THE NEW ZEALAND
MATHEMATICAL SOCIETY (INC.)

NEWSLETTER

CONTENTS

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PUBLISHER'S NOTICE

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

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

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

Dr John Giffin,
Department of Mathematics and Statistics,
Massey University, Palmerston North, New Zealand.

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A-Prof D A Nield	Engineering Science (University of Auckland)
Dr J Rayner	Mathematics and Statistics (University of Otago)
Mr G J Tee	Mathematics and Statistics (University of Auckland)

NOTICE OF ANNUAL GENERAL MEETING

The Annual General Meeting of the New Zealand Mathematical Society will be held at 4.30pm on Tuesday May 15, 1990 during the New Zealand Mathematics Colloquium at the University of Auckland. Items for the Agenda should be forwarded to the Secretary.

J.W. Giffin
Honorary Secretary, NZMS

LOCAL NEWS

DSIR
AMD Auckland

We have lost several staff. Susan Brown left us last October to take a job at Waikato University. Sue Cammell left at the end of January to work for New Zealand Insurance, to work in forecasting. David Whitaker has resigned to take up a position at Waikato University, in the Unit for Quality and Productivity Improvement. On a more positive note, we expect Tony Cooper back from Stanford University in June.

In mid-January I returned from several months' study leave at Rothamsted Experimental Station (Harpenden, near London) and elsewhere. One outcome will be the addition to the Genstat statistical language of a directive DISTRIBUTION, for the fitting of various discrete and continuous probability distributions as in the program MLP (= Maximum Likelihood Program).

John Maindonald

UNIVERSITY OF AUCKLAND

Engineering Science

We have been working away steadily over the summer, though some of us have been distracted by the Commonwealth Games. David Ryan has been promoted to Associate Professor. He has just returned from Research and Study Leave during which he spent four months at each of three places: the Naval Postgraduate School in Monterey, Calif., Cornell University and the University of Colorado at Boulder. Andy Philpott has left on Short Leave to Cambridge (U.K.) via Stanford. Don Nield is preparing to go on Long Leave (from May) to Duke University, where he plans to collaborate on writing a book on convection in porous media. He will be a Visiting Professor in Mechanical Engineering. Mervyn Rosser is semi-retired from his Associate Professorship, and will be a Lecturer until he completes the retiring process at the end of 1990.

D.A. Nield

Mathematics and Statistics

On January 31st, David Gauld finished a period of 3167 days as Head of Department, and Alastair Scott took over. George Seber is now Head of the Statistics Unit.

At the end of enrolment, there were 612.3 EFTS at Stage 1, 231.8 at Stage 2 and 74.2 at Stage 3, compared with 581, 211 and 73 for 1989. The Stage 1 statistics service course 26.181 (& 26.182) has 1305 enrolments.

A farewell celebration was held for Jeff Hunter, before he left after 22 years here, to take up his new post at Massey University. He was presented with a plaque with the University's coat of arms, and with a silver tray.

Joel Schiff has returned from leave at York University. He attended a lecture on knots given by Vaughan Jones, as the Hardy Lecturer of the LMS for 1989. John Kalman is on leave at the University of Chicago, Ganesh Dixit is on leave at the University of New Orleans, and Nick Wormald is on leave at ANU. Margaret Morton attended a meeting of the American Mathematical Society in December at Louisville, Kentucky, at which the major topic was the deteriorating state of mathematics teaching at schools in the USA.

Robert Chan has completed his Ph.D with a thesis on extrapolation methods for numerical solution of ordinary differential equations.

Alastair McNaughton, from Papatoetoe College, is a Teaching Fellow for 1990. Maurice Hall returns as a part-time lecturer. He had formerly done some part-time lecturing here, when he was Head of Mathematics at Mt. Albert Grammar School. Brian Weatherly departed after a year as technician to the department, and Werner Schmidt is now our technician. Dr. Horst Gerlach and Paul Goodyear are full-time tutors for 1990. Dr. Gerlach studied at Kaiserslautern University (FRG), where he gained a Ph.D. in analytical number theory. He will be teaching courses in computational mathematics and in algebra. Paul Goodyear graduated B.Sc.(Honours) here in 1981, and M.Sc. from Harvard in 1984. His interests are primarily in the foundations of analysis. Jill Ellis, Barbara Reilly, Moira Statham and Dr. Günter Steinke are part-time tutors for 1990. The Temporary Tutors for 1990 are Andrew Balemi, Andrew Ensor, Brent Everitt, Tava Lennon, Simon Marchant, Michael Smyth, Tim Surendonk and Paul Turner.

Professor William Thompson, from the University of Missouri - Columbia, is here for the first term, and is teaching a course on Point Processes. Prof. Shayle Searle, from Cornell University, is here for the first term and is teaching a course on Mixed Models in Analysis of Variance. Prof. Keith Miller, from Berkeley, is here from March to June. He is giving a series of seminars on numerical analysis of partial differential equations. Dr. Michel Roche, from the University of Geneva, visited the Department in January and February. He participated in a series of seminars with John Butcher and Robert Chan on differential-algebraic equations.

A new lectureship in pure mathematics (preferably discrete mathematics) is being advertised.

The Wellesley Programme was begun in 1989 at the University of Auckland, in conjunction with Auckland Institute of Technology, to provide a bridge between secondary schooling and tertiary education. It aims at bringing students up to a level acceptable for entry to a technical institute, teacher training college or university. It is hoped to attract particularly those from groups at present under-represented in tertiary education, namely Maori, Polynesian and women students. It is a full-time one-year course taken in either Arts or Science, with English and Mathematics as compulsory subjects. In 1989, 48 students enrolled and 33 of them qualified for a Tertiary Foundation Certificate. Some of those have gone on to further study at technical institutes or at the University of Auckland. Enrolment for 1990 stands at 92, with a wide range of entry qualifications.

The academic year commenced in the Science Block amidst the chaos of demolition and re-construction. Four new tutorial rooms in the basement came into use in the 3rd week of the 1st term, and it is hoped that the new computing laboratory (for the Computer Science department and this department) will be ready for the start of the 2nd term. Meanwhile, lectures in the Science Block continue to be delivered with an obbligato role performed by pneumatic drills on the frame of the building.

Seminars:

Dr. Colin Fox (University of Otago), "Predicting the break-up of shore-fast sea-ice".
Prof. M. Ohtsuka (Gakushuin University), "Extremal length and networks".
Dr. Manley Perkel (Wright State University, Ohio), "Some algebraic and combinatorial problems on hypercubes".

G. J. Tee

UNIVERSITY OF CANTERBURY
Mathematics

We have two long-term visitors in the department currently (March). Professor Bob Kruse is here as an Erskine fellow, visiting both the Mathematics and Computer Science departments. He is teaching part of our third year Discrete Algebra course (searching and sorting algorithms), as well as giving the occasional seminar. Our other visitor is Professor Rudolf Vyborny who comes from the University of Queensland. He is giving a series of lectures on gauge integrals.

Comings and goings: Esaw Chacko is back from his sabbatical year in Singapore. John Connolly has completed his Ph.D. about "Non-linear Methods for Inverse Problems" (done under David Wall), and has gone to the University of Melbourne to take up a Post-doctoral Fellowship.

Our first year courses have undergone a small administrative revolution this year with the introduction of

limited entry to the first year Statistics course, and the demise of the non-continuing 6-point general Mathematics course MATH110.

The Statistics numbers have been held at about 600. To get into the course this year students had to get at least 50% in either of the Bursary mathematics papers (in the past almost all students who have got less than 55% have failed). Earlier reforms in the teaching of this course seem to be bearing fruit, as the second year Statistics courses now have as many as 40-50 students in them.

The standard first year Mathematics course now has three streams each with about 250 students (we also have an accelerated course which is limited to about 120 students). Experience has shown that a poor mark in the bursary Calculus paper (less than about 55%) almost always leads to a failure in this course, yet we have well over 250 such students in this category. To try to improve this situation, the Mathematics department at the Polytechnic are offering a supporting course aimed at weaker students. So far about 80 students are taking part in this, and we hope that this will improve their final performance.

Seminars

Professor Ralph McKenzie (University of California, Berkeley), "Finite groups and finite lattices".
Professor Bob Kruse (St. Mary's University, Halifax, Nova Scotia), "Tools for technical typesetting".
Professor Makoto Ohtsuka (Gakushuin University, Tokyo), "Extremal length and networks".

