1992

The 1992 NZ Mathematics Colloquium was held at Victoria University from Monday 11 to Thursday 14 May, the final day being, as usual, Education Day. The NZ Statistical Association met on 15 May; this arrangement minimised travel expenditure for at least some people. There were 109 participants, 46 contributed papers, 9 invited lectures, 4 sponsors (NZMS, Vice-Chancellor of VUW, BNZ, Ansett Airlines, all of whose

help is gratefully acknowledged), 3 discussions, 2 meetings, 2 receptions (by the Colloquium Committee on the Sunday evening, and by the Vice-Chancellor on the Monday), 2 excursions (to the Wairarapa wineries and the Wellington Eastern Walkway), 1 conference dinner, and more compliments than complaints.

Professor John Loxton, Macquarie, was a good NZMS Lecturer: he spoke twice,on number theory and some of its applications, and mathematical education.

The finances are not yet finalised: one large bill is still to be presented ,and so we do not yet know whether there was a small profit or a small loss. As the previous avenue for publication of the abstracts is no longer available, we were asked to send copies to the National and university libraries. Extra copies will have to be printed for this to be possible. Paying tax on the Colloquium bank account interest is not our most congenial activity; we are trying to arrange with the Inland Revenue to avoid it.

Next year's Colloquium is to be at Canterbury; just when had not yet been settled at the date of writing.

J F Harper, Chairman
NZ Mathematics Colloquium Committee 1992.

NZMS AWARDS FOR MATHEMATICAL RESEARCH

These Awards were instituted in 1991 to acknowledge the research contribution of New Zealand mathematicians. The four recipients to date are

1991 John Butcher (Auckland)
Rob Goldblatt (VUW)

1992 Rod Downey (VUW)
Vernon Squire (Otago)

Call for Nominations, 1993 Round

Applications and nominations are invited for the NZMS Award for Mathematical Research. (Nominations should include the written consent of candidates.) These should be sent to Derek Holton, Department of Mathematics and Statistics, Otago University, Dunedin by 2 October 1992.

Purpose of the award

The purpose of this award is to foster mathematical research in New Zealand and to recognise excellence in research carried out by New Zealand mathematicians.

The award will be based on mathematical research published in books or recognised journals within the previous **five** calendar years only.

Candidates must have been residents of New Zealand for the previous three years.

Procedures

Candidates should supply the following;

Name and affiliation
Statement of general area of research
Names of two persons who are willing to act as referees
A list of research published within the previous five calendar years Two copies of the **five** most significant publications selected from the above list
A clear statement of how much of any joint work is due to the applicant.

A judging panel shall be chosen by the NZMS Council. The judges may call for reports from the nominated referees and/or obtain whatever additional referees' reports they feel necessary.

The judges shall recommend one person for the award, or a joint award to more than one person, or that no award be made.

No person shall win the award more than once.

The award shall consist of a certificate including an appropriate citation of the awardee's work.

Publicity

Announcements of the award(s) and presentation of certificate(s) for any year shall be made at the AGM of the Society if at all possible). Also an announcement including the appropriate citation(s) shall be made in the NZMS Newsletter, and in a national press release.

NEW POSITIONS

MASSEY UNIVERSITY
Professor of Pure Mathematics

Applications are invited for a newly-established Chair in Pure Mathematics within the Department of Mathematics. The Department is one of four in the School of Mathematical and Information Sciences which comprises the Departments of Mathematics, Computer Science, Information Systems, and Statistics. This Chair is designed to provide leadership in research and teaching in the more theoretical branches of mathematics. The other established Chair in Mathematics is held by Professor Graeme C Wake who is also currently Head of Department.

The appointee will be expected to provide direction within the Department, University, and in the wider community. Applicants should be distinguished in research in one or more fields of Pure Mathematics, and have proven ability in teaching. The appointee will be expected to take a full part in teaching, research and administration and may be expected to serve a term as Head of Department. It is envisaged that the appointee would take up the Chair in 1993.

The Department of Mathematics offers a full undergraduate programme in mathematics including service teaching. Most undergraduate courses are taught both to internal students and by correspondence to extramural students throughout New Zealand and overseas. The graduate study programmes include masterate and PhD thesis supervision - currently for fifteen students. The University reserves the right to make no appointment or to fill the Chair by invitation.

Reference number M1 must be quoted.

Closing date: 31 October 1992.

Conditions of Appointment are obtainable from Mrs V B Bretherton, Personnel Section, to whom applications, including a full curriculum vitae and the names and addresses of three referees with facsimile numbers if possible should be sent before the closing date specified.

B R H Monks
Registrar

UNIVERSITY OF AUCKLAND
Chair of Pure Mathematics

With the imminent retirement of Professor J A Kalman, the University of Auckland invites applications for a Chair of Pure Mathematics. The successful applicant will have an outstanding academic and research background in some branch of Pure Mathematics with personal qualities and experience which will enable her/him to contribute significantly to the continuing development of Pure Mathematics at Auckland both in research and teaching.

Information on the application procedure and further particulars (quoting the number UAC–197) may be

obtained from the Registrar, University of Auckland, Private Bag 92019, Auckland, New Zealand, telephone 9–3737599–5789, fax 9–3737454 with whom applications close on 20 November 1992. Information may also be obtained from the Head of Department, Professor A J Scott, or from Professor D B Gauld, Department of Mathematics and Statistics, University of Auckland, Private Bag 92019, Auckland, New Zealand, electronic mail addresses scott@mat.aukuni.ac.nz and gauld@mat.aukuni.ac.nz.

Salary will be in the range $80080 to $99840.

UNIVERSITY OF AUCKLAND
Tamaki Campus Appointments

The University invites applications for Lectureships / Senior Lectureships / Associate-Professorships in the Department of Mathematics and Statistics, Division of Science, Tamaki Campus.

The Tamaki campus is the second campus of the University of Auckland. Based at Tamaki (12 km from the city centre) staff will be members of Departments and Faculties on the main city campus, have access to its resources and be invited to take part in its academic programmes. At the same time they may expect to be able to work in and interdisciplinary fashion more often than is common on the main campus and to deal with smaller classes.

There are three academic divisions—Arts, Science and Commerce—on the Tamaki Campus. The Science division will offer BSc courses in Environmental Management and Electronic and Computational Physics and a BTech course in Information Technology from 1993.

The offered posts will normally be available at Lectureship or Senior Lectureship level. Particularly well qualified applicants may be considered for initial appointment at the level of Associate-Professor. Candidates are requested to indicate the level of appointment for which they would wish to be considered.

Qualifications. Applicants should have a proven record in teaching and research in some branch of Mathematics, Statistics or Operations Research. Applications from candidates with interest in Statistics, Operations Research or areas of Mathematics related to Information Technology are particularly welcome.

Duties. The persons appointed will be responsible to the Vice-Chancellor through the Head of Department of Mathematics and Statistics and Assistant Vice-Chancellor (Tamaki) for such teaching, research and related duties as may be required. The initiation of a research programme in an appropriate area of expertise will be expected. The line of responsibility may require amendment over time as the Tamaki campus and its administrative structure develops.

Salary. Commencing salary will be determined in accordance with qualifications and experience. The present salary scale for a Lecturer is $NZ37,440 per annum, rising to $NZ45,448 per annum by seven annual increments, then by a further three increments to $NZ49,088. The salary scale for a Senior Lecturer is $NZ52,000 rising to $NZ60,944 by four annual increments. Council may, at its discretion increase this to $NZ67,080 per annum. Associate Professors are paid on a four-step scale $NZ69,680 – $NZ75,920 per annum.

General Conditions. The appointment will be subject also to the General Conditions, a copy of which is available on request.

Taking up of Duties. The person appointed will be expected to take up duties on a date to be arranged as soon as possible, on or before 1 February 1993.

Closing Date for Applications. 31 August 1992.

Further information, including the Method of Application can be obtained from Professor R F Meyer, Assistant Vice-Chancellor Tamaki Campus, Telephone 64-9-570 0224, Extn 8028, FAX 64-9-570 0207

BOOK REVIEWS

Higher Recursion Theory, by G.E. Sacks. Perspectives in Mathematical Logic. Springer-Verlag, Berlin-Heidelberg-New York, 1990, xv + 344pp, DM 168. ISBN 3-540-19305-7.

What is "Recursion Theory" ?

Recursion theory is that branch of mathematics that is devoted to understanding what we mean by computation or algorithm. It provides techniques and concepts whereby we can ascertain the limits of the effective content of mathematics. While the ideas are implicit throughout the history of mathematics, it is fair to say that the real roots of its modern incarnation are Hilbert's program, initiated at the turn of the century International Congress of Mathematicians, and the subsequent work of Gödel, Kleene, Post, Church and Turing in the 30's. This remarkable body of work gave a framework that enabled us to formally define a class - the class of partial recursive functions - in precise mathematical terms, which are now virtually universally accepted as capturing the notion of "intuitively computable". Of course, once this class is identified we have clear methods to explore the limits of computability. First one shows certain canonical problems such as the halting problem are insoluble. Then one applies this metatheory. For instance, as in the resolution of the word problems for groups [3], or Matijasevic's Theorem [13], one key idea is to encode an appropriate class of partial recursive functions into the objects at hand. This enables one to argue that these problems are algorithmically insoluble.

Such "classical" recursion theory has blossomed into many fascinating and diverse areas. Some examples include the study of time or space bounded computations (complexity theory, particularly structural complexity e.g. [1]), the study of the time structure of the notions of reducibility (i.e. methods where by one object can be computed from another (e.g. [18,19])) and the study of classical mathematics through effective eyes (e.g. [8, 14, 16]).

What is "Higher" Recursion Theory?

In all of the previous notions, the central concept is that of a computation being performed in a "finite number of steps". So we do not allow "infinite computations" except for machines that do not halt. The fundamental idea behind the collection of generalisations of classical recursion theory referred to as higher recursion theory is to allow us to weaken this condition of finiteness. Imagine you were the continuum looking down at the integers. They would look essentially finite from your point of view. So one could imagine continuum level computations being regarded as "halting" if they only took $|\mathbb{N}|$ many steps. Actually notions of machines become very unwieldy here, and it is much easier to deal with objects via what are called computation trees or via semantic models. One example of a higher recursion theory (not treated in this book) is the Blum-Schub-Smale model in [2], which is actually a specialisation of Kleene recursion theory [9,10].

So the idea is to pursue formal analogues of classical computations from a much more abstract and axiomatic point of view. Clearly this can be done in a number of ways, and we will discuss this more fully later. Historically the first such generalisation of "finiteness" was Kriesel's idea that there was a direct analogue between "π^1_1 vs hyperarithmetic" and "r.e. vs finite". The key was that most of the appropriate closure properties held. Nevertheless it required a great deal of technical virtuosity to lift a fair fragment of classical recursion theory to what was deemed "meta-recursion theory".

The natural next step was to extend the notions to ordinals with appropriate closure properties. This is somewhat along the lines of what I alluded to earlier when I discussed the continuum. The most appropriate notion seems to be what is called Σ_1 admissibility. Here a set A is called Σ_1 admissible if it is transitive, closed under pairing, union, Δ_1 separation and Σ_1 bounding. Roughly speaking this means that "recursive" functions applied to "finite" sets are again "finite". The least Σ_1 admissible set is the collection H of hereditarily finite subsets of $\mathbb{N}$, and the classical notion of being partial recursive is identical with being Σ_1 definable over H. The result of this type of generalisation is called admissible or α-recursion theory.

Admissible recursion theory is a rich and exceedingly difficult area. The problem is that a Σ_1 admissible ordinal need not be Σ_2 admissible, and hence most of constructions of classical recursion theory do not naturally lift. It is a real challenge to resolve whether they hold for all admissible ordinals. As Sacks puts it: the combinatorics one takes for granted in $\mathbb{N}$ no longer apply in the higher recursion theory situation.