John Hannah

MASSEY UNIVERSITY
Mathematics and Statistics

In February Massey was represented by a team of five at the Australian Applied Mathematics Conference at Coolangatta (just south of Surfer's Paradise!). The team comprised Graeme Wake, Dean Halford and three Ph.D. students: Aroon Parshotam, Bob Sisson and Marijcke Vlieg. Between them they presented five papers, three of which were in the competition for the T.M. Cherry prize (for the best student paper). Regrettably, the prize eluded us this time, but our spies tell us that the papers were all well received. Graeme Wake was prevented from enjoying the obvious local delights by his co-option onto the Executive Division of the Australian Division of Applied Mathematics—and the consequent need to attend meetings up to midnight most nights. He celebrated his release by motoring to Armidale, where he gave a post-conference lecture on thermal ignition theory at the University of New England.

Gordon Knight has been involved for some time in a research project looking at the teaching of mathematics in the growing number of New Zealand secondary school bilingual units. Last October he presented a paper on "Cultural alienation and mathematics" at a symposium in Leeds; the paper will form part of a book based on the symposium. He and his collaborators have also been asked to contribute a chapter to another book on the cultural context of learning mathematics.

A paper written by Emeritus Professor Brian Hayman titled "The Theory and analysis of diallele crosses" (*Genetics* Vol 39 (1954), pp 789-809) has emerged as one of the most heavily cited papers in its field, according to data from the Science Citation Index. Clearly this piece of work by Professor Hayman has had considerable influence on other authors in the same speciality over the years. Its frequent citation is worthy recognition for a pioneer researcher in the field.

Congratulations to Mike Hendy on his promotion to Associate Professor (Massey has decided that from 1990 the old title of Reader will be changed to Associate Professor).

Graeme Wake leaves early in April to take up a 6-month SERC Fellowship in the UK. He will travel via Claremont (USA) to Oxford and Leeds. Gordon Knight will be acting HOD in his absence.

Overall, enrolments at Massey are down this year due to a sharp drop in extramural student numbers, presumably because of the new fees. However, enrolments in Mathematics and Statistics have gone against the trend and shown a modest but nonetheless pleasing increase.

Seminars

John Butcher (Auckland), "The stability of numerical approximation to ordinary differential equations."
Franz Rendl (Institut für Mathematik, Graz, Austria), "Lexicographic bottleneck problems".
Charles Lawoko, "Maximum likelihood estimation of parameters of a spatial statistical discrimination model."
Paul Bonnington, "Separation in 3-graphs."

M R Carter

OTAGO UNIVERSITY
Mathematics and Statistics

Student numbers are up again this year, this time by approximately 10%. In the wake of this increase we have several additional staff. Mike Steel is temporary lecturer for one year. He has an M.Sc. from Canterbury, a Ph.D. from Massey, and a Diploma in Journalism. Thomas Forster is a temporary half-time lecturer for one year. He graduated with an M.A. from East Anglia and a Ph.D from Cambridge. Ross Vennell is temporary lecturer for one year. His postdoctoral fellowship with Professor Vernon Squire has been deferred for this year. Ross came to us from the Woods Hole Oceanographic Institute. Stephanie McConnon returns for this year as a three-quarter-time assistant lecturer. Janet Levy also returns as a full-time assistant lecturer for one year. Graham Haase has had his position of organising tutor converted to that of full-time assistant lecturer.

We are expecting several visitors in the near future. Professor Afzal Ahmed is a leading British Mathematics educator from the West Sussex Institute of Education. He is to be in New Zealand with a colleague in February and March. Together they will be visiting universities and teachers' colleges, and working with mathematics teachers. Professor Paul Cohn is an outstanding algebraist with an international reputation. He hails from Bedford College in the University of London, and will be visiting Australia and New Zealand for about three weeks in June and July. In Australia he'll spend a few days at the ANU and is an invited lecturer at the AMS Annual Meeting in Townsville. In New Zealand he will visit Auckland and Wellington as well as Dunedin. Professor Bob Hemminger is a graph theorist from Vanderbilt University, Nashville, Tennessee. His visit is from September 1989 to July 1990. Dr Richard Anstee works in Combinatorics. He is from the University of British Columbia, and will be in Dunedin from September 1990 until June 1991. Professor Roger Mead is a Statistician from the University of Reading. He will be with us from August 1990 until April 1991. Professor Toby Lewis is retired but currently attached to the University of East Anglia at Norwich. He will be in Otago for ICOTS 3 and at least a week afterwards. Dr Lyman Mc Donald returns to Otago to continue work with Professor Bryan Manly and to attend ICOTS 3. Lyman is a statistician from the University of Wyoming. He will be with us for all of August 1990.

Professor Bryan Manly and Dr Lyman McDonald will run a five-day workshop for scientists working for government and private organizations on Statistics for Field Ecology and Resource Selection. The course will be held at the University of Otago in Dunedin from August 6 to August 10 and will provide a review of statistical procedures related to sampling and analysis of biological populations. For more details contact Bryan Manly by telephone (024)797-774, Fax (024) 741607, and email Math05@OTAGO.AC.NZ.

Dr John Curran has recently returned from leave spent at the University of Warwick and the Australian National University in Canberra. He attended international group theory conferences in both Australia and Italy. The latter was a result of sharing an office with Professor Giovanni Zacher, who, to quote John's leave report, is "one of the Godfathers of Italian group theory!" John returns with fond memories of invaluable experiences, and much valuable software.

Dr Gerrard Liddell is currently on leave. Included in his program is a period at the University of Western Australia working on problems in differential geometry and robotics. From June 1990 to January 1991 he will be at the University of Indiana working on problems in logic and mathematical interfaces.

The traditional Algebra Seminar lives again, meeting twice weekly. This year's topic is "Group Presentations".

Statistics Seminars

John Rayner (University of Otago), "Ordered Contingency tables". March 9.
Peter Johnstone (Invermay Research Station), "The practice of Statistics". March 23
Ken Dodds (Invermay Research Station), "Statistics for major genes". April 6.
Bryan Manly (University of Otago), "The Statistics of resource selection by animals". April 20.
Laimonis Kavalieris (University of Otago), "Stochastic complexity and order estimation". May 4.

John Rayner

VICTORIA UNIVERSITY
Mathematics and Statistics

We are glad to welcome Bill Barton, from the Bilingual Unit at Wellington High School, who is with our Mathematics Education Unit this year with a McCarthy Fellowship, continuing his research on bilingual mathematics teaching and ethnomathematics.

Dr Ritei Shibata (Kyoto Univ.) is visiting ISOR (Inst. of Statistics and Operations Research) and working on questions concerning data, its attributes and how these should be described for statistical analysis.

Congratulations to Song-Xi Chen, John Hurst, Alix Jermyn, Malcolm Quinn and Chris Scott who have all been appointed Teaching Assistants, the first three of them part-time. Also to Song-Xi Chen for a scholarship to do a Ph.D. at Monash.

Elizabeth Robinson will be sorely missed from ISOR where she has been a statistical consultant. She is moving to Auckland.

David Vere-Jones is being kept busy helping to organise ICOTS this year (the first major international conference in the mathematical area ever to be held in NZ).

Ross Renner is getting back into statistical teaching; we await the results with interest.

Brian Dawkins and Philip Rhodes-Robinson returned from their sabbaticals in the long vacation. Jim McGregor left then for his in the Environmental Science Division, Inst. Environmental and Biological Sci., Lancaster Univ. John Harper will leave in June for his at Dept. Geol. Sci., Northwestern Univ., Illinois, Dept. Earth Sci., Cambridge, UK and Math. Inst., Oxford, returning July 1991.

JF Harper

NOTICES

ORSNZ 26th ANNUAL CONFERENCE
University of Waikato, Hamilton
20-21 August, 1990

Papers are invited on all aspects of the theory, practice and teaching of Operational Research. Each paper will be allocated about thirty minutes and will be published in summary form (up to six pages) prior to the conference.

Student papers are especially welcome. Student travel grants may be available. For details, contact the conference organisers.

Registration forms will be sent to members in due course, and are available to others from the conference organisers.

Please send to the conference organisers either a one page abstract or a summary paper of up to six pages **before 30 April.**

The conference organisers are

Paul Cragg, (071) 562889 Ext 8103, Email P.CRAGG@ WAIKATO.AC.NZ
John Buchanan, (071) 562889 Ext 8646.
Les Foulds, (071) 562889 Ext 8127.
Department of Management Science and Systems
University of Waikato
Private Bag, Hamilton

1990 NEW ZEALAND MATHEMATICS COLLOQUIUM
University of Auckland
14-17 May, 1990

The Annual General Meeting of the New Zealand Mathematical Society will be held at the University of Auckland, during the 1990 NZ Mathematics Colloquium, on Tuesday May 15th at 4.30 pm. May 17th will be the Mathematics Education Day.

The invited speakers, presenting one-hour lectures to the Colloquium, are:

Professor Jim Ansell (VUW),
Dr. Marston Conder (University of Auckland),
Professor Jeffrey J. Hunter (Massey University),
Professor Keith Miller (University of California, Berkeley),
Professor Brailey Sims (University of Newcastle),
Professor William Thompson (University of Missouri - Columbia),
Dr. Gillian Thornley (NZMS President, Massey University).