Just as the development of effective methods in algebra often requires new algebraic insights, the

development of α-recursion theory and its later generalisations of β-recursion theory [6,7] and γ-recursion theory [12] required the development of substantial set theoretic and model theoretic techniques. Sy Friedman [7] has shown that questions can even eventually become formally independent in the sense of the continuum hypothesis [4] and their resolution thus depends on the flavour of set theory one wishes to live in. Many open questions remain. For some of these, such as the existence of minimal α-degrees, there does not even seem a decent strategy in any direction.

Another route to higher recursive theory was the one suggested by Kleene [9,10]. One makes the e-th procedure on input x have meaning for x a "finite type object". The natural numbers have type zero, and an object of type n is an arbitrary collection of objects of type less than n. This approach is very syntactic in flavour. Subsequently Normann [17] suggested a way to generalise this, to assign a meaning to $\{e\}(x)$ for every set x via what are now called Normann Schemes. This definition leads to the fact that, for instance, a property $P(x)$ is E-recursive iff $P(x)$ is Δ_0-definable relative to Zermelo-Frankel Set Theory. Computations are now represented via "computation trees". Techniques are very set theoretical and use forcing and compactness arguments.

The reader might wonder why one would pursue such difficult, but apparently esoteric pursuits. There is a multiplicity of answers, some of which are as follows. Certainly the techniques and questions have led to many new set theoretical insights such as perfect set forcing, as well as insights into classical recursion, such as Slaman's program of analysing constructions in fragments of Peano Arithmetic. One area of great promise is the observation that many of the fundamental issues in structural complexity (e.g P *vs* NP) exhibit very similar problems to those encountered in Higher Recursion. For instance,n α-recursion one might need to diagonalize 2^{ω} many requirements in a construction that only lasts ω many steps (because of co-finality problems). In P *vs* NP we similarly need apparently to have few actions perform the duty of many. Shinoda and Slaman applied ideas from E-recursion to the polynomial time degrees. Also, in computer science, typed languages abound, and from this point of view Kleene's recursion theory might give insights into practical computations; witness Cook's talk at the Tokyo ICM. Other applications are to descriptive set theory [15].

What about this book?

Much of higher recursion theory was developed by Sacks and his students, particularly in the so-called "golden age" of MIT/Harvard in the late 60's to the late 70's. Apparently Sacks conceived of this book way back then. Certainly I have drafts from 1971 and 1975. It is not surprising that the text is a masterly overview of the subject. From the point of view of accessibility of the subject to those not in the MIT/Harvard cabal, it is a pity the book did not come out earlier.

The book is divided into 4 parts: hyperarithmetic theory, meta-recursion, α-recursion and E-recursion. There is no real account of β-recursion and no discussion of Kleene recursion except via E-recursion. It covers most of the important results in these areas, with extremely judicious choices of theorems and exercises. The first two sections on hyperarithmetic theory cannot be easily found elsewhere. The first section contains all the Spector/Kleene/Kriesel results as well as, for example, forcing, measure and other techniques with analytic sets. The second section carries out the meta-recursive precursor to α-recursion theory. The section on α-recursion contains all the basic techniques. It is interesting to see the comparison between Shore blocking, the Sacks-Simpson "fine structure" method and Lerman's "tame" approach. That is, the dynamic vs the fine structural approach. Included is Shore's density theorem. I found the presentation of this whole section is rather more accessible than Chong's book [5].

The final section deals with E-recursion and includes the work of Harrington, Normann, Moschovakis, Sacks and others. I found this section more difficult, but admit that I knew almost nothing about E-recursion before I read it. The reader needs to know a lot about forcing to get through this section, which finishes with Slaman's density theorem.

The presentation is economical and full of insight. I did find it quite tough going in places. While the author suggest that the book is self contained and claims one would not need to know about Gödel's L, forcing, or priority arguments, one would need to be pretty brilliant to be able to read and appreciate the book without a reasonable grounding in logic (e.g. [11],[19]).

The book is clearly a research level monograph written by a real master of the area. I believe it should certainly be on the shelves of any logician working in recursion theory or set theory, and it is of course absolutely essential for anyone working in any area of higher recursion theory.

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Mathematics of Ramsey Theory, edited by J. Nesetril and V. Rödl. Algorithmics and Combinatorics, Vol. 5, Springer-Verlag, Berlin-Heidelberg-New York, 1990, xiv + 269pp, DM 128. ISBN 3-540-18191-1.

When we look into the sky we see patterns among the stars. Ramsey theory is a beautiful part of modern combinatorics devoted to results which establish that in any sufficiently large apparently chaotic system, there will be well behaved subsystems. The original results of Ramsey theory provide archetypal examples. In Ramsey [1930], Frank Plumpton Ramsey proved what is now known as Ramsey's Theorem: Let $[n]=\{1,\ldots,n\}$. Denote the collection of subsets of A with exactly k elements by A^k (and hence the k element subsets of $[n]$ by $[n]^k$). We will colour $[n]^k$ by p colours. To indicate this we use the notation $(n)^k_p$. Let $A \subseteq [n]$. For a colouring χ of $[n]^k$ we say that A is *homogeneous* if A^k is monochromatic. To help the reader understand these concepts, think of the case $k = p = 2$ as follows. Imagine $[n]$ is a party of people, and $[n]^2$ thus consists of pairs of people. Colour the pair $\{i, j\}$ by red if i and j are friends and black if they are nonfriends. In this setting a homogeneous set size q corresponds to a collection of q mutual friends or q mutual nonfriends.

Ramsey's Theorem *For any q, k, p there is an n so large that for any p-colouring of $[n]^k$, $[n]$ contains a homogeneous set of size q. We denote this by Rado's notation:*

$$q \to (n)^k_p$$

Thus for any q there is a party so large that there will be a set of q mutual friends or q mutual nonfriends. At the time Ramsey applied this result to logic — he established a sort of Löwenheim-Skolem theorem for finite models — but realised the theorem would have wider applications. In effect, Ramsey's theorem was subsequently rediscovered by Erdös and E. Szekeres [1933], who were analysing generalisations of the fact that if we have five points in the plane, no three collinear, then there will be four that form a convex quadrilateral.

Theorem (Erdös-Szekeres [1933]) *For any p there is an n so large that if one takes any n points in the plane with no three collinear, then there will be p points forming a convex p-gon.*

One proof runs as follows. Choose n so that $n \to (p)^2_3$, and number the points 1, ..., n in any fashion. For $i < j < k$ colour $\{i, j, k\}$ red if travelling i, j, k, i is clockwise and blue otherwise. The homogeneous set of size p will correspond to the convex p-gon.

Ramsey theory is concerned with extensions of the above, as well as theorems of a similar flavour. Three marvellous examples are ***Hilbert's Partition Theorem*** (Hilbert [1892]) *For all k, n there exists an N with the following property*: If $|X| > N$ *and we partition $P(X)$ into k classes there exist distinct subsets $A_1, \ldots, A_n$ of X with pairwise identical intersections such that all the $2^n - 1$ nonempty unions belong to the same class of the partition.*

Schur's theorem (Schur 1916) *For all k there is an N with the property: For every partition of $[N]$ into k classes, one of the classes contains two numbers x and y such that $x + y$ is also in the class.*

Van der Waerden's Theorem (Van der Waerden [1927]) *For all k, n there is an N so large that for any colouring of $[N]$ into k colours, there is a monochromatic arithmetic progression of size n.*

The last result has been extremely influential. Due to the intuition of Hales and Jewett ([1963]) we now know that many of these results have a common generalisation concerning the existence of monochromatic "lines" in a combinatorial "space". Indeed, Graham, Leeb and Rothschild [1972] verified a conjecture of Rota by proving that one could even prove a vector space Ramsey theorem about colourings of the lattice of subspaces. Quite early on, Erdös and Turan [1936] suggested the following beguiling generalisation of Van der Waerden's theorem: for all k, n there is an N so large that if $[N]$ is k-coloured then there is a monochromatic arithmetic progression of the size n *of most common colour*. The resolution of this conjecture proved remarkably difficult. It was proven for $n = 3$ by Roth in 1952 using analytic number theory and only resolved completely by the very difficult proof of Szemeredi [1974], who used elementary methods. Later Furstenberg [1977, 1981] gave a proof using methods from ergodic theory and topological dynamics.

In a short review such as this one cannot discuss all of the ways that Ramsey theory has evolved, but it would seem appropriate to mention a couple of recent developments.

First a natural question in the above is to try to determine the minimum value for the relevant N's. The determination of these Ramsey, Van der Waerden and other numbers has proven to be extraordinarily difficult. Aside from the fact that they tend to be *very* large, perhaps one of the reasons for the difficulty in determining even reasonable bounds for such numbers is the following. One of the great theorems of mathematics is Gödel's incompleteness theorem, which says roughly that in any sufficiently strong formal system there will be results true of the system and statable within the system which can not be proven within the system. Unfortunately, the statements one gets from the classical proof of this result are mathematically uninteresting. Naturally it was asked if, for instance, Peano arithmetic had any "mathematical" incompletenesses. Building on work of Kirby, Paris and Harrington used Ramsey theory to show that indeed there were. Call a set Q of positive integers *relatively large* if $|Q| > \min\{z | z \in Q\}$. Using the party analogy, everybody has a unique number. Someone thinks the set is large if the number of people in the set exceeds that person's number. The statement

$$p \xrightarrow[*]{} (n)^k_q$$

is read as: for any q-colouring of $[n]^k$ there is a relatively large homogeneous set of size p.

Theorem (Paris-Harrington [1977]) *For all p, q, k there is an n with* $p \xrightarrow[*]{} (n)^k_q$.

So in our party there is a group of p mutual friends or p mutual nonfriends, and furthermore someone in the group thinks it is large. What is remarkable is that although the statement above is clearly statable in finite combinatorics (i.e. Peano Arithmetic) it cannot be proven there (Paris-Harrington [1977]). Subsequently there have been a host of such incompleteness results, statable in Peano arithmetic and in some cases not provable in very strong extensions of the system.

The method of proving such incompleteness is fascinating. One shows that the minimum n which works for p, q and k grows faster than all the provably recursive functions (i.e. faster than (extensions of) Ackermann's function). For a long time it was also felt that perhaps the Van der Waerden numbers were like this too. Certainly it was shown that the known *proofs* gave such remarkable growth relying, as they did, on double induction. Using a completely new approach, Shelah [1987] proved that this was not the case and reduced the Van der Waerden numbers from the realms of the unimaginably astronomical to the merely ridiculous. It is still unknown if this can be done for Szemeredi's theorem.

Another very exciting application of Ramsey theory is to computational complexity theory. The reason is fairly clear. We have an algorithm that we feel is the best possible for some process. We'd like to prove this. Now the idea is that we have some subprocess which we know takes a (fairly) long time, and we use Ramsey theory as well as other combinatorial arguments to show that to perform the required process we need many

applications of the known process which does take a long time. Such applications to complexity can be found in the work of Yao [1981], Alon and Maass [1986], Moran, Snir and Manber [1985], Babai, Budlak, Rödl, Szemeredi [ta] and many others. It is hoped the above might give the reader some insight into the basic ideas of Ramsey theory, and a glimpse into the diversity and vigour of this area of modern combinatorics.