For the Mathematics Education Day, the keynote speakers are:

Dr. Trevor Boyle (Ministry of Education),
Brenda Burns (Glenfield College).

Pre-registration forms and information can be obtained from:

Mr. G. J. Tee (Colloquium Secretary),
Department of Mathematics & Statistics,
University of Auckland,
Private Bag,
Auckland.

Telephone (09) 737-999, extension 8789;
Electronic mail tee@maths.aukuni.ac.nz

Abstracts of papers to be presented should be returned by April 14th, and pre-registration forms should be returned by April 28th to the Colloquium Secretary.

NEW ZEALAND MATHEMATICS AWARENESS WEEK?

The AMS/MAA/SIAM Joint Policy Board for Mathematics is promoting its increasingly successful annual Mathematics Awareness Week throughout the United States to be held this year from 22-28 April. It is a "... national and annual celebration of the beauty and creativity of mathematics and our observance of the relevance of mathematics in everyday life."

The activities are varied and multitudinous, being planned and sponsored mainly by local secondary and tertiary educational institution. They include such things as book displays, films and videos, series of lectures, contests at all levels, receptions, television interviews, T-shirts, mathematical art exhibits and contests, flyers and banners, prizes of puzzles, games, books and cash, newspaper articles, official proclamations by mayors and other officials, open days, etc.

The week is proclaimed, and coordinators at local institutions are sought to devise and plan local activities. Information on ideas and resources is circulated to anyone who is interested, and it grows from there.

Is it desirable? Would it work in New Zealand? Should NZMS and NZAMT (for example) join in promoting this sort of activity? If anyone is interested in seeing what can be done with this idea, there is a sheaf of information available containing ideas that have succeeded in the past, and samples of useful material. It will be available for perusal at the forthcoming Colloquium, at which time it might be appropriate to proclaim such a national week, and get started.

In the meantime, questions and expressions of interest in the idea may be addressed to the NZMS Secretary, John Giffin.

VACANT LECTURESHIP
University of Auckland, Department of Mathematics and Statistics

The Department of Mathematics and Statistics teaches a full range of undergraduate and postgraduate courses. Within the department there are two units which operate with a certain degree of autonomy. These are the Statistics Unit and the newly formed Applied and Computational Mathematics Unit.

The Department has particular research strength in combinatorics and graph theory, finite group theory, functional analysis, topology, numerical analysis and statistics.

Applicants should have a proven record in teaching and research in a branch of pure mathematics. Preference will be given to those with a strong interest in discrete mathematics. Duties will include teaching, examining and research, as may be required by the Head of the Department.

Commencing salary will be within the ranges $NZ36,000 – $NZ47,200 per annum.

Conditions of Appointment and Method of Application are available from the Assistant Registrar, Academic Appointments, University of Auckland, Private Bag, Auckland. Applications should be forwarded as soon as possible but not later than the closing date 20 May 1990.

The University of Auckland is an equal opportunity employer.

WB Nicoll
Registrar
University of Auckland

TUITION FEES FOR MATHEMATICS STUDENTS

"(The Government) recognises that students undertaking low-cost courses, such as courses in mathematics, will pay proportionately more of the actual tuition cost than other students."

From a letter of 18/1/90 to Ms J Kirk, MP for Birkenhead, from Phil Goff, Minister of Education, in reply to a memo from Peter Lorimer.

SIXTEENTH AUSTRALASIAN CONFERENCE ON COMBINATORIAL MATHEMATICS AND COMBINATORIAL COMPUTING

The 16th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing will be held at Massey University, Palmerston North, New Zealand during December 3-7, 1990. The conference is one of a series of annual conferences run by the Combinatorial Mathematics Society of Australasia, and is being sponsored by the Royal Society of New Zealand.

The following people have agreed to deliver one-hour invited lectures:

Fan Chung, Bell Communications Research
Charles Colbourn, Department of Computer Science, University of Waterloo
Ron Graham, AT&T Bell Laboratories
Jennifer Seberry, Department of Computer Science, Australian Defence Force Academy
Ralph Stanton, Department of Computer Science, University of Manitoba
Doug Stinson, Department of Computer Science, University of Manitoba
Douglas Woodall, Department of Mathematics, University of Nottingham

There will also be half-hour contributed papers.

It is planned that the proceedings of the conference be published in the Australasian Journal of Combinatorics.

For further information, please contact: Dr C. Little, Department of Mathematics and Statistics, Massey University, Private Bag, Palmerston North.

The organisers wish to thank the Royal Society of New Zealand, and Bennett's University Book Centre Ltd for financial assistance, and the British Council for a generous contribution towards the airfares for Douglas Woodall.

1990 NZMS LECTURER

David S. Moore

Professor David Moore of Purdue University, Indiana, will be visiting New Zealand in August as the 1990 NZMS Lecturer and will be an invited speaker at ICOTS in Dunedin. Professor Moore is a statistician whose research interests are in large sample theory and goodness of fit tests. He has served on the US National Research Council Committee for the project "Mathematical Sciences in the Year 2000."

Professor Moore is an outstanding teacher and lecturer with a particular interest in teaching statistics for non-technical students. He has been a lecturer for the AT&T Technologies, ALCOA, and Eli Lilly Corporations. In addition he was the content developer of "Against All Odds: Inside Statistics", released in 1989 by the Corporation for Public Broadcasting in the USA. This was a series of 256 half-hour television programs directed at students at the beginning college level.

Professor Moore has also published a polemical paper, "Should Mathematicians Teach Statistics?" in the College Mathematics Journal. While in New Zealand he will speak on "Teaching Statistics as a Respectable Discipline". A "respectable discipline" is defined as having a distinct identity and clear unifying concepts and principles. He believes that statistics is too often taught as either a subfield of mathematics or as a collection of useful methods, and holds that the theory of statistics, whilst important, gives a distorted and incomplete picture of the field.

David Moore with his wide background in research and teaching promises to be an exciting NZMS Lecturer.

Chris Triggs
DSIR AMD Auckland

HAMILTON AWARD

Congratulations to Rod Downey, who has won the 1990 Hamilton Award from the Royal Society of New Zealand! This award is given each year to the scientist working in NZ or the South Pacific whose first publication was less than seven years previously and whose research work is judged to be the best.

Rod is, according to one of his distinguished overseas referees, "one of the two best researchers in Recursion Theory of his age, and is more prolific than anyone else in the field. His work covers the gamut of Recursion Theory, and uses the deepest and most difficult techniques of the field in an insightful way."

Recursion Theory arises from trying to determine whether or not problems can be solved by a computer. One tries to develop a general theory of interactive computing, in which someone sitting at a terminal can influence how the program runs. Rod's work helps us understand better the algebraical methods used in the subject.

Rod was born in Australia, has a Monash Ph.D., and worked in Singapore and the United States before coming to VUW as a Lecturer in 1986; he is now a Senior Lecturer in Mathematics.

PAPPUS'S BYPASS PAST THE PONS ASINORUM

Since 1962 [Good], many reports have been published claiming that a totally new proof of the theorem that the angles at the base of an isosceles triangle are equal, much simpler than Euclid's notorious "bridge of asses", had been discovered by a computer program [Gelernter] for proving theorems in Euclidean geometry.

The curious history of the folklore concerning that proof has been traced by Michael Deakin, and he tells that the artificial intelligence advocate Dr. Marvin Minsky has recently explained "that it was he who produced the proof by hand simulation of what a machine might do .... that he found the proof by following mechanical procedures and that he had no previous knowledge of it, though later he learned of its attribution to Pappus" [Deakin].

Professor Henry George Forder, at Auckland University College, taught me Pappus's ingenious and elegant proof in 1949 or 1950, and I told Dr. Minsky of it in 1965. The proof is not contained in the surviving part of Pappus's *Synagoge*; but Proklus (5th century) attributed the proof to Pappus, and Proklus's account is readily available in T. L. Heath's commentary to his edition [Euclid] of Euclid's *Elements*. H. G. Forder gave the proof as Theorem 1 in his textbook *A School Geometry* [Forder], whose first edition (1930) was reprinted in 1934, with the second edition (1938) reprinted in 1939, 1944, 1945 and 1949. Forder's version of Pappus's proof is reproduced here from the second edition (1938).

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THEOREM I (Assumption 10, p. 12).

The angles at the base of an isosceles triangle are equal.

Given. ABC is a triangle; $AB = AC$.

To prove that $A\hat{B}C = A\hat{C}B$.

Proof. Treat the triangles ABC, ACB as if they were distinct triangles.

Fig. 319

We have in the two triangles the following parts equal:

In $\triangle ABC$	In $\triangle ACB$
AB	AC
AC	AB
$B\hat{A}C$	$C\hat{A}B$. (two sides, incl. $\angle$).

Hence, by Axiom 3, $A\hat{B}C = A\hat{C}B$. Q.E.D.

Note. What we have shown is that this theorem is contained implicitly in Axiom 3 as a special case. In that Axiom, it is not necessary that ABC and DEF should be distinct triangles, and when the points D, E, F are at C, B, A resp. we have Theorem I at once.

'*Congruent triangles*' are defined as before, p. 16.

Deakin tells that some schoolboy gave Pappus's proof in an examination script. Not only was he marked wrong for it, but his answer was published in 1937 [Anonymous] as though it were a howler! C. Dudley Langford pointed out that the alleged howler is in fact the classic (and classical) proof of Pappus [Langford]. That unfortunate schoolboy could well have learned the proof from Forder's widely-used textbook.

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Garry J. Tee

BOOK REVIEWS

A History of Non-Euclidean Geometry: Evolution of the Concept of a Geometric Space, by B.A.Rosenfeld, translated from Russian by Abe Shenitzer with the editorial assistance of Hardy Grant. Studies in the History of Mathematics and Physical Sciences, Volume 12, Springer-Verlag, Berlin-Heidelberg-New York, 1988, xii + 471pp, DM 184. ISBN 3-540-96458.

The first part of the title of this book suggests that it will turn out to be an updated and expanded version of the kind of material found in the old but still useful book by Bonola [1] — that is, an account of attempts to prove Euclid's parallel postulate, the consequent discovery of hyperbolic geometry, and modern developments arising from this. This was certainly my initial expectation. However the second part of the title promises a wider scope, perhaps something along the lines of the excellent book by Jeremy Gray [2]. This is indeed the case, for the scope of the book is very wide indeed. Rosenfeld interprets the term "Non-Euclidean Geometry" in the broadest possible sense as including all mathematical topics with any relevance to geometry, excepting only classical two- and three-dimensional Euclidean geometry.

It quickly becomes apparent to the reader that Rosenfeld's policy, broadly speaking, is to let the original sources speak for themselves. He quotes extensively from sources wherever possible, often with only the briefest of commentary. It is this feature of Rosenfeld's style which was, for me, the chief disappointment about his book. Allowing the reader to study original sources is valuable and commendable — I have no quarrel with that — but the historian also has a role to play in providing the reader with background to and insight into the source material. Rosenfeld does not always provide this, so that in many places the book reads more like a source-book than a history. As a source-book, however, it is very valuable. The bibliography (containing 652 items) is a great asset on its own.

Rosenfeld begins in a somewhat unorthodox way, by plunging straight into a discussion of the history of spherical geometry, "the first geometry other than Euclidean geometry", as he describes it in the opening sentence. Of particular interest here is the detailed analysis of the *Sphaerica* of Menelaus (c 100 AD), in which the geometry of spherical triangles is developed in a series of propositions paralleling those for plane triangles in Book I of Euclid's "Elements". The subsequent history of spherical trigonometry is followed in some detail, through India and the medieval Near and Middle East to the work of Regiomontanus, Viete, Giraud and Euler.

The account now turns back to the material which forms the starting-point for most similar studies—the Euclidean theory of parallels. This is familiar material treated in a straightforward way. Rosenfeld does comment briefly on references in Aristotle's works relating to the pre-Euclidean theory of parallels, but unfortunately some of his remarks are misleading. He quotes the well-known passage from the *Prior Analytics* concerning the logical error of *petitio principii* committed by "... those who think they describe parallel lines, for they unconsciously assume things which it is not possible to demonstrate if parallels do not exist", and says that in order to avoid this logical error one must explicitly assume something equivalent to the Euclidean parallel postulate. An unwary reader might suppose from this that the parallel postulate is required in order to establish the existence of parallels, which is of course not the case. In fact the exact nature of the logical error referred to by Aristotle is a matter of speculation, as is the remedy for it.

Some of Rosenfeld's other comments on Aristotle also rest on shaky ground. For instance, he asserts that when Aristotle refers to triangles whose angle-sum is greater than two right angles, he has spherical triangles in mind. In fact, the context of Aristotle's remarks suggest that he is putting forward the hypothesis

of an angle-sum greater than two right angles as a hypothesis about plane triangles which is to be proved false by *reductio ad absurdum.*

From Euclid Rosenfeld moves through the early attempts by Proclus and others at "proofs" of the parallel postulate to the work of the Arab mathematicians from Al-Jawhari (9th C.) to Al-Maghribi (13th C.). This is a topic concerning which the author is particularly knowledgeable and his presentation is correspondingly detailed. The source material presented here is especially valuable since much of it is not readily available in any Western European language.

The subsequent account of later "proofs" of the parallel postulate up to the time of Farkas Bolyai follows traditional lines though I was a little surprised at the brevity of the treatment of Saccheri's work.

Rosenfeld now leaves the history of the parallel postulate and turns to the story of transformation geometry from the Greek use of the principle of superposition through the applications of stereographic projections by Arabic astronomers to the use of projective, affine and other transformations in the work of mathematicians such as Desargues, Newton, Clairaut and Euler. The author's interest in Arabic mathematics shows again in the loving care with which the construction and use of various types of astrolabe is described.

There follows a fascinating chapter on geometric algebra and the early development of vector calculus and the notion of higher-dimensional spaces. A chapter on the philosophy of space is appropriately included at this point. Doctrines such as the *a priori* nature of space and debates such as that concerning the question of whether space is continuous or discrete are presented through the opinions of a wide range of thinkers from Plato and Aristotle to Marx and Lenin.

In his Foreword the author remarks that the sixth chapter, on Lobacevskian geometry, "plays a central role" and deals with "the history of the discovery of hyperbolic geometry, the struggle for its acceptance, and the history of its more important interpretations". The role of Lobacevsky as the first to publish the discovery of hyperbolic geometry is justly emphasized. Rosenfeld makes full use of Russian sources to tell the story of Lobacevsky's struggle for recognition and Western readers will find interesting new material here. By contrast the role of Janos Bolyai, Gauss and others is somewhat downplayed and only familiar material is presented.

From here on the content (not surprisingly) becomes progressively more technically demanding. There are extensive treatments of the history of: multidimensional spaces (leading up to the special theory of relativity and to infinite-dimensional spaces); the curvature of space (covering the work of Riemann and Clifford, and topics such as topology, the geometry of the general theory of relativity, differentiable manifolds, fibrations and exterior differential forms); groups of transformations (including Galois theory, the work of Helmholtz and Klein on groups of transformations, and Lie groups and Lie algebras, with a lengthy discussion of the classification of simple and quasisimple Lie groups and their connections with geometries, another of the author's special interests). Finally, the book concludes with a chapter on the application of algebras to geometry dealing with such topics as quaternions, matrices and tensors, associative algebras and spaces over these, and linear representation of groups, especially Lie groups.

Perhaps wisely the author makes no attempt to give any overview of all this material. His achievement in assembling it all is sufficiently impressive and indicative of the author's great breadth of knowledge. The wide coverage of topics results in a presentation which is frequently quite terse and since few, if any, readers will be familiar with all the mathematical topics treated the last part of the book is likely to be heavy going for most. Also, lists of authors and titles of their works, while valuable reference material for those wishing to follow up the historical development of their special field, tend to have the same effect on the general reader as lists of families in the Book of Numbers.

To sum up in a few words: this is a very valuable source book and reference work—it should certainly be in your local mathematics library —but bedtime reading, it isn't.

References:

[1] Bonola, R. "Non-Euclidean Geometry" translated from the Italian with additional appendices by H.S. Carslaw, Dover, 1955.

[2] Gray, J. "Ideas of Space: Euclidean, Non-Euclidean and Relativistic", Oxford University Press, 1979.

M.R.Carter
Massey University

Projective Geometry, by Pierre Samuel. Undergraduate Texts in Mathematics, Springer-Verlag, New York-Berlin-Heidelberg, 1988, x + 156pp, DM 48. ISBN 3-540-96572-4.

The subtitle of the series is *Readings in Mathematics* and this book is indeed a reading, and a very good one too, which will appeal to the – shall we say? – well-rounded mathematician (the rounding can refer to an estimate of age or to a mature stature, or both). But this work is a very suitable textbook for an advanced undergraduates' course; it is for that purpose that the original version, published 1986 in French, was written. It has come from the author's enthusiasm for the subject, an enthusiasm developed over 50 years ago from what he was taught in high school (one concludes that French high schools and New Zealand high schools are not equivalent). He describes the so-called "modern geometry" as being

> *a type of algebra, so thoroughly known that the actual calculations had become almost unnecessary, and "pure-thought" reasonings sufficed.*

Later on in his introduction he writes, of recent times:

> *and it seemed that geometry was no longer taught in high school (even to those preparing for the Ecole Polytechnique), or even in college.*

Those of us who teach first and second year calculus join in this lamentation.