Turning now to the book at hard, it is impossible to consider it without the context of the classic monograph *Ramsey Theory* by Graham, Rothschild and Spencer. *Ramsey Theory* is a truly beautiful book that very carefully picks most of the high points of the area, and presents them in a coherent sequence with great lucidity (particularly in the second edition where all of the errors are corrected!). If you are a combinatoricist or someone interested in this area, Ramsey theory is a must. The same cannot be said of *Mathematics of Ramsey Theory*. The book consists of a number of articles by various authors assembled over some years all concerned with aspects of Ramsey theory. The idea was to "complement" the Graham *et al* text, and to "exhibit the diverse techniques of contemporary Ramsey theory". This is an interesting idea, and, as well as a lot of repetition of what is in the Graham *et al* text, there are quite a number of well written and diverse papers covering topics not to be found in *Ramsey Theory*. In particular, the papers by Paris (on incompleteness results), Carlson and Simpson (on topological versions of Ramsey's theorem, such as Ellentuck's theorem and the dual Ramsey theorem), Graham (on topics in Euclidean Ramsey theory), and Pudlak (on Boolean complexity) were certainly of this type. Some papers such as the one by Kriz and Thomas (on ordinal types, and connections with well-quasi-ordering theory) certainly covered different material, but I found them very tough going. Unfortunately, I also found many of the other papers rather too technical to be of interest to any but a really hard core Ramsey theorist. This is rather what you would expect—a mixture of quasi-survey articles and some rather technical papers. The level of exposition varied considerably, some having the "pearls before the swine" type approach which characterises many papers in journals, while in others one felt that the author was clearly trying to guide the reader through the area. The fact that notation varied from paper to paper did not help. There were other aspects that seemed to indicate that the volume had been very carefully edited for instance, the correctness of the English.

To summarise, I feel quite ambivalent about *Mathematics of Ramsey Theory*. I find it rather difficult to figure out the exact aim of the book. If it was really meant as a companion to *Ramsey Theory*, it seems to me that it should have picked certain high points such as those above not covered in *Ramsey Theory* and should have given high level expositions of these areas. Instead I feel that the book rather lost its way and became too ambitious. No doubt, it is worth a copy in the library and certainly worth selected readings. But I really feel that to own a copy one would need to be wealthy (a professor?) or a Ramsey theorist.

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Mathematics for Computer Algebra, by M. Mignotte. Springer-Verlag, New-York, 1992, xiv+346pp, DM 78.00. ISBN 0-387-97675-2.

The fundamental part of any of the classical Computer Algebra systems (e.g. REDUCE, Macsyma, Maple, Mathematica) is the manipulation of polynomials, usually multivariate.

Mignotte's book is a translation of the 1989 French version which has been reviewed in Maths Reviews #91a:68001. The book manages to find a useful niche in the Computer Algebra (CA) book literature by placing a heavy emphasis on the factorization of polynomials, particularly univariate ones. Though the other CA books in the reference list treat the area, none treat it as thoroughly as Mignotte's book. The books by Akritas [1] and by Geddes et al. [5] are the closest, followed by that by Davenport et al. [4]. Major older reference books are Buchberger et al. [2] and Lipson [7].

Mignotte's book is at Postgraduate level or, perhaps, at 4th year Honours Undergraduate level for Australasian university students. Childs [3] covers the algebra pre-requisites.

After an introductory chapter on algorithms for integers and number theory, the book settles down to its main theme of polynomials and their factorization, and treats this thoroughly and well. It is far less thorough in the treatment of other equally useful matters such as polynomial g.c.d.'s, for which some of the other books in the reference list below are better. See Keady [6] for a review of [1], [4], [8], [9]. Nevertheless the book definitely belongs in the libraries of any university where there are people interested in the algebraic aspects of computer algebra systems.

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7. Lipson, J.D. *Algebra and algebraic computing*, Addison-Wesley, (1981).
8. MacCallum, M.A.H. and Wright, F.J. *Algebraic computing with REDUCE: Lectures given at the first Brazilian school on computer algebra*, Oxford University Press, Oxford (to appear 1991).
9. Zippel, R.E. *Computer Algebra, Part I: Algebraic Techniques* (in preparation).

Grant Keady
University of Western Australia

Differential Equations. A Dynamical Systems Approach. Part I: Ordinary Differential Equations by John H. Hubbard and Beverley H. West. Texts in Applied Mathematics, Volume 5, Springer-Verlag, New York, 1991, xx + 348 pages, DM 78. ISBN 0-387-97286-2.

The authors have taken a fresh approach to the subject. Traditional courses on differential equations have techniques leading to solutions in terms of elementary functions, despite the fact that this is possible for only a restricted class of equations. The authors wish to deal with the generic situation. They take the view that a differential equation defines functions, and that the object should be to understand the behaviour of these functions. Consequently they spend much space on qualitative and numerical methods and relatively little on traditional analytic methods.

The book is normally accompanied by *Macmath*, computer software designed to explore the nature of the solutions of differential equations. This was not available to the reviewer. While this did not greatly hamper the reviewer, its absence would be a handicap to a student working through the exercises in this book. However, this handicap is mitigated by the large number of figures displaying computer generated solutions.

The first chapter is titled Qualitative Methods. Right at the beginning the authors introduce some new terminology, "fence", "funnel" and "antifunnel" to label certain phenomena involving differential inequalities, and extensive use of these is made in the subsequent discussion. They are used to give simple, direct, noniterative proofs of several important theorems.

Chapter 2 is on analytical methods. This is concerned with the more traditional material on solutions of separable and linear equations. The reviewer was surprised to find that the technique of solving a linear equation using an integrating factor is relegated to a single exercise.

Numerical methods are treated in Chapter 3. One of the strengths of this book is the way in which material on practical numerical analysis is integrated with a discussion of the nature of the solutions of the differential equations.

The fourth chapter deals with questions of existence and uniqueness. Here the authors discuss the consequences of imposing a Lipschitz condition. They establish error bounds and prove some general theorems involving the concepts of fence, funnel and antifunnel.

Chapter 5 is devoted to iteration. This topic is not normally considered to be part of a course on differential equations, but it is closely related, and here the similarities are emphasized. In fact this chapter occupies about one-third of the book, and it is questionable whether all this material is justified in a course on differential equations.

A short appendix deals with asymptotic development.

The book contains a large number of useful exercises, for many of which solutions have been provided. The authors write clearly and most of what they have written I found interesting and helpful (but I would not support them in their strong objection to the expression "asymptotic series"). The book is very well produced and is a pleasure to read. I found only a handful of misprints.

Part I is to be followed by *Part II: Higher Dimensional Differential Equations* and *Part III: Partial Differential Equations*, and I look forward to reading these sequels.

In summary, the book is well worth reading. Students should find it a pleasure to work from, and if they work their way through it they will gain a comprehensive knowledge of first order differential equations. Whether they can afford to have the luxury of spending an entire course on first order equations and then take a second course, and buy another book (Part 2), before they can learn about second order equations, is a question that has to be answered. I suspect that for many students the answer will be no, and for this reason the use of this text will be confined to courses for mathematics specialists. This is a pity, because other readers could gain considerable benefit from it.

D.A. Nield
Department of Engineering Science
University of Auckland

The Little Book of Big Primes, by Paulo Ribenboim. Springer-Verlag, New York-Berlin-Heidelberg, 1991, xvii+237 pages, paperback, DM 49.50. ISBN 0-387-97508-X.

This is an abridged version of **The Book of Prime Number Records**, by the same author and publisher (1987). The author explains that this abridged version is intended for beginners in number theory rather than for specialists. Nonetheless, the readers do need to have some experience in number theory, including fluency in multiplicativity and divisibility of congruences. For example, the very short proof of Fermat's little theorem (p.13) is followed by the comment that "the above proof required only the fact that if p is a prime number and if $1 \le k \le p\text{-}1$, then the binomial coefficient $\binom{p}{k}$ is a multiple of p".

Several proofs are given that there are infinitely many primes, and the Sieve of Eratosthenes is explained. Various primality tests and factorization method are presented, with Fermat's little theorem, primitive roots, Wilson's theorem, the Chinese remainder theorem, Euler's totient function, quadratic residues, Lehmer's test, Lucas sequences, Fermat numbers, Mersenne numbers, perfect numbers, pseudoprimes (of several flavours) and Carmichael numbers, including applications to Public Key Cryptography. Various functions for generating primes are presented, including Willans's remarkably simple formulae for p_n (the nth prime) and for $\pi(m)$ (the number of primes less than m), Mills's very simple function which yields only prime values, and Matijasevic's astonishing polynomial of degree 25 in 26 integer variables, whose positive values yield all of the primes.

The studies of the distribution of primes done by Euler, Legendre, Gauß, Chebyshev, Riemann, de la Vallée Poissin, Hadamard, Erdös and Selberg are explained, with accounts of the Riemann hypothesis, of gaps between primes (including twin primes), primes in arithmetic progressions, and Goldbach's conjecture. There are accounts of special kinds of primes, including those considered by Sophie Germain, Kummer, Wieferich, Wilson and Cullen, and there are sundry heuristic results and conjectures about primes. The book is provided with extensive references and indexes, plus a table of primes up to 10093.

In the discussion of Fermat numbers, the author states (p.64) that in **Disquisitiones Arithmeticæ** §365 and §366, Gauß showed (in 1801) "that if $n \ge 3$ is an integer, the regular polygon with n sides may be constructed by ruler and compass, if and only if $n = 2^k p_1 p_2 \dots p_h$, where $k \ge 0$, $h \ge 0$ and $p_1 \dots p_h$ are distinct odd primes, each being a Fermat number". Actually, Gauß proved that the condition on n is sufficient for that construction but he did not publish a proof that it is necessary. Rather, he asserted that he could demonstrate the result with all rigour, and he warned readers not to try to extend his construction to any other value of n. The first published proof of the necessity is credited to Pierre Laurent Wantzel (in 1837).

In the section on Lucas Sequences (pages 35-53), the standard expression for the solutions of the recurrence relation $W_n = PW_{n-1} - QW_{n-2}$ in terms of the roots of the characteristic equation is attributed to Binet (in 1834), rather than to Daniel Bernoulli (in 1732).

The "Addendum on Cullen Numbers" (p.175) lists the few known primes of the form $n\times2^n+1$; but does not mention that C. Hooley has proved that almost all such integers are composite (cf. C. Hooley, **Applications of sieve methods to the theory of numbers** Cambridge University Press, 1976, pp.115-119).

Legendre symbols and Jacobi symbols are both printed, not only in the standard form $\left(\frac{a}{b}\right)$ but also (within text) in the form (a/b). That can be rather confusing – e.g. on page 185 it is not immediately clear whether (9/8) is to be interpreted (twice) as a Jacobi symbol or as a fraction.

There are several misprints which should be corrected in subsequent printings:

p.18 The representation of positive integer a in base b (which is misleadingly called the p-adic development of a) should be corrected to:

$$a = a_k p^k + a_{k-1} p^{k-1} + \dots + a_1 p + a_0.$$

p.27 "Schinzel showed that $\frac{n}{ek(ab)}$ is an odd integer" should be

"Schinzel showed that if $\frac{n}{ek(ab)}$ is an odd integer".

p.33 "$2 \equiv 1 \pmod{1093^2}$" (!) should be "$2^{1092} \equiv 1 \pmod{1093^2}$".

Spaces between words are needed in p.35 (last line), p.40 (lines 5,7) and in some other places.

p.70 The statement that $q = 39051 \times 2^{6001} - 1$ gives the largest known composite Mersenne number M_q is repeated in 2 consecutive sentences.

p.151 A lengthy footnote has got embedded in the text.

For a reader with some knowledge of introductory number theory, this inexpensive (I hope!) paperback book could well stimulate a strong interest in primes.

G. J. Tee
University of Auckland

Miscellanea Mathematica, edited by Peter Hilton, Friedrich Hirzebruch & Reinhold Remmert. Springer-Verlag, New York-Berlin-Heidelberg, 1991, xiii + 326 pages, DM 36. ISBN 3-540-54174-8.