Do you remember from your undergraduate years a time when, contrary to your intuitions about what geometry ought to be, you were bereft of distances and angles and given the impression that these were rather noisome things that could be summoned with the wave of a harmonic wand if really needed? And that from time to time the clouds parted below some higher circle in the mathematicians' heaven to allow glimpses of a pool of knowledge of a limpid clarity in which results of great beauty crystallized at the behest of players of some glass-beaded game? If you had these feelings of being at a disadvantage then probably not enough care was given to the foundations of the topic. This is not the case with this book. Chapter I (52 pages) is about projective spaces. The reader needs to have the basics of linear algebra, some elementary group theory (up to quotient groups say), and a feel for the factorization of polynomials. The ground results in general field theory are assumed, but if the reader wishes to live within the fields of real and complex numbers then he or she will still get much from this text. After a discussion of projective spaces and bases there follow projective transformations and groups. Then we are taken into the world of affine and homogeneous coordinates and are introduced to the theorems of Desargues, Pappus and the so-called fundamental theorem of projective geometry: if there is a bijection f between two projective spaces $P(V)$ and $P'(V')$ of the same dimension over fields K and K' which takes collinear points into collinear points, then f is induced by a bijection $g : V \to V'$ that is additive and satisfies $g(ax) = s(a)g(x)$ where $s : K \to K'$ is a fixed field isomorphism.

After these algebraic considerations we have the axiomatic presentation of affine and projective planes with examples of finite planes and non-Desarguesian planes. The last sections of the chapter are given to the projective space of circles, conics, and of the divisors in algebraic geometry. Here we are introduced to pencils of conics and a study of their multiple points and lines. Included (on page 50) is a nice geometric explanation of how the general quartic equation can be solved by radicals.

Chapter 2 (of 38 pages) is entitled *One-Dimensional Projective Geometry* and it is here that the cross-ratio, appears defined on four points a, b, c, d as a projective transformation, dependent on d, which takes a, b, c to ∞, 0, 1 respectively. This leads to a discussion of rational maps, permuted cross-ratios, projective groups, harmonic divisions, and so to involutions on a projective line. Then follow, by way of line pencils, some of the classical theorems on the projective structure of conics. But, more than that, we get a discussion of unicursal curves including Lüroth's theorem that every unicursal curve has a proper representation. A complete classification of unicursal cubics is given. The chapter ends with sections on the complex projective line and the circular group and on the topology of projective spaces; the first of these sections deals with Möbius transformations and inverse geometry.

Chapter 3 is short (12 pages). In it the conics and quadrics are classified according to the signatures of their corresponding quadric forms. This is all fairly standard but included is a treatment of families of lines on a quadric (here called rectilinear generators—some of the older textbooks use the term regulus for such a family of lines). And as a bonus we are given a short description of Segre varieties and the embedding of the direct product of two projective spaces into a projective space of higher order.

Chapter 4 (23 pages) describes polarities with respect to conics and quadrics. These are treated from the standpoint of orthogonality with respect to a symmetric bilinear form and the isomorphism induced by such a form over a vector space between the dual of that space and the space itself. Among other things we have the dual concept of a conic either as a collection of points or as an envelope of lines. There is a neat relationship between the matrices of the coefficients of the corresponding point and line equations. Then come tangential pencils of conics followed by a treatment of foci. The chapter ends with some non-elementary results such as:

> *The pedal P of a point* m *with respect to a proper conic C is a circle or a line if and only if* m *is a focus of C.*

The last 21 pages of text are devoted to an appendix on (2,2) correspondences. Such a correspondence C is induced by a biquadratic equation in two variables u and v. The correspondence is symmetric if the relations $(u,v) \in C$ and $(v,u) \in C$ are equivalent. If the correspondence is between two projective lines then, excluding degenerate cases, it can always be presented in symmetric form. To each point u on one line there correspond two points on the other. If these two points coincide then u is said to be critical. There are 4 critical points (counting multiplicities) on each of the projective lines. Their formal sum on one of these lines is called a critical divisor, on that line, of the correspondence. There is a projective transformation of one line onto the other which takes the critical divisor of one onto the critical divisor of the other. The possible multiplicity types of the 4 critical points are (1,1,1,1), (1,1,2), (1,3), (2,2) and (4). All this leads to the theorem:

> *The geometry of a non-degenerate* (2,2) *correspondence is uniquely determined by the type of its critical divisor.*

By applying this theory to (2,2) correspondences set up on a pair of conics, there is obtained a proof of Poncelet's theorem (sometimes called Poncelet's porism):

> *If for two conics C and C' there is a point P on C such that, beginning and ending at P, an m-gon* ($m \geq 3$) *can be traced with vertices on C and sides tangent to C', then every point on C has this property.*

The chapter ends with a short discussion of curves on quadrics and of (p,q) correspondences. This appendix could well be relabelled Chapter 5 of the book.

Now for some minor complaints. On page 71 there is mention of a theorem which says that in a triangle the tangents, at the vertices, to the circumcircle intersect the opposite sides in three collinear points. The line of collinearity is described in the text as Simpson's line. It seems that here and in the index "Simpson" is a misprint for "Simson". If this is so then we have the wrong line. Simson's line for a point P on the circumference is the line of collinearity of the feet of the perpendiculars from P to the sides of the triangle. But maybe there are (or were) two individuals, Simpson and Simson, each of whom has an eponymous line.

On page 33 the information about the possible order, q, of a finite projective plane could be better stated. The text has 'Little is known about other values of q [other than prime powers]. Combinatorial arguments show that there is no projective plane with $q = 6, 14, 21, 22$. The case $q = 10$ seems to be still open'.* Here the Bruck-Ryser-Chowla theorem could be stated to great advantage.

On page 21 the incidence axioms for a projective plane are presented thus: 'Consider a set P of points, called a *plane*, and a non-empty family of proper, non-empty subsets of P, called *lines*. Assume the following *incidence axioms* are satisfied: (A1) *Two distinct points in P belong to exactly one line.* (A2) *Two distinct lines in P have exactly one point in common.*' So just two axioms are postulated. Subsequently the case where all but one of the points are collinear has to be declared 'uninteresting and excluded from further consideration.' Moreover, for the purpose of showing that there is a bijection between any two distinct lines, it must be shown that there *is* a point not on either. Although the existence of such a point is implied it is not commented on specifically. These matters could be clarified by using a third axiom – *there are four distinct points no three of which lie on a line.*

There are some infelicities of translation which nevertheless is of a high quality. Such transgressions of the English idiom when they do occur usually add charm to the text. In any substantial mathematical text typographical errors are almost bound to occur and this book is no exception. However such errors in nearly all cases are easily corrected and do not interrupt the flow of argument. On page 25, 'Given two distinct, non-collinear points…' should read 'Given four distinct…'.

This is a very enjoyable book to read. One finds oneself carried along by the arguments and saying 'Yes! Yes! By golly, that is true!' And sometimes 'Just a cotton-picking minute!' So if you want to discover how a mathematical text can contain (on page 135):

We have just found a necessary condition for the containment of hell (but not a sufficient one!)

then read this fine book and be pleasantly enlightened.

D.R.Breach
University of Canterbury

* For q =10 see the paper of C.W.H. Lam, L.H. Thiel, and S. Swiercz, The non-existence of finite projective planes of order 10, *Can. Journal of Math* (to appear). See also an article by C.W.H. Lam in *The Mathematical Intelligencer*, Vol.12, No.1 (1990), How reliable is a computer-based proof?

SPRINGER-VERLAG PUBLICATIONS

Information has been received about the following publications. Anyone interested in reviewing any of these books should contact

David Alcorn
Department of Mathematics and Statistics
University of Auckland

Algorithms and Combinatorics

6.	Recski A	Matroid Theory and its Applications in Electric Network Theory and Statics. 531pp.

Applied Mathematical Sciences

80.	Lawden DF	Elliptic Functions and Applications. 334pp.
81.	Bluman G	Symmetries and Differential Equations. 412pp.
82.	Kress R	Linear Integral Equations. 299pp.
83.	Bebernes J	Mathematical Problems from Combustion Theory. 178pp.

Encyclopaedia of Mathematical Sciences

2.	Sinai YG (ed)	Dynamical Systems II. 281pp.
4.	Arnold VI (ed)	Dynamical Systems IV. 283pp.
7.	Vitushkin AG (ed)	Several Complex Variables I. 248pp.
10.	Gindikin SG (ed)	Several Complex Variables IV. 251pp.
11.	Kostrikin AI (ed)	Algebra I. 258pp.
13.	Gamkrelidze RV (ed)	Analysis I. 238pp.

Graduate Texts in Mathematics

120.	Ziemer WP	Weakly Differentiable Functions. 308pp.

Grundlehren der mathematischen Wissenschaften

291.	Hahn A	The Classical Groups and K-Theory. 576pp.

Lecture Notes in Mathematics

1387.	Petkovic M	Iterative Methods for Simultaneous Inclusion of Polynomial Zeros. 263pp.
1392.	Sihol R	Real Algebraic Surfaces. 215pp.

The IMA Volumes in Mathematics and its Applications

18.	Stanton D	q-Series and Partitions. 212pp.
24.	Friedman A	Mathematics in Industrial Problems. Vol.2. 183pp.

Undergraduate Texts in Mathematics

Bressoud DM	Factorization and Primality Testing. 237pp.
Cederberg JN	A Course in Modern Geometries. 232pp.
Stillwell J	Mathematics and History. 371pp.
Strayer JK	Linear Programming and its Applications. 265pp.

Miscellaneous

Buell DA	Binary Quadratic Forms. 247pp.
Dautray R	Mathematical Analysis and Numerical Methods for Science and Technology. Vol.1: Physical Origins and Classical Methods. 695pp.
Euler L	Introduction to Analysis of the Infinite. Book II. 504pp.
Miyake T	Modular Forms. 335pp.
Nürnberger G	Approximation by Spline Functions. 243pp.
Siegel CL	Lectures on the Geometry of Numbers. 160pp.
Zeidler E	Nonlinear Functional Analysis and its Applications. Part II/A: Linear Monotone Operators. 467pp.

MATHEMATICAL VISITORS TO NEW ZEALAND

LIST NO.25 : 1 MARCH 1990

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.

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.

Professor Afzal Ahmed; West Sussex Institute of Education, U.K.; mathematics education; 23–26 March 1990; Mathematics Education Centre (MECA), Auckland College of Education; Jill Ellis.

Professor Richard Anstee; University of British Columbia, Canada; combinatorics; September 1990 – June 1991; University of Otago; Prof. Derek Holton.

Dr. Russell Blyth; University of St. Louis, Missouri; wife (Peg) & child; group theory; June – August 1990; University of Auckland; Dr. Marston Conder. Dr. Blyth's visit will be partly supported by the University of Auckland Foundation.

Professor G.E.P. Box; University of Wisconsin, Madison, U.S.A.; wife (Claire); statistics & quality improvement; 14–18 July 1990; University of Waikato; Prof. J.A. John.

Professor P.M. Cohn; Bedford College, University of London; algebra; 8–18 July 1990; University of Otago; Prof. Derek Holton.

Dr. J.A. Eccleston; Bond University, Queensland; design & analysis of experiments; 28 March – 1 April 1990; University of Waikato; Prof. J.A. John.

Dr. D.J. Fletcher; University of Sydney, N.S.W.; design & analysis of experiments; 28 March – 1 April 1990; University of Waikato; Prof. J.A. John.

Professor Chris Godsil; University of Waterloo, Ontario; wife (Gillian Nonay) & daughter; graph theory & algebraic combinatorics; March – April 1991; University of Auckland; Dr. Marston Conder.

Professor R. Hemminger; Vanderbilt University, Tennessee; graph theory; September 1989 – July 1990; University of Otago; Prof. Derek Holton.

Dr. Flavia Jolliffe; Brunel University, U.K.; statistics teaching; August 1990; University of Waikato; Dr. Fay Sharples.

Dr. Grant Keady; University of Western Australia; wife & daughter; symbol manipulative computation, differential equations; 1 July 1989 – 30 June 1991; University of Waikato; Dr. Kevin Broughan.

Professor Toby Lewis; The Open University, U.K.; statistics; 19–31 August 1990; University of Otago; Prof. Brian Manly.

Professor D.V. Lindley; retired (U.K.); Bayesian statistics; 27 August – 5 October 1990; University of Canterbury; Prof. John Deely.

Dr. Lyman McDonald; University of Wyoming, U.S.A.; wife; statistics; 1–31 August 1990; University of Otago; Prof. Brian Manly.

Professor F.R. McMorris; University of Louisville, Kentucky; combinatorics, mathematical phylogeny; 2–17 December 1990; Massey University; Dr. Mike Hendy.

Professor Roger Mead; University of Reading, U.K.; wife; statistics; August 1990 – April 1991; University of Otago; Prof. Brian Manly.

Professor Keith Miller; University of California, Berkeley; wife (Jackie); numerical analysis and partial differential equations; 4 March - 1 June 1990; University of Auckland; Prof. John Butcher.

Professor Marcel Neuts; University of Arizona; wife (Olga); algorithmic probability & queueing theory; 16 July – 10 August 1990; University of Auckland; Prof. George Seber. Professor Neuts is a University of Auckland Foundation Visitor for 1990.

Dr. Gillian Nonay; Wilfrid Laurier University, Ontario; husband (Chris Godsil) & daughter; graph theory, combinatorics; March – April 1991; University of Auckland; Dr. Marston Conder.

Professor H.D. Patterson; retired (U.K.); wife (Janet); design & analysis of experiments; 26 March – 8 April 1990; University of Waikato; Prof. J.A. John.

Dr. K.G. Russell; University of Wollongong, N.S.W.; design & analysis of experiments; 28 March – 1 April 1990; University of Waikato; Prof. J.A. John.

Professor Shayle R. Searle; Cornell University, U.S.A.; wife; statistics – linear models, components of variance; 26 February – 4 May 1990; University of Auckland; Prof. George Seber.

Professor Jerome Spanier; Claremont Graduate School, California; wife; numerical analysis, applied mathematical modelling, Monte carlo methods; 1 September – 30 November 1990; Massey University; Profs Jeff Hunter & Graeme Wake. Professor Spanier is a Fullbright Visiting Professor.

Dr. Günter Steinke; Christian-Albrechts Universität zu Kiel, West Germany; wife & son; topological projective planes; from 27 August 1989, indefinitely; University of Auckland; Prof. Peter Lorimer.

Professor W.A. Thompson, Jr.; University of Columbia-Missouri, U.S.A.; wife; reliability theory, statistics; March – June 1990; University of Auckland; Prof. George Seber.

Dr. E.R. Williams; C.S.I.R.O., Canberra; design & analysis of experiments; 28 March – 1 April 1990; University of Waikato; Prof. J.A. John.

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.

Marston Conder
N.Z. Mathematical Society Visitors' Co-ordinator
Department of Mathematics & Statistics
University of Auckland

In addition to those listed, the following overseas visitors are expected to attend the **16th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing**, to be held at Massey University, 3–7 December 1990:

Dr. Latif Al-Hakim (Chisholm Institute of Technology)
Dr. Brian Alspach (Simon Fraser University)
Sharon Boswell (University of Newcastle)
Richard Buskens (University of Manitoba)
Dr. Fan Chung (Bell Communications Research)
Dr. Charles Colbourn (University of Waterloo)
Dr. Nathaniel Dean (Bell Communications Research)
Diane Donovan (University of Queensland)
Dr. Ron Graham (A.T.&T. Bell Laboratories)
Ken Gray (University of Queensland)
Dr. Katherine Heinrich (Simon Fraser University)
Sampei Kageyama (Hiroshima University)
Miro Kretzl (Curtin University)
Kam Wing Leung (Chinese University of Hong Kong)
Tao Lin (University of Queensland)
Xuemin Lin (University of Queensland)
G. Maxwell (University of British Columbia)
Dr. Kevin McAvaney (Deakin University)
Dr. Brendan McKay (Australian National University)
Prof. B.H. Neumann (Australian National University)
Prof. Peter O'Halloran (University of Canberra)
Prof. Cheryl Praeger (University of Western Australia)
Dr. A. Rahilly (University of Queensland)
Prof. Jennifer Seberry (Australian Defence Force Academy)
Prof. Douglas Shier (College of William and Mary)
W.F. Smyth (McMaster University)
Prof. Ralph Stanton (University of Manitoba)
Dr. Doug Stinson (University of Manitoba)
R.P. Sullivan (University of Western Australia)
George Szekeres (University of New South Wales)
Dr. W.D. Wallis (Southern Illinois University)
Xiaoji Wang (Australian National University)
Dr. Douglas Woodall (University of Nottingham)
X. Zhang (Australian Defence Force Academy).

Further details may be obtained from Dr Charles Little (Department of Mathematics & Statistics, Massey University, Palmerston North).

Prof L C Woods

LESLIE COLIN WOODS

by Brian Woods

The account that I shall give of the life and work of Les Woods must be short, informal and incomplete, but I hope that, drawing on a diversity of sources, the most important being conversations with him enjoyed over a period of time when he and I shared a small house in West Vancouver in 1984, I can do some justice to both.