Many of the leading mathematicians of today have contributed papers to this *Festschrift*, which honours Dr Heinz Götze for his achievements in scientific publishing, making "so unique and invaluable a contribution to the spread of mathematical cultures that is reported in these pages". The papers are:

Michael Atiyah, "The European Mathematical Society",
Friedrich L. Bauer, "Sternpolygone und Hyperwürfel",
Henri Cartan, "Sur quelques progrès dans la théorie des fonctions analytiques de variables complexes entre 1930 et 1950",
Shiing-Shen Chern, "Surface theory with Darboux and Bianchi",
John H. Conway & Neil J. A. Sloane, "The cell structures of certain lattices",
Beno Eckmann, "Von der Studierstube in die Öffenlichkeit",
Ludvig D. Faddeev, "A mathematician's view of the development of physics",
Hans Grauert, "The methods of the theory of functions of several complex variables",
Peter Hilton, "The mathematical component of a good education",
Heisuke Hironaka, "Fame, sweet and bitter",
Friedrich Hirzebruch, "Centennial of the German Mathematical Society",
Lars Hörmander, "The first woman professor and her male colleague",
Fritz John, "Memories of student days in Göttingen",
Max Koecher, "Castel del Monte und das Oktogon",
Raghavan Narasimhan, "The coming of age of mathematics in India",
Constance Reid, "Hans Lewy (1904-1988)",
Reinhold Remmert, "Inventiones mathematicae: Die ersten Jahre",
Jean-Pierre Serre, "Les petits cousins",
Jaques Tits, "Symmetrie",
André Weil, "Sur quelques symètries dans l'Iliade",
Don Zagier, "Lösungen von Gleichungen in ganzen Zahlen".

What more need any reviewer say?

G. J. Tee
University of Auckland

MATHEMATICAL VISITORS TO NEW ZEALAND

List No. 32 : 1 July 1992

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

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

Professor Peter Duren; Ann Arbor, Michigan; wife; complex analysis; February 1993; University of Auckland; G. Martin; Walking Milford track in January?

Professor Elizabeth Fennema; Wisconsin Centre for Educational Research; husband Professor Owen Fennema; mathematics education and gender issues; July 4 - August 7 1992, Massey University; Prof. Graeme Wake.

Professor Aimo Hijkkanen; University of Chicago, Urbana; spouse Porama; complex analysis; March to August 1993; University of Auckland; G Martin; very likely.

Mr Karel In t'Hout; University of Leiden; numerical solution of differential equations; September 1992 - September 1993; University of Auckland; Prof. John Butcher.

Dr Jan Jaworowski; Indiana University; wife and daughter; algebraic topology; 1 February - 30 June 1993; University of Auckland; Prof. David Gauld.

Professor Gerhard Kristenssen; University of Lund, Sweden; wife and children; inverse problems, mathematics of wave propagation; 29 June to 10 September 1992; University of Canterbury; Dr David Wall.

Professor C. C. Lindner; Auburn University, Alabama; wife; combinatorics, Steiner triple systems; second term 1993; University of Canterbury; Dr D.R. Breach; Visiting Erskine Fellow.

Ken Milton; Centre for Educational Studies, University of Tasmania; mathematics education; later 1992; Centre for Science and Mathematics Education, University of Waikato; Andy Begg.

Professor J W Moon; University of Alberta; graph theory; August 1991 to August 1992; University of Otago; Prof. Derek Holton.

Professor Bruce Murtagh; Macquarie University, Australia; wife Kim; operations research, optimization; 21 September to 3 November 1992; Department of Engineering Science, University of Auckland; David Ryan.

Professor Melvin A Nyman; Alma College, Michigan, USA; applications of mathematics to problems in resource management, biological and social sciences; June - August 1992; University of Otago; Prof. Brian Manly.

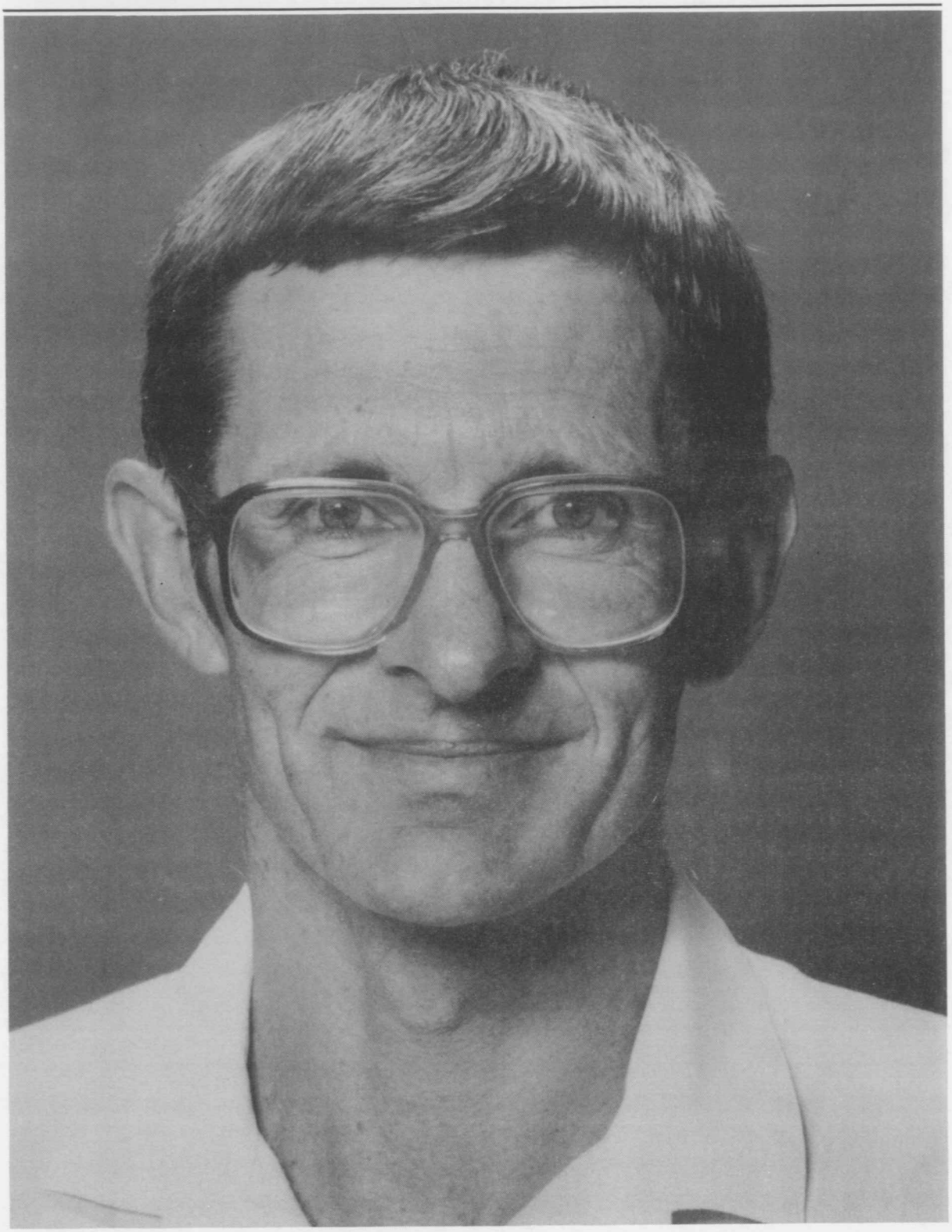
Dr Simo Puntanen; University of Tampere, Finland; wife and daughter; statistics; 1 September - 15 December 1992; University of Auckland; Dr Alastair Scott.

Dr Terry Quinn II, Assoc. Prof. of Fish Population Dynamics; University of Alaska, Fairbanks; fisheries, statistics; March - June 1993; Auckland University; Prof George Seber.

Professor Dr Peter Schmid; University of Tübingen, Germany; wife; group representation theory; December 1992 - February 1993; University of Auckland; A-Prof. Marston Conder.

(Continued on page 26)

CENTREFOLD



Professor George Seber

GEORGE ARTHUR FREDERICK SEBER

by Alastair Scott and Chris Wild

George is accomplished in many areas. He has published papers in mathematical and statistical areas as diverse as Linear Algebra and Blood Genetics. Indeed, he also writes popular articles on theology and the nature of science. His papers on the estimation of animal numbers have made a very significant contribution to the research literature in this area. In particular, his "Estimation of Animal Abundance", now in its second edition, is the standard work in the field. He is perhaps best known to the broad spectrum of statisticians around the world for his series of important graduate and research level texts, from his 1966 monograph on the Linear Hypothesis, through "Linear Regression Analysis" in 1976 and "Multivariate Observations" in 1984, to "Nonlinear Regression" (with Chris Wild) in 1989.

Yet another research monograph on Adaptive Sampling (with Steve Thompson) is nearing completion. George has always been interested in other fields of Mathematics as well. With his background in Linear Models he has become an authority on Linear Algebra. He has published theoretical papers in this area and has begun work on a new book which will be a compendium of results in Matrix Theory, conceived as a tool for helping research workers in other disciplines.

When George first arrived in Auckland in 1965 he was the only full-time statistician at the university. From the beginning he threw himself into building up Statistics, his efforts culminating in the founding of the Statistics Unit which he heads and which now has a full-time academic staff of twelve. Although teaching extremely heavy loads, and initially carrying virtually all statistics teaching himself, he became involved in many outside activities as representative and missionary for Mathematics and Statistics. He was involved, for instance, in University Extension Courses, syllabus committees and teacher refresher courses for Mathematics and Statistics in secondary schools, a committee of the New Zealand Institute of Architects and the Research Advisory Committee of the Cancer Society. In addition he has been an active statistical consultant both inside the University and for outside organizations. All of this went hand in hand with his writing and the increasingly heavy burden of nursing his late wife Pat, who died in 1985.

As well as being a first-rate teacher, George has been an active mathematical administrator. He was a very efficient Head of the Mathematics Department for six years from 1975 to 1981. During this time he greatly streamlined administrative procedures, built unity in a department made up of disparate natural groupings, and acted as midwife to the birth of the Computer Science Department.

This year has been a good one for George, with his recent marriage to Jean McDermott and the start of new interests in Sampling and Financial Mathematics. We look forward to reading his definitive treatments of both subjects shortly.

(Continued from page 23)

Dr Michael Stiassnie; Technion, Israel Institute of Technology; wife; ocean wave dynamics, fractal analysis; March 1993 - February 1994; University of Canterbury; Dr Peter Bryant.

Professor Yuri Tiourin; Moscow State University; wife; non-parametric statistics; July - December 1992; University of Auckland; Prof. George Seber.

Professor Andrew Vince; University of Florida; wife and child; graph theory; July 1993 - July 1994; Massey University; Dr Charles Little; possible.

Professor Jang-Mei Wu; University of Illinois at Urbana-Champaign; husband, Robert Kaufman (also a mathematician) and daughter Julie, age 10; potential theory; 12 July - 12 August 1992; University of Canterbury; Dr N A Watson; Visiting Erskine Fellow.

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

David Robinson
N.Z. Mathematical Society Visitors' Co-ordinator
Department of Mathematics
University of Canterbury
email: dfr@math.canterbury.ac.nz

PRESIDENTIAL

NZMS POLICY

At the AGM I presented a policy document that I put together last year with the assistance of Vernon Squire and with input from departments across the country. I would like to revise it this year and submit the revised document to the 1993 AGM for acceptance.

If you have any additions, deletions or comments I would be glad to receive them. I'll then incorporate them and circulate a policy document to all departments prior to the AGM next year.

Derek Holton
University of Otago

STATEMENT OF POLICY 1991

1. The New Zealand Mathematical Society is the professional body for academic and research mathematicians in this country. As such its main concerns are with mathematical research and with teaching in all tertiary institutions. Notwithstanding this it has an obvious interest in, and concern for, the teaching of mathematics at all levels and for the application of mathematics outside universities.

2. The NZMS is keenly aware of reports from a number of other countries which indicate that too few mathematicians (and scientists generally) are being trained to meet the anticipated needs of the early 21st century. It is concerned that, by the end of the decade, New Zealand will find itself in a position where it is unable to replace the large number of professional mathematicians which will begin to retire at that stage. It is also concerned that this will mean that their posts will be filled by graduates without PhD's or by people without strong research background.

Policy 1. The NZMS will do all in its power to maintain, and where possible, raise, the standard of mathematical teaching in tertiary institutions and of research in both these institutions and government establishments. It will also seek to increase the number of graduates with the appropriate training and enthusiasm for teaching mathematics at all levels.

3. As a result of policy 1, the NZMS will bring to the attention of the government and universities the problems that lie ahead, and where possible suggest ways in which these problems can be solved.