Les was born on 6 December 1922, and lived, for the early years of his life, in Mercury Bay. His family later removed to Auckland, and he had his secondary schooling at Seddon Memorial Technical College. In 1940 he became the first pupil of that school to win an Entrance Scholarship, and began to study towards a degree in mathematics at Auckland University College. But later in that year he had to withdraw from these studies because of lack of money. He then joined the Public Works Department as a cadet (at \2434/15/- a week) and was sent to Ashburton, to begin his cadetship with pick and shovel. However, on reaching the age of eighteen, he deferred further instruction in civil engineering, and joined the Royal New Zealand Air Force. After training, he served as a fighter pilot, flying Corsairs in the South Pacific theatre. While on active service, he gained the degrees of B.Sc. and M.Sc. (N.Z.) extramurally. He also made a start to his teaching career, giving classes, for modest fees, in technical mathematics (trigonometry, etc.) to aircraftsmen working for certificates. At the end of the war he returned to Auckland University College and added a B.E. (N.Z.) to the qualifications he had already got. In 1949 he went as a Rhodes Scholar to Merton College, Oxford, and did research with Alexander Thom, leading to a D.Phil. in Engineering Science, conferred in 1950. To this he added a B.A. with first class honours in Mathematics in 1951. His list of degrees does not end here: he later received two D.Sc's—from the University of New Zealand in 1954, and from Oxford in 1958—and an honorary D.Sc. from the University of Auckland on the occasion of its centenary in 1983.

Les's work has been in the classical tradition of British applied mathematics, which is to say that the solution of real problems, arising in physical or technological contexts, are what have engaged him. While his papers may exhibit a formidable mastery of technique, they are characterised more by critical care and independence in formulation, and in the subsequent evaluation of the results. Following his student years at Oxford, he joined the Royal New Zealand Air Force in the Defence Science Corps, and was seconded to the National Physical Laboratory, where he worked on aerodynamical problems. Out of this period came his first major book, *Theory of Subsonic Plane Flow* (CUP,1961). In 1954 he went to Australia, first as a Senior Lecturer at Sydney University, and then as Nuffield Research Professor in Engineering at the newly created University of New South Wales. While there he became interested in reactor physics, as a result of work undertaken with colleagues at Lucas Heights. This led to the publication of a Methuen Monograph on neutron transport. He returned to Oxford in 1961, first as a lecturer in Engineering Science, then as a Reader in Applied Mathematics, and from 1970 as a Professor of Mathematics. His College now became Balliol, of which he is a Professorial Fellow. His research interests enlarged to embrace non-equilibrium thermodynamics and plasma dynamics, and he has published major monographs on both subjects; the first in 1975 (but recently reissued in paper covers) and the second in 1987. In the five years before his retirement, 1984-1989, Les was the Chairman of the Mathematical Institute, Oxford.

This severely abridged catalogue of scientific and worldly success might tempt the reader to suppose that Les is a solidly establishment figure. I suppose that there is an uninteresting sense in which that might be true, but there is a refreshingly maverick aspect to his character which the years have not attenuated. He has not flinched from open controversy. Perhaps the clearest statement of his approach to applied mathematics can be found in two papers, "Beware of Axiomatics in Applied Mathematics", and "The Bogus Axioms of Continuum Mechanics", both in the Bulletin of the IMA (Vol 9, pp40-44, and Vol 17, pp 98-102 respectively). I shall not attempt to summarize these, but both are substantial in content and polemical in tone, and led to quite strong exchanges of views subsequently. I commend them to readers of this Newsletter.

Les has now officially "retired"; however, his programme of research interests, and the support he has to pursue them, hardly reflect this. I hope that he may again have the opportunity to revisit this country. On his last visit to Christchurch (as the New Zealand Vice-Chancellors' Distinguished Visitor), when he also represented Oxford at the Centennial of the University of Canterbury, I had the pleasure of entertaining him to a meal featuring Fouveaux Straits oysters. He still remembered these when we were together in Vancouver, where we had to make do with the less tasty North Pacific variety.

And so, after extending to him on the Society's behalf cordial respect and best wishes for the success of his projects, I should like on my own part to end by pledging him a dozen of Bluff's best, against his return.

CONFERENCES

**** 1990 ****

May 3-4 (Pittsburgh, Pennsylvania) **21st Annual Pittsburgh Conference on Modeling and Simulation**
Contact W.G. Vogt, Modeling and Simulation Conference, 348 Benedum Engineering Hall, University of Pittsburgh, Pittsburgh, Pennsylvania 15261, U.S.A.

May 6-9 (Ithaca, New York) **Computer Algebra and Differential Equations (CADE - 90)**
Contact M. Singer, North Carolina State University, Department of Mathematics, Box 8205, Raleigh, North Carolina 27695-8205, U.S.A.

May 6-12 (Oberwolfach, West Germany) **Geschichte der Mathematik**
Contact MFOG: see (1) below.

May 7-9 (Oakland, California) **1990 IEEE Symposium on Research in Security and Privacy**
Contact D. Cooper, Unisys Corporation, 5731 Slauson Avenue, Culver City, California 90230, U.S.A.

May 7-10 (Orlando, Florida) **SIAM** Conference on Applications of Dynamical Systems Contact SIAM: see (6) below.

May 7-June 1 (Trieste, Italy) **College on Recent Developments and Applications in Mathematics and Computer Science**
Contact ICTP: see (5) below.

May 9-12 (Ithaca, New York) **Computer Algebra and Parallelism (CAP-90)**
Contact E. Kaltofen, Computer Science Department, Rensselaer Polytechnic Institute, Troy, New York 12180-3590, U.S.A.

May 13-19 (Oberwolfach, West Germany) **Abstrakte Konvexe Analysis**
Contact MFOG: see (1) below.

May 14-17 (Auckland) **1990 New Zealand Mathematics Colloquium**
Contact Garry Tee, Mathematics and Statistics Department, University of Auckland, Auckland, New Zealand.

May 14-18 (New Brunswick, New Jersey) **Conference on Nonlinear Analysis and Partial Differential Equations**
Contact E. Oates, Department of Mathematics, Hill Center, Rutgers University, New Brunswick, New Jersey 08903, U.S.A.

May 17-19 (East Lansing, Michigan) **Interface '90 (formerly Computer Science and Statistics: Symposium on Interface)**
Contact R. LePage, Dept. of Statistics and Probability, Michigan State University, East Lansing, Michigan 48824-1024, U.S.A.

May 17-19 (Iowa City, Iowa) **Colloquium: Computer Graphics in Pure Mathematics**
Contact D. Roseman, Department of Mathematics, University of Iowa, Iowa City, Iowa 52242, U.S.A.

May 20-26 (Oberwolfach, West Germany) **The Schrödinger Equation and its Classical Counterparts**
Contact MFOG: see (1) below.

May 21-24 (Portofino, Italy) **The Simulation of Random Processes and Fields—Mathematics and Applications**
Contact F. Marchetti, Universita di Genova, Dipartimento di Mathematica, v.L.B. Alberti 4, I-16132 Genova, Italy.

May 21-25 (Tucson, Arizona) **Eleventh United States National Congress of Applied Mechanics**
Contact C.F. Chen, Department of Aerospace and Mechanical Engineering, University of Arizona, Tucson, Arizona 85721, U.S.A.0.

May 23-25 (Charlotte, N. Carolina) **1990 International Symposium on Multiple-Valued Logic**
Contact G. Epstein, Computer Science Department, University of North Crolina at Charlotte, Charlotte, North Carolina 28223, U.S.A.

May 23-26 (Niagara Falls, Ontario, Canada) **International Conference on Computing and Information**
Contact W.W. Koczdodaj, Laurentian University CoSc, Sudbury, Ontario P3E 2C6, Canada.

May 24-25 (Washington DC) **Twelfth Symposium on Mathematical Programming with Data Perturbations**
Contact A.V. Fiacco, The George Washington University, Washington, DC 20052, U.S.A.

May 25-31 (Atlantic City, New Jersey) **Tenth International Conference on Pattern Recognition**
Contact H. Freeman, CAIP Center, 605 Hill, Rutgers University, New Brunswick, New Jersey 08903, U.S.A.

May 27-June 2 (Oberwolfach, West Germany) **Lyapunov-Exponents**
Contact MFOG: see (1) below.

May 28-June 1 (Tours, France) **22nd Annual Conference on Statistics**
Contact J.P. Asselin de Beauville, Laboratoire d'Informatique, Facultré des Sciences et Techniques, Parc du Grandmont, 37 200 Tours, France.

May 28-June 2 (Malta) **First Malta Conference on Graphs and Combinatorics** Contact The Organisers, Graphs and Combinatorics Conference, Department of Mathematics, University of Malta, Malta.

May 29-30 (Boulder, Colorado) **Algebraic Logic Conference in Honour of Professor Don Monk**
Contact Walter Taylor, Department of Mathematics, Campus Box 426, Boulder, Colorado 80309-0426, U.S.A.

May 29-June 2 (Minneapolis, Minnesota) **Workshop on Dynamical Systems in Fluid Mechanics**
Contact IMA: see (3) below.

May 29-June 2 (Minneapolis, Minnesota) **Dynamical Theories of Turbulence in Fluid Flows**
Contact IMA: see (3) below.

May 31-June 3 (Ithaca, New York) **Percolation Models of Material Failure**
Contact S.L. Phoenix, Cornell University, Department of T & AM, 321 Thurston Hall, Ithaca, New York 14853, U.S.A.

June-July (Vilnius, U.S.S.R.) **International IMACS Conference on Mathematical Modelling and Applied Mathematics**
Contact A.A. Samarskii, Keldysh Institute of Applied Mathematics, USSR Academy of Sciences Miusskaya pl.4, 125047 Moscow, U.S.S.R.

June 1-8 (Erice-Trapani, Sicily) **Third International IMACS Symposium on Orthogonal Polynomials and their Applications**
Contact L. Michelucci, Dipartimentio di Matematica e Applicazioni, Universitá di Palermo, Via Archirafi 34, I-90123 Palermo, Italy.

June 1–10 (Dubrovnik-Kupari, Yugoslavia) **Fourth Annual Meeting of the International Workshop in Analysis and its Applications**
Contact C.V. Stanojevic, Dept. of Mathematics and Statistics, University of Missouri-Rolla, Rolla, Missouri 65401, U.S.A.

June 3–9 (Oberwolfach, West Germany) **Graphentheorie**
Contact MFOG: see (1) below.

June 4–7 (Philadelphia, Pennsylvania) **Fifth Annual IEEE Symposium on Logic in Computer Science**
Contact J.C. Mitchell, LICS Program Chair, Dept. of Computer Science, Stanford University, Stanford, California 94305, U.S.A.

June 4–8 (Berkeley, California) **Workshop on Model Theory**
Contact MSRI : see(2) below.

June 4–8 (Tel Aviv Israel) **International Conference on Approximation, Interpolation and Summability in Honour of A. Jakimovsky**
Contact D. Leviatan, School of Mathematical Sciences, Tel Aviv University, Tel Aviv 69978, Israel.

June 4-8 (Trier, West Germany) **International Conference on Bootstrapping and Related Techniques** Contact Prof. Dr. K.H. Jockel, Bremen Institute for Prevention Research, St-Jurgenstrasse 1, 2800 Bremen 1, West Germany.

June 4-8 (Minneapolis, Minnesota) **Workshop on Nonlinear Phenomena in Atmospheric and Oceanic Sciences**
Contact IMA: see (3) below.

June 6-9 (Lahti, Finland) **Fifth Annual Conference of the European Consortium for Mathematics in Industry**
Contact S. Vaskelainen, University of Helsinki, Lahti Research and Training Centre, Kirkkokatu 16, SF-15140 Lahti, Finland.

June 6-12 (Barcelona) **1990 Barcelona Conference on Algebraic Topology**
Contact M. Castellet, Director, Centre de Recerca Matematica, Institut D'Estudis Catalans, Apartat 50-08193 Bellaterra, Barcelona, Spain.

June 6-15 (Chaika, Bulgaria) **Third Logic Biennial (in honour of S.C. Kleene)** Contact Kleene '90, Mathematics Faculty, Boulevard Anton Ivanov 5, Sofia 1126, Bulgaria.

June 10-16 (Oberwolfach, West Germany) **Reele Algebraische Geometrie**
Contact MFOG : see (1) below.

June 10-16 (Prachtice, Czechoslovakia) **Fourth Czechoslovak Symposium on Combinatorics** Contact P. Liebl, Mu CSAV, 115 67 Praha 1, Czechoslovakia.

June 11-14 (Helsinki) **Fourteenth Rolf Nevanlinna Colloquium** Contact S. Rickman, University of Helsinki, Department of Mathematics, SF-00100, Helsinki, Finland.

June 11-14 (New York) **8th International Conference of Systems and Cybernetics** Contact Professor C.V. Negoita, Department of Computer Science, Hunter College, City University of New York, 695 Park Avenue, New York, N.Y. 10021, U.S.A.

June 11-14 (Atlanta, Georgia) **Fifth SIAM Conference on Discrete Mathematics** Contact SIAM: see (6) below.

June 11-15 (Uppsala, Sweden) **Third International Conference on Hyperbolic Problems** Contact Professor Dr B. Gustafason, Department of Computer Sciences, University of Uppsala, Sturegatan 4B 2TR, Uppsala, Sweden.

June 11-15 (Minneapolis, Minnesota) **Workshop on Chaotic Processes in Geophysical Phenomena** Contact IMA: see (3) below.

June 11-15 (Liblice Castle, Czechoslovakia) **Rigorous Results in Quantum Dynamics** Contact J. Dittrich, Theoretical Department, Institute of Nuclear Physics, 250 68 Rez, Czechoslovakia.

June 11-15 (Lowell, Maryland) **NSF/CBMS Conference on Wavelets** Contact CBMS Wavelet Conference, Department of Mathematics, University of Lowell, Lowell, Maryland 01854, U.S.A.

June 11-15 (Boulder, Colorado) **IMACS First International Conference on Computational Physics** Contact K. Gustafson, Chair, IMACS Computational Physics, C/- D. Ramsey, Scientific Secretary, University of Colorado, Boulder, Colorado 80309-0425, U.S.A.

June 12-15 (Antibes, France) **Ninth International Conference on Analysis and Optimization of Systems** Contact INRIA, Service des Relations Exterieurer, Domain du Voluceau-Roquencourt B.P. 105, F-78153 Le Chesnay cedex, France.

June 13-22 (Montréal) **Free Boundary Problems: Theory and Applications** Contcat J. Aoy, Coordinator, Scientific Activities, CRM, Université de Montréal, C.P. 6128-A, Montréal, Québec H3C 357, Canada.

June 14–16 (Gadong, Brunei Darussalam) **Fifth Southeast Asian Conference on Mathematical Education** Contact Dr David Daniels, SEACME 5 Secretary, University of Brunei Darussalam, Gadong, Brunei Darussalam.

June 17–23 (Oberwolfach, West Germany) **Partial Differential Equations in Complex Analysis** Contact MFOG : see (1) below.

June 18–20 (Tylosand, Sweden) **Eleventh Householder Symposium on Numerical Algebra** Contact Ake Björck, Department of Mathematics, Linköping University, S-581 83 Linköping, Sweden.

June 18–23 (Belgrade) **Topology and its Applications** Contact Prof. M. Mrsevic´, Drustvo Matematicara SR Srbije, Knez Mihailova 35/IV, p.p. 791, 11001 Belgrade, Yugoslavia.

June 21–27 (Chamonix, France) **Curves and Surfaces**
Contact Madame Claude Rivet, Curves and Surfaces TIM3–IMAG, Universitè Joseph Fourier BP 53X, 38041 Grenoble cedex, France.

June 24–30 (Oberwolfach, West Germany) **Mathematische Probleme in der Nichtlinearen Elastizität**
Contact MFOG: see (1) below

June 25–29 (Bochyne, Czechoslovakia) **International Symposium on Fuzzy Approach to Reasoning and Decision Making**
Contact V. Novak, Minin Institute, Czechoslovakia Academy of Sciences, A. Rimana 1768, 70800 Ostrava-Poruba, Czechoslovakia.

June 25–29 (Athens) **Twelfth IFORS Conference on Operational Research**
Contact G. Rand, Department of Operational Research, School of Management and Organisational sciences, University of Lancaster, Gillow House, Bailrigg, Lancaster, LA1 4YX,England.

June 27–29 (Coventry, England) **Applications of Mathematics in the National Curriculum**
Contact IMA: see (7) below.

June 27-30 (Xanthi, Greece) **Fourth International Congress on Algebraic Hyperstructures and Applications**
Contact L. Konguetsof, Democritus University of Thrace, 67100 Xanthi, Greece.

June 29–July 1 (Sydney) **1990 Conference of the Australasian Association for Logic**
Contact A/Professor M.W. Bunder, Faculty of Mathematical Sciences, The University of Wollongong, P.O. Box 1144, Wollongong, NSW 2500, Australia.

July 1–7 (Oberwolfach, West Germany) **Modulfunktionen In Mehreren Variablen**
Contact MFOG: see (1) below.

July 1–15 (Manchester) **International Symposium on Algebraic Topology – Adams Memorial Symposium**
Contact J. Minshull, Department of Mathematics, University of Manchester, Manchester M13 9PL