4. It is anticipated that, by the time this document is released, the universities will have entered the Foundation for Research, Science and Technology. The NZMS believes that the word "Science" in the Foundations title includes "Mathematics". Hence the NZMS expects that much of the funding for university mathematical research grants and CRI mathematics will come from the Foundation.

5. The current outputs specified by the Foundation do not include mathematics explicitly. In addition, it would be constructive for mathematicians to have some control over the areas in which they do research.

Policy 2. The NZMS will press the Foundation for an output (Mathematical Sciences) which is specific to mathematics. When this output is in place, it will be monitored to ensure its longterm validity.

6. Policy 2 has implications for Policy 1. A lack of adequate funding for mathematical research may help accelerate the decline of quality mathematics staff in this country. It is undoubtedly true that there is considerably more money available for mathematics research in the United States of America.

7. The NZMS is aware that, as far as funding is concerned, there are differences in the nature of the requirements for mathematics compared to the other sciences. To be more specific, mathematicians at this time usually require little in the way of sophisticated equipment, other than computers which are now used extensively in many branches of mathematics. They also need the stimulation of peer interaction - perhaps more than in most other sciences - because the subject often develops through a symbiosis of seemingly disjoint ideas. The recent wide availability of e-mail can certainly help this process, but there is no substitute for face-to-face interaction and dialogue which on many occasions has accelerated research discoveries markedly. Up-to-date and expansive library resources are another essential element in mathematical progress.

Policy 3. The NZMS will undertake to contact the Foundation and impress upon it the needs of mathematicians for research funding and how these needs may differ from those of the other sciences.

8. A large percentage of research mathematicians in universities is engaged in fundamental, pure research which is not motivated by immediate obvious applications. This does not, of course, mean that this research will never lead to valuable applications. There are many instances where important applications have arisen from pure research. Neither does it mean that pure mathematicians should be unaware of potential applications. It should be pointed out too, that ongoing fundamental research is essential to provide the tools for future applications.

Policy 4. The NZMS will undertake to emphasise the importance of fundamental research to the Foundation in an effort to ensure that this facet of mathematical research does not wither and die in this country. Further, the NZMS will endeavour to foster interactions between pure mathematicians and applied mathematicians and research workers in other areas.

9. There has been some concern at the manner in which the first round of proposals to the Foundation for grants for mathematical research were assigned to referees. In many cases, referees were asked to comment on proposals which were outside their area of expertise.

Policy 5. The NZMS will suggest to the Foundation that an international recognised panel of mathematically expert referees be established to monitor mathematical research proposals, so that proposals in a given area are considered by referees with the appropriate expertise. The development of the process of refereeing will be monitored by the NZMS.

10. The restructuring of Government science divisions into CRI's has implications for the effectiveness and viability of the present DSIR Applied Mathematics Group (AMG). If the AMG is located within any particular CRI, even if maintained as a discrete unit, there are serious concerns as to whether it will be able to maintain involvement with other CRI's. Hence it may not be able to play the national role that is implied by the universal application of mathematical methods.

Policy 6. The NZMS takes an interest in the development of government based mathematical research in CRI's and will do all in its power to ensure that its autonomy and nation-wide applications, as well as the valuable work that has been done in the past, continues.

11. It is clear that there is mounting public concern at the level of achievement in mathematics among school leavers. The Minister of Education is rightly emphasising the importance of the subject by insisting that it is taken by all students up to the end of Form 5. But the universities must play their part too. It is well known that the increase in school retention rates and the current economic situation are forcing an increase in the number of students who wish to undertake some mathematical study at university. The current increase in student numbers in university mathematics courses has not been matched by an increase in academic staff. Consequently university mathematicians are being forced to spend a greater time on the teaching of mathematics, to the detriment of their research. Simultaneously they are unable to give as much time to each student as has been the case in the past. The nature of university mathematics teaching is also changing with the advent of affordable microcomputers, to reflect the changing nature of some areas of mathematics and mathematical research. In most universities now, students are being taught in mathematics computer laboratories.

Policy 7. The NZMS will do all in its power to increase the funding for university mathematics in order to decrease lecture class sizes, especially at first year, to recognise the changing nature of university mathematics teaching, and to enable adequate time to be spent on research.

12. Policy 7 is an important adjunct to Policy 1. In the future, as the number of trained mathematicians decreases, New Zealand universities will be competing with other countries for staff. It is unlikely that this country will be able to afford salaries as lucrative as those available in countries such as the United States. To some extent, the lifestyle and conditions of academic employment here may offset a drop in real income, but it is essential that such conditions be made as attractive as possible to encourage first-rank mathematicians to pursue a career here.

13. The high profile given to mathematics in schools by the Minister of Education is appreciated by the NZMS. There are, of course, still many problems and difficulties for mathematics and for mathematics teachers in schools. One of these is the chronic shortage of maths teachers with a strong background in the subject.

Policy 8. The NZMS will do all in its power to assist the teaching of mathematics in schools. It will endeavour to play a role in the development of the curriculum and it will support teachers with a view to increasing both the standard of achievement in, and the level of enjoyment of, the subject of mathematics.

PRESIDENT'S REPORT 1991-92

It seems that at least where government is concerned, everything has to be done yesterday. Hence the Council was subjected to faxes and circulars to respond to at short notice on a number of matters (see below). I mention this so that you realise that the Council does more than take part in a long meeting twice a year.

The highlights of this year are detailed under the headings below.

Visiting Lecturers

The 1991 NZMS Visiting Lecturer was Douglas Bridges of the University of Waikato. He made a couple of sallies around the country and produced a valuable report recommending uniformity of treatment by the various departments he visited.

The 1992 NZMS Visiting Lecturer was John Loxton who was here in April and May and gave one of the invited talks at the Colloquium. Johns' interests are number theoretical.

We hope to have Andreas Dress as the 1993 NZMS Visiting Lecturer. His areas of interest are wide, extending out from classical algebra to various applications of combinatorics. Mike Hendy (Massey) will be organising Andreas' visit.

The fourth Forder Lecturer is to be Roger Penrose and he will be here in 1993. Graeme Wake (Massey) will look after his stay in New Zealand.

Publications

(l) **Newsletter.** Once again we are grateful to David Smith and John Shanks, who respectively edit and oversee the printing and distribution, for the work they put in to producing this high quality publication. The Council would also like to thank all those who have contributed to the Newsletter. We would like to especially thank the departmental representatives for their work in keeping us up to date with the events in their universities.

(2) **Textbooks.** The sales from our textbooks are dwindling and are no longer a significant source of income for us. We need to decide whether or not we will continue to publish books. We would be grateful to hear from anyone who has a text hot off the wordprocessor and is looking for a publisher.

(3) **Journal.** Perhaps the biggest decision of the Council for some years was to join with the Department of Mathematics and Statistics at Auckland University to metamorphose The Chronicle into the New Zealand Journal of Mathematics. The first issue of the Journal appeared in May 1992 and incorporates the invited lecturers (including that of Vaughan Jones) from the 1991 Colloquium held at Otago. David Gauld is the Editor and papers should be sent to him at the University of Auckland. He, Paul Hafner and Joel Schiff should be congratulated for the high quality of the first volume. Thanks are also due to Betty Fong for her TeX typing for the Journal.

As you will see from the Treasurer's statement, the Council has approved grants of $3000 (1992), $2000 (1993) and $2000 (1994) towards the running costs of the Journal.

Grants

It is Council policy to distribute interest from the Society's investments as grants. The details of the grants made from the 1990 interest are shown below. The interest that year amounted to $10 691.

Regular Commitment

Colloquium (1992)	$1500	
NZMS Visiting Lecturer	685	
RSNZ Prince and Princes of Wales Award	500	
		2,685

Research Fund

5 grants for travel	2200	
NZMS Research Award expenses	255	
		2,455

Post Graduate Student Travel Fund

1 grant for other conference	500	
		500

Other Grants

NZ Journal of Mathematics	3000	
Jim Campbell Teachers' Award (1991)	586	
Predoctoral Thesis Competition	250	
		2,836
		9,476
Less grants not taken up:		
Post-graduate student travel		500
		$ 8,976

It should be noted that the Jim Campbell Awards is a joint venture of NZAMT and NZMS. They are for excellence in teaching.

NZMS Awards for Mathematical Research

The inaugural Awards were made at the Colloquium dinner last year to John Butcher and Rob Goldblatt.

This years' Awards were made during the opening lecture period. The Awards went to Rod Downey (VUW) and Vernon Squire (Otago).

We would like to thank the two adjudicators and the various referees for their input. Nominations are invited for the 1993 Awards. These should be sent to Derek Holton at Otago University. A request for nominations is made elsewhere in this Newsletter.

FOSTS

The Federation of Scientific & Technological Societies was established in 1990 and Graeme Wake (Massey) represented us on its Council for the first year. In a collegial election in Wellington in November last year, John Clare of the DSIR, Physical Sciences, Gracefield was chosen to represent the Royal Astronomical Society of NZ, NZ Mathematical Soc., NZ Statistical Soc., NZ Computer Soc., NZ Institute of Physics, NZ Electronics Institute, Society of Automotive Engineers Australia, and the Population Association of NZ. I am glad to report that Graeme Wake was elected as one of the general representatives to the Council of FOSTS.

Graeme reported on the activities of FOSTS at the AGM so I would only like to say here that they are a very active body and are doing valuable work. As a result of their prompting, during the year Council developed an NZMS policy. This policy should be kept up to date. As it has not had wide circulation, a copy is attached. I would be grateful for any comments which can be incorporated into a document which should be accepted at the next AGM.

Many Thanks

I would like to thank all the members of the current Council for their considerable help to me over the course of the year. In particular I would like to mention Gillian Thornley, the retiring Outgoing Vice President. She has been extremely helpful to me on many occasions during the year. On behalf of the Society I would

also like to thank her for the work she has done during her period on Council, two years of which were spent as President.

John Giffin is the other retiring member of Council, though he was far from retiring where his work was concerned. As part of his service on Council, John spent two years as Secretary to the NZMS. On the Society's behalf I would like to thank him for his invaluable contribution.

Other specific mentions should be made to Kee Teo as (Treasurer) and Robert Aldred (Secretary), both of whom contribute a great deal behind the scenes.

Finally, on behalf of the Society, I would like to thank all those who are involved in other ways which contribute to the success of the Society.

Derek Holton
May 1992

SECRETARIAL

FINANCIAL STATEMENTS
Year Ended 31 December 1991

BOOK TRADING ACCOUNTS

		1991	1990
MAHS/CALCULUS			
Sales		11,248	19,165
Less Cost of Sales			
Opening Stock	2,662		8,014
Purchases/Expenses	13,537		9,587
	16,199		17,601
Closing Stock	8,784		2,662
		7,415	14,939
Gross Profit from Maths/Calculus Books		**3,833**	**4,226**
MATHS/STATISTICS			
Sales		4,416	9,630
Less Cost of Sales			
Opening Stock	12,054		17,738
Purchases/Expenses	1,411		3,005
	13,465		20,743
Closing Stock	9,366		12,054
		4,099	8,689
Gross Profit from Maths/Statistics Books		**317**	**941**

SECONDARY SCHOOL MATHS			
Sales		1,042	421
Less Cost of Sales			
Opening Stock	6,389		7,218
Purchases/Expenses	334		130
	6,723		7,348
Closing Stock (see Note 1)	-		6,389
		6,723	959
Gross Loss from Secondary School Maths Books		**(5,681)**	**(538)**
LINEAR ALGEBRA			
Sales		6,596	6,504
Less Cost of Sales			
Opening Stock	6,714		10,980
Purchases/Expenses	966		914
	7,680		11,894
Closing Stock	2,628		6,714
		5,052	5,180
Gross Profit from Linear Algebra Books		**1,544**	**1,324**
MODELLING ACTIVITIES			
Sales		1,120	2,637
Less Cost of Sales			
Opening Stock	4,136		5,737
Purchases/Expenses	149		707
	4,285		6,444
Closing Stock	3,696		4,136
		589	2,308
Gross Profit from Modelling Activities Books		**531**	**329**
GROSS PROFIT FROM BOOKS		**544**	**6,282**

INCOME AND EXPENDITURE ACCOUNT

		1991	1990
INCOME			
Donations	500		
Interest Received	9,541		10,691
Miscellaneous Receipts	-		1,031
Subscriptions	5,249		4,924
Gross Profit from Books	544		6,282
		15,834	22,928

LESS OPERATING EXPENSES			
Accountancy and Audit Fees	881		-
Donations	1,500		9,533
Forder Lecturer	463		-
Mathematics Prizes & Awards	1,005		-
Newsletter	1,717		1,580
NZAMT Share of Publication Profits	(1,000)		2,675
Miscellaneous	100		1,258
NZMS Lecturer	684		-
Postage & Stationery	393		-
Travel & Research Grants	5,036		3,500
Travel/Council Expenses	3,061		2,040
		13,840	20,586
EXCESS OF INCOME OVER EXPENDITURE		1,994	2,342
PLUS ACCUMULATED FUNDS AT BEGINNING OF YEAR		124,983	122,641
		126,977	124,983
Less:			
Transfer of Massey (Aitken) Account out of Books		393	-
ACCUMULATED FUNDS AT END OF YEAR		**126,584**	**124,983**

BALANCE SHEET AS AT 31ST DECEMBER 1991

		1991	1990
ACCUMULATED FUNDS		**126,584**	**124,983**
Represented By:			
CURRENT ASSETS			
Petty Cash Imprest	3		-
Bank - General Account	1,657		6,302
- Massey (Aitken) Account	-		393
- Text Book Account	21		105
- Wellington Account	279		240
BNZ Autocall Account	6,548		90,955
ENZ Investment	103,509		-
Accounts Receivable	4,204		6,926
RWT Deposit	-		74
Book Stock on Hand (Note 2)	24,474		31,955
		140,695	136,950
CURRENT LIABILITIES			
Petty Cash Imprest			7
Accounts Payable	4,061		1,411
Owing to NZAMT	9,128		10,128
GST Payment Due	922		421
		14,111	11,967
NET ASSETS		**126,584**	**124,983**

NOTES TO THE FINANCIAL STATEMENTS

1. STATEMENT OF ACCOUNTING POLICIES

General Accounting Policies

The following general accounting policies have been adopted in the preparation of the financial statements.

(i) The measurement base adopted is that of historical cost and reliance is placed on the fact that the business is a going concern.

(ii) The matching of revenue earned and expenses incurred using accrual accounting concepts.

Specific Accounting Policies

- Inventories Inventories have been valued at the lower of cost on a first in first out basis or net realisable value after due allowance for damaged and obsolete stock. Stocks of Secondary School Maths texts have all been written off as they have become obsolete.

- Accounts Receivable Accounts receivable are recorded at net realisable value.

- Goods and Services Tax The financial statements have been prepared stating all income and expenditure items exclusive of GST

- Changes in Accounting Policies There have been no changes in accounting policies. All policies have been applied on bases consistent with those used last year.

2. BOOKS ON HAND

	1991		1990	
	No.	$	No.	$
Maths/Calculus	732	8,784	240	2,662
Maths/Statistics	669	9,366	861	12,054
Secondary School Maths	-	-	1,037	6,389
Linear Algebra	146	2,628	373	6,714
Modelling Activities	210	3,696	235	4,136
	1,757	**24,474**	**2,746**	**31,955**

AUDITORS REPORT

We have examined the accompanying Balance Sheet and Statement of Income and Expenditure of the New Zealand Mathematical Society and have obtained all the information and explanations we have required.

In common with other organisations of similar nature, control over income (except interest received) prior to its being recorded is limited, and there are no practical audit procedures to determine the effect of this limited control.

Subject to the possible effect of the limited control over income referred to in the preceding paragraph, in our opinion the Balance Sheet and Statement of Income and Expenditure respectively give a true and fair view of the financial position of the New Zealand Mathematical Society at 31 December 1991 and of the results for the year ended on that date.

KPMG Peat Markwik
Chartered Accountants
4 May 1992

CONFERENCES

** 1992 **

September (Beijing) **IMACS 2nd International Conference on System Simulation and Scientific Computing - BICSC '92**
Contact W. Chuan-Yuan, Chinese Association for System Simulation, 37 Xue Yuan Rd., Beijing 100083, China.

September (Montréal) **Workshop on Topics in Probability and Lie Groups – Boundary Theory**
Contact CRM: see (9) below.

September 1-3 (Wageningen, The Netherlands) **Pedometrics '92: Developments in Spatial Statistics for Soil Science**
Contact J.J. de Gruijter, Winand Staring Centre, P.O. Box 125, 6700 AC Wageningen, The Netherlands.

September 2-4 (Munich) **Ninth IFAC Workshop on Control Applications of Optimization**
Contact D. Kraft, Fachhochschule Munich, Dachauerstrasse 98b, D-8000 Munich 2, Germany.

September 2-4 (Manchester) **Internatonal Conference on Control: Modelling, Computation, Information**
Contact IMA: see (7) below.

September 4-9 (Lake Garda, Italy) **Homotopy Theory**
Contact R. Piccinini, University of Milan, Via Saldini 50, 20133 Milano, Italy.

September 6-12 (Oberwolfach, Germany) **Topologie**
Contact MFOG: see (1) below.

September 7-14 (Bressanone, Italy) **IMACS Conference on Innovative Methods in Numerical Analysis**
Contact M. Morandi Cecci, Univ. degli Studi di Padova, Dept. de Math., Via Belzone 7, 35131 Padova, Italy.

September 8-11 (Minneapolis, Minnesota) **IMA Tutorial: Introduction to Linear Multivariable Control, Optimal Design and Parameter Estimation**
Contact IMA: see (3) below.

September 9-11 (Sheffield, U.K.) **Royal Statistical Society Full Conference**
Contact Professor P.J. Diggle, Mathematics Department, Lancaster University, Lancaster LA1 4YF, U.K.

September 13-18 (Udine, Italy) **6th International Conference on Stochastic Programming**
Contact Giovanni Andreatta, Dept. of Pure and Applied Mathematics, Via Belzone 7, 35131 Padova, Italy.

September 13-19 (Oberwolfach, Germany) **4-Dimensional Manifolds**
Contact MFOG: see (1) below.

September 13-19 (Coventry, U.K.) **Symposium on Analytic and Geometrical Aspects of Hyperbolic Geometry**
Contact E. Shiels, Mathematics Institute, University of Warwick, Coventry CV4 7AL, U.K.

September 14-16 (Edinburgh) **Fifth IMA Conference on the Mathematics of Surfaces**
Contact IMA: see (7) below.

September 14-18 (Bath, U.K.) **20th European Meeting of Statisticians**
Contact Professor R. Gibson, School of Mathematics, University of Bath, Claverton Down, Bath BA2 7AY, U.K.

September 14-18 (Marseilles, France) **Second Atelier International de Théorie des Ensembles**
Contact CIRM: see (8) below.

September 14-25 (Trieste, Italy) **Workshop on Commutative Algebra**
Contact ICTP: see (5) below.

September 16-18 (Minneapolis, Minnesota) **2nd SIAM Conference on Control in the 90s**
Contact SIAM: see (6) below.

September 17-19 (Timisoara, Romania) **International Conference on Group Theory**
Contact "The Group Theory Conference", Division of Algebra, Dept. of Mathematics, Univ. of Timisoara, Bd. V. Parvan 4, 1900 Timisoara, Romania.

September 17-19 (Minneapolis, Minnesota) **SIAM Conference on Control and its Applications**
Contact SIAM: see (6) below.

September 20-26 (Oberwolfach, Germany) **Funktionalgleichungen**
Contact MFOG: see (1) below.

September 21-23 (Guildford, England) **Fourth IMA Conference on Stably Stratified Flows: Flow and Dispersion over Topography**
Contact IMA: see (7) below.

September 21-23 (Barcelona) **7th International Conference on Multivariate Analysis in memory of Ronald A. Fisher**
Contact C.M. Cuadras, Universitat de Barcelona, Barcelona, Spain.

September 21-23 (Berkeley, California) **Workshop on Algebraic Cycles**
Contact MSRI: see (2) below.

September 21-25 (Minneapolis, Minnesota) **IMA Workshop on Robust Control Theory**
Contact IMA: see (3) below.

September 27 - October 3 (Oberwolfach, Germany) **Darstellungstheorie Endlicher Gruppen**
Contact MFOG: see (1) below.

September 30 - October 2 (Urbana, Illinois) **Thirtieth Annual Allerton Conference on Communication, Control and Computing**
Contact Allerton Conference, U. of Illinois at Urbana-Champaign, Coordinated Science Lab., 1101 West Springfield Ave., Urbana, Illinois 61801, U.S.A.

September 31 - October 4 (Poznan, Poland) **Third International Conference on Function Spaces**
Contact M. Nowak, Inst. of Math., Adam Mickiewicz University, Matejki 48149, 60-769 Poznan, Poland.

October (Montréal) **Workshop on Superprocesses and Interacting Systems**
Contact CRM: see (9) below.

October 2-3 (Oxford, Ohio) **Fourth Midwest Conference on the History of Mathematics**
Contact D.E. Kullman, Conference Director, Dept. of Math. and Stat., Miami University, Oxford, Ohio 45056, U.S.A.

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

October 12-16 (Minneapolis, Minnesota) **IMA Workshop on Control Systems Design for Advanced Engineering Systems: Complexity, Uncertainty, Information and Organization**
Contact IMA: see (3) below.

October 12-16 (Berkeley, California) **Workshop on Visualization of Geometric Structures**
Contact MSRI: see (2) below.

October 12-16 (Luminy, France) **International Conference on Polynomial Automorphisms and Related Topics**
Contact A. van den Essen, Dept. of Math., Catholic University, Nijmegen, The Netherlands.

October 14-18 (Madison, Wisconsin) **IMA Workshop on Sparse Matrix Computations: Graph Theory Issues and Algorithms**
Contact Richard Brualdi, Mathematics Dept., University of Wisconsin 53706, U.S.A.

October 15-19 (Salt Lake City, Utah) **SIAM Conference on Applications of Dynamical Systems**
Contact SIAM: see (6) below.

October 18-24 (Oberwolfach, Germany) **Geometrie**
Contact MFOG: see (1) below.

October 19-23 (Evian, France) **Fourth International Symposium on Orthogonal Polynomials and their Applications**
Contact C. Brezinski, IS0PA4, Laboratoire d'Analyse Numerique et d'Optimisation, UFR IEEA-M3, Univ. des Sciences et Technologies de Lille, 59655 - Villeneuve d'Ascq cedex, France.

October 20-25 (Waterloo, Ontario) **Workshop on Conservative Systems and Quantum Chaos**
Contact FIRMS: see (10) below.

October 25-31 (Oberwolfach, Germany) **Stochastische Analysis**
Contact MFOG: see (1) below.

November (Gold Coast, Queensland) **AUSCRYPT '92**
Contact Professor W. Caelli, Faculty of Information Technology, Queensland University of Technology, P.O. Box 243, Brisbane, Queensland 4001, Australia.

November (Tartu, Estonia) **The International Lie-Lobachevsky Colloquium Dedicated to the Anniversaries of Sophus Lie's 150th birthday and Nikolai Lobachevski's 200th birthday**
Contact Estonian Mathematical Society, LL-Colloquium 1992, Vanemuise 46-129, 202400 Tartu, Estonia.

November (Montréal) **Workshop on Stochastic Control**
Contact CRM: see (9) below.

November 1-7 (Oberwolfach, Germany) **Kombinatorik**
Contact MFOG: see (1) below.

November 2-6 (Berkeley, California) **Workshop on Symbolic Dynamics**
Contact MSRI: see (2) below.

November 8-14 (Neuhofen an der Ybbs, Austria) **Third Austrian Symposium on the History of Mathematics**
Contact C. Binder, Institute for Technical Mathematics, TU Vienna, Wiedner Hauptstr. 8-10/1141, A-1040 Vienna, Austria.

November 8-14 (Oberwolfach, Germany) **Numerische Integration**
Contact MFOG: see (1) below.

November 9-13 (Minneapolis, Minnesota) **IMA Workshop on Control and Optimal Design of Distributed Parameter Systems**
Contact IMA: see (3) below.

November 14-16 (Allahabad, India) **The Third Biennial Conference of the Allahabad Mathematical Society**
Contact K.K. Azad, Secretary, Allahabad Mathematical Society, 10, C.S.P. Singh Marg, Allahabad - 211001, India.

November 15-21 (Oberwolfach, Germany) **Komplexitätstheorie**
Contact MFOG: see (1) below.

November 16-18 (Berkeley, California) **Workshop on Higher Dimensional Geometry**
Contact MSRI: see (2) below.

November 16-20 (Concepcion, Chile) **International Congress on Numerical Methods in Engineering and Applied Sciences**
Contact Sergio Lavanchy, Facultad de Ingenieria, Casilla 53-C, Concepcion, Chile.

November 16-20 (Minneapolis, Minnesota) **IMA Period of Concentration: Flow Control**
Contact IMA: see (3) below.

November 16-22 (Waterloo, Ontario) **Workshop on Normal Forms, Homoclinic Bifurcations and Chaos**
Contact FIRMS: see (10) below.

November 23-27 (Marseille, France) **Séminaire Sud-Rhodanien de Geometrie**
Contact CIRM: see (8) below.

November 29 - December 5 (Oberwolfach, Germany) **Theory of Large Deviations**
Contact MFOG: see (1) below.

November 30 - December 2 (Newcastle, Australia) **Satellite meeting on Biostatistics**
Contact Professor Annette Dobson, Department of Statistics, University of Newcastle, Newcastle, NSW 2308, Australia.

December 2-4 (Rotorua) **Molecular Evolution Workshop**
Contact Dr Bruce Weir, North Carolina State University, Raleigh, NC 27695-8203, U.S.A.

December 2-4 (Canberra) **Workshop on Practical Applications of the Bootstrap**
Contact Dr Kim-Anh Do, Statistical Sciences Division, CMA, Australian National University, Canberra, ACT 2601, Australia.

December 2-4 (Berkeley, California) **Workshop on Curves, Abelian Varieties, and their Moduli**
Contact MSRI: see (2) below.

December 3-4 (Hamilton, New Zealand) **Analysis of Repeated Measurements Data: an Overview**
Contact Dr David Fletcher, Department of Mathematics and Statistics, University of Otago, Box 56, Dunedin, New Zealand.

December 4-5 (Auckland) **International Workshop on Matrix Methods for Statistics**
Contact George Styan, Dept. of Mathematics and Statistics, McGill University, Burnside Hall 1240, 805 ouest, rue Sherbrooke, Montréal, Quebec H3A 2K6, Canada.

December 6 (Hamilton, New Zealand) **Dynamic graphical analysis of statistical models: short course**
Contact IBC92 Secretary, Ruakura Agricultural Centre, Private Bag 3080, Hamilton, New Zealand.

December 6-12 (Oberwolfach, Germany) **Theory and Numerical Methods for Initial-Boundary Value Problems**
Contact MFOG: see (1) below.

December 7-11 (Bangalore, India) **IMACS Symposium on Scientific Computing and Mathematical Modelling**
Contact K.S. Yajnik, C-MMACS, National Aeronautical Lab, Belur Campus, Bangalore 560037, India.

December 7-11 (Hamilton, New Zealand) **Sixteenth International Biometric Conference (IBC 92)**
Contact IBC 92 Secretary, Ruakura Agricultural Centre, Private Bag 3080, Hamilton, New Zealand.

December 8-11 (Paris) **International Conference on Computer Science and Control**
Contact C. Genest, INRIA - Rocquencourt, France.

December 11-16 (New Delhi, India) **Workshop on Generalised Inverses - Computational Techniques and Applications**
Contact S.K. Mitra, Delhi University, New Delhi, India.

December 13-19 (Oberwolfach, Germany) **Asymptotische Statistik**
Contact MFOG: see (1) below.

December 14-15 (Queenstown, New Zealand) **Statistical Methods in Epidemiology**
Contact K. Sharples, Department of Preventive and Social Medicine, University of Otago Medical School, Box 913, Dunedin, New Zealand.

December 14-16 (Queenstown, New Zealand) **Methods for correlated data: current research**
Contact K. Sharples, Department of Preventive and Social Medicine, University of Otago Medical School, Box 913, Dunedin, New Zealand.

December 14-16 (Rotorua) **2nd Australasian GENSTAT Conference**
Contact David Baird, MAF, P.O. Box 24, Lincoln, New Zealand.

December 15-17 (Coventry, England) **Third IMA Conference on Mathematics in Signal Processing**
Contact IMA: see (7) below.

December 16-22 (New Delhi) **7th International Conference on Multivariate Analysis in memory of Prasanta Chandra Mahalanobis**
Contact S.K. Mitra, Delhi University, New Delhi, India.

December 27-31 (Las Cruces, New Mexico) **Holiday Symposium on Lie Group Representation and Combinatorics**
Contact R. J. Wisner, Lie Group Symposium, Dept. of Math. Sciences, New Mexico State University, Box 30001, Las Cruces, New Mexico 88003-0001, U.S.A.

** 1993 **

January 4-8 (Auckland) **International Conference on Scientific Computation and Differential Equations (in honour of Professor John Butcher's 60th birthday)**
Contact Dr Horst Gerlach, Department of Mathematics and Statistics, University of Auckland, Auckland, New Zealand.

January 3-9 (Oberwolfach, Germany) **Grundlagen der Geometrie**
Contact MFOG: see (1) below.

January 3-9 (Oberwolfach, Germany) **Extensions of Buildings and Geomeries**
Contact MFOG: see (1) below.

January 4-9 (New Delhi, India) **Advances in Computational Mathematics**
Contact C.A. Micchelli, IBM Research Center, P.O. Box 218, Yorktown Heights, New York 10598, U.S.A.

January 10-16 (Oberwolfach, Germany) **Computational Methods for Non-Linear Phenomena**
Contact MFOG: see (1) below.

January 17-22 (San Antonio, Texas) **1993 IEEE International Symposium on Information Theory**
Contact R. Gray, Electrical Engineering Dept., 133 Durand, Stanford University, Stanford, California 94305, U.S.A.

January 17-23 (Oberwolfach, Germany) **Combinatorial Optimisation**
Contact MFOG: see (1) below.

January 24-30 (Oberwolfach, Germany) **Optimale Steuerung Partielle Differentialgleichungen**
Contact MFOG: see (1) below.

January 25-27(?) Fourth ACM-SIAM **Symposium on Discrete Algorithms**
Contact SIAM: see (6) below.

January 25-29 (Minneapolis, Minnesota) **IMA Workshop on Robotics**
Contact IMA: see (3) below.

January 31-February 6 (Oberwolfach, Germany) **Asymptotics and Adaptivity in Computational Mechanics**
Contact MFOG: see (1) below.

February 1-3 (Minneapolis, Minnesota) **IMA Minisymposium on Biological Control of Movement**
Contact IMA: see (3) below.

February 7-11 (South Australia) **29th Australian Applied Mathematics Conference**
Contact Dr A. J. Roberts, Department of Applied Mathematics, University of Adelaide, GPO Box 498, Adelaide, SA 5001, Australia.

February 7-13 (Oberwolfach, Germany) **Partielle Differentialgleichungen**
Contact MFOG: see (1) below.

February 8-17 (Minneapolis, Minnesota) **IMA Workshop on Non-smooth Analysis and Geometric Methods in Deterministic Optimal Control**
Contact IMA: see (3) below.

February 14-20 (Oberwolfach, Germany) **Applicable Algebra**
Contact MFOG: see (1) below.

February 16-25 (Minneapolis, Minnesota) **IMA Workshop on Nonsmooth Analysis and Geometric Methods in Control**
Contact IMA: see (3) below.

February 21-27 (Oberwolfach, Germany) **Curves, Images, Massive Computation**
Contact MFOG: see (1) below.

February 22-28 (Waterloo, Ontario) **Workshop on Pattern Formation and Symmetry Breaking**
Contact FIRMS: see (10) below.

February 25- March 1 (La Fayette, Louisiana) **Conference on Numerical Analysis with Automatic Result Verification**
Contact Interval Methods Conference, c/o R. Baker Kearfott, Dept. of Math., Univ. of Southwestern Louisiana, U.S.L. Box 4-1010, La Fayette, Louisiana 70504-1010, U.S.A.

February 28 - March 6 (Oberwolfach, Germany) **Medical Statistics: Statistical Methods for Risk Assessment**
Contact MFOG: see (1) below.

March 7-13 (Oberwolfach, Germany) **Mathematische Stochastik**
Contact MFOG: see (1) below.

March 14-20 (Oberwolfach, Germany) **Gewöhnliche Differentialgleichungen**
Contact MFOG: see (1) below.

March 15-19 (Minneapolis, Minnesota) **IMA Workshop on Systems and Control Theory for Power Systems**
Contact IMA: see (3) below.

March 21-24 (Norfolk, Virginia) **Sixth SIAM Conference on Parallel Processing for Scientific Computing**
Contact SIAM: see (6) below.

March 21-27 (Oberwolfach, Germany) **Analysis auf Lokalsymmetrischen Räumen**
Contact MFOG: see (1) below.

March 22-28 (Waterloo, Ontario) **Workshop on Pattern Formation in Earth Sciences and Biology**
Contact FIRMS: see (10) below.

March 28-April 3 (Oberwolfach, Germany) **Combinatorial Convexity and Algebraic Geometry**
Contact MFOG: see (1) below.

April 4-10 (Oberwolfach, Germany) **Topics in Pseudo-Differential Operators**
Contact MFOG: see (1) below.

April 5-9 (Minneapolis, Minnesota) **IMA Tutorial: Design and Analysis of Adaptive Systems**
Contact IMA: see (3) below.

April 12-14 (Belfast) **Mathematics in Food Production, Processing and Preservation**
Contact IMA: see (7) below.

April 12-16 (Minneapolis, Minnesota) **IMA Workshop on Adaptive Control, Filtering and Signal Processing**
Contact IMA: see (3) below.

April 14-16 (Eindhoven, The Netherlands) **Seventh SEFI European Seminar on Mathematics in Engineering Education**
Contact F. Simons, Dept. of Math. and Comp. Sci., Eindhoven University of Technology, P.O. Box 513, NL 5600 MB Eindhoven, The Netherlands.

April 15-22 (Coventry, England) **Symposium on Analytic and Geometric Aspects of Hypebolic Geometry: Research Level Workshop**
Contact E. Shiels, Mathematics Institute, University of Warwick, Coventry CV4 7AL, U.K.

April 18-24 (Oberwolfach, Germany) **The Arithmetic of Fields**
Contact MFOG: see (1) below.

April 18-24 (Oberwolfach, Germany) **Mathematische Grundlagen und Numerische Verfahren bei Transsonischen Strömungen**
Contact MFOG: see (1) below.

April 19-20 (Minneapolis, Minnesota) **IMA Minisymposium on Fuzzy Control**
Contact IMA: see (3) below.

April 29-May 1 (Oberwolfach, Germany) **Low Dimensional Dynamics**
Contact MFOG: see (1) below.

May 3-7 (Minneapolis, Minnesota) **IMA Tutorial: Verification Issues in Discrete Event Systems**
Contact IMA: see (3) below.

May 3-9 (Waterloo, Ontario) **Workshop on Ecological Systems**
Contact FIRMS: see (10) below.

May 9-15 (Oberwolfach, Germany) **Reelle Algebraische Geometrie**
Contact MFOG: see (1) below.

May 10-12 (Montréal) **IMACS Symposium on Signal Processing and Neural Networks - SPANN '93**
Contact Z. Jacyno, Chair of IMACS SPANN '93, Dept. of Physics, Univ. of Quebec at Montréal, P.O. Box 8888, Station A, Montréal, PQ, Canada H3C 3P8.

May 10-14 (Minneapolis, Minnesota) **IMA Workshop on Discrete Event Systems, Manufacturing Systems and Communication Networks**
Contact IMA: see (3) below.

May 16-22 (Oberwolfach, Germany) **Mathematical Problems in Viscoelastic Flows**
Contact MFOG: see (1) below.

May 20-23 (Santa Barbara, California) **International Conference on Approximation Probability and Related Fields**
Contact S.T. Rachev, Dept. of Statistics and Applied Probability, University of California, Santa Barbara, California 93106, U.S.A.

May 23-29 (Oberwolfach, Germany) **Differentialgeometrie im Grössen**
Contact MFOG: see (1) below.

May 30-June 5 (Oberwolfach, Germany) **Funktionalanalysis und Nichtlineare Partielle Differentialgleichungen**
Contact MFOG: see (1) below.

June (Cambridge, England) **Fourth ImACS International Symposium on Computational Acoustics**
Contact D. Lee, Code 3122, Naval Underwater Systems Center, New London, CT 06320, U.S.A.

June 6-12 (Oberwolfach, Germany) **Analysis auf Kompakten Varietäten**
Contact MFOG: see (1) below.

June 7-13 (Waterloo, Ontario) **Workshop on Pattern Formation and Cellular Automata**
Contact FIRMS: see (10) below.

June 13-19 (Oberwolfach, Germany) **Differential-Algebraic Equations: Theory and Applications in Technical Simulation**
Contact MFOG: see (1) below.

June 14-18 (Minneapolis, Minnesota) **IMA Workshop on Mathematical Finance**
Contact IMA: see (3) below.

June 15-18 (Barcelona) **Third IMACS International Workshop on Qualitative Reasoning and Decision Technologies - QR & DT-3**
Contact N. Piera, Univ. Politecnica de Catalunya, Dept. di Matematica Aplicada II, c/o Pau Gargallo 6, E-08028 Barcelona, Spain.

June 20-26 (Oberwolfach, Germany) **Konvexgeometrie**
Contact MFOG: see (1) below.

June 27-July 3 (Oberwolfach, Germany) **Algebraische K-Theorie**
Contact MFOG: see (1) below.

July 4-9 (Seoul, Korea) **Fifth International Fuzzy Systems Association World Congress**
Contact Congress Secretary, c/o K.C. Min, Dept. of Mathematics, Yonsei University, Seoul 120-749, Korea.

July 4-10 (Oberwolfach, Germany) **Freie Randwertprobleme**
Contact MFOG: see (1) below.

July 5-9 (Wollongong, New South Wales) **37th Annual Meeting of the Australian Mathematical Society**
Contact Associate Professor M. W. Bunder, Department of Mathematics, University of Wollongong, NSW 2500, Australia.

July 11-17 (Oberwolfach, Germany) **Nonlinear Evolution Equations, Solutions and the Inverse Scattering Transform**
Contact MFOG: see (1) below.

July 12-16 (Adelaide) **19th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing**
Contact Dr C. M. O'Keefe, Dept. of Pure Mathematics, University of Adelaide, GPO Box 498, Adelaide, SA 5001, Australia.

July 18-24 (Oberwolfach, Germany) **Dynamische Systeme**
Contact MFOG: see (1) below.

July 21-25 (Amsterdam) **Twenty-second Conference on Stochastic Processes and their Applications**
Contact SPA '93, c/o CWI, P.O. Box 4079, NL-1009 AB Amsterdam, The Netherlands.

July 25-31 (Oberwolfach, Germany) **Geometric Methods in Theoretical and Computational Mechanics**
Contact MFOG: see (1) below.

August 1-7 (Oberwolfach, Germany) **Abelsche Gruppen**
Contact MFOG: see (1) below.

August 1-14 (Galway, Ireland) **Groups 93 Galway/St Andrews**
Contact: email groups 93 @ st. andrews.ac,uk (telefax +353 91 25700).

August 7-21 (York, England) **Semigroups and their Applications**
Contact Dr John Fountain, Department of Mathematics, University of York, Heslington, York YO1 5DD, England.

August 8-14 (Oberwolfach, Germany) **Konstruktive Approximationstheorie**
Contact MFOG: see (1) below.

August 13-17 (Plovdiv, Bulgaria) **Second International Colloquium on Numerical Analysis**
Contact Ass. S. Zlatev, Mathematical Faculty of the Plovdiv University, Tsar Assen Str. 24, Plovdiv 4000, Bulgaria.

August 15-21 (Oberwolfach, Germany) **Noncommutative Algebra and Representation Theory**
Contact MFOG: see (1) below.

August 17-20 (Innsbruck, Austria) **International Symposium on Statistics with Non-Precise Data**
Contact Professor R. Viertl, Institut f. Statistik u. Wahrscheinlichkeitstheorie, Technische Universität Wien, A-1040 Wien, Austria.

August 18-22 (Plovdiv, Bulgaria) **Fourth International Colloquium on Differential Equations**
Contact Ass. S. Slatev, Mathematical Faculty of the Plovdiv University, Tsar Assen Str. 24, Plovdiv 4000, Bulgaria.

August 22-28 (Oberwolfach, Germany) **Special Complex Varieties**
Contact MFOG: see (1) below.

August 22-29 (Zaragoza, Spain) **Twenty-ninth International Congress of History of Science**
Contact XXIX International Congress of History of Science, Faculdad de Ciencias (Matematicas), Ciudad Universitania, 50009 Zaragoza, Spain.

August 25 - September 3 (Firenze, Italy) **49th Biennial Session of the International Statistical Institute**
Contact ISI Permanent Office, 428 Prinses Beatrixloan, P.O. Box 950, 2270 AZ Voorburg, Netherlands.

August 29-September 4 (Oberwolfach, Germany) **Random Graphs and Combinatorial Structures**
Contact MFOG: see (1) below.

September 5-11 (Oberwolfach, Germany) **Novikov Conjectures, Index Theorems and Rigidity**
Contact MFOG: see (1) below.

September 12-18 (Oberwolfach, Germany) **Topologie**
Contact MFOG: see (1) below.

September 19-25 (Oberwolfach, Germany) **Mathematical Game Theory**
Contact MFOG: see (1) below.

September 26-October 2 (Oberwolfach, Germany) **Diophantische Approximationen**
Contact MFOG: see (1) below.

October 17-23 (Oberwolfach, Germany) **Geometrie**
Contact MFOG: see (1) below.

October 31-November 6 (Oberwolfach, Germany) **Algorithmische Methoden der Diskreten Mathematik**
Contact MFOG: see (1) below.

November 21-27 (Oberwolfach, Germany) **Mathematische Modelle in der Biologie**
Contact MFOG: see (1) below.

November 28-December 4 (Oberwolfach, Germany) **Nonlinear Equations in Many-Particle Systems**
Contact MFOG: see (1) below.

** 1994 **

July 4-8 (Armidale, New South Wales) **38th Annual Meeting of the Australian Mathematical Society**
Contact Dr C. Radford, Department of Mathematics, Statistics and Computing Science, University of New England, Armidale, NSW 2351, Australia.

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

** 1995 **

(Italy) **Second Internatonal Conference on Numerical Methods for Volterra and Delay Equations (A conference to celebrate the 100th anniversary of Volterra's birth.)**
Contact A. Feldstein, Dept. of Math., Arizona State University, Tempe, Arizona 85287, U.S.A.

Special Contact Addresses:

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

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

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

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

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

(6) **SIAM:** SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, Pennsylvania 19104-2688, U.S.A.

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

(8) **CIRM:** A. Zeller-Meier, CIRM, Luminy, Case 916, F-13288 Marseille, Cedex 9, France.

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

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M.R. Carter

Solution to Crossword No 36

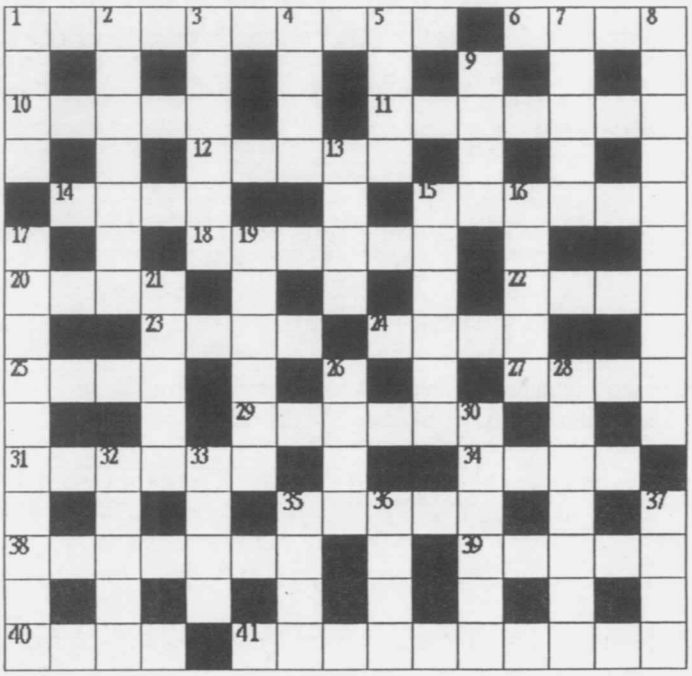
The winner of the competition for Crossword Number 36 is D McCauchan, Mathematics Department, Otago University. The forme seems to have been slightly pied in its trans-Tasman crossing from Dr Tode (who was last heard of at Uluru). The principal damage caused an incredible longevity for Poincaré. One disgruntled non-competitor also suggested that one or more zeros had been omitted from the prize money.

M. V.

CROSSWORD

No 37

by Matt Varnish



Across

1. Low Sunday ringers (one a Nobel laureate) (10)
6. Combination of divergent powers not quite a stoppage (4)
10. Tolling with pounds out turns to metal mass (5)
11. Town-crier with Peel's Ranter (7)
12, 29 and 16d. Ring-ins for Bramwell's sisters (5,6,5)
14. Starting bell-like, sounds you are indistinct thing (4)
15. Cash found in the carillon? (6)
18 and 32d. Fitting bell for 33 results (6,5)
20. Enquire after shirt for duty (4)
22. Christ Church bell by beginning is the end (4)
23. Mark any of the other 7 tones (4)
24. Result of ringing back? (4)
25. Rope spun Nile (4)
27. North organ in close (4)
31. Changes in a thousand scales for mineral spots (6)
34. Plant wreathed while Xmas bells sound (4)
35. Hark! You chaps, with N or S a state (5)
37. The tar rang about to tell (7)
39. Note to go bats is serious (5)
40. Pace one heard in 17's rhyme without a joint (4)
41. Metal mender sounder for Barrie's flyer. (10)

Down

1. Question; 22 on 7 about snide remark ? (4)
2. Heavenly beings round the bend for evening sound (7)
3. To emprison sounds how ringers work (6)
4. Cricket ground made by oblique bell's mouth (4)
5. Ring the right B's for rounds (4)
7. Fruit from 17's music (5)
8. Harry's place or where to keep music (10)
9. Empty bell at Doctor's command, meaningless words (4)
13. One small writing for all those doctrines (4)
15. The hat in the French belfry ? (6)
16. see 12a
17. Kind with saints for stranded Danes of ringing fame (2,8)
19. Small glass bells on spirit bottles in light studies (6)
21. Heard on the way to 22 or 39 (5)
26. Transport that is found under cheese bell ? (4)
28. Levitate so it becomes E before, thus raise on high (7)
30. Top shearer can pull the ropes ? (6)
32. see 18a
33. Test out the morning (4)
35. Goodbye tinkly beast within (4)
36. Some music before monarch comes from some flower bells (4)
37. To sound like the huntsman from the leap (4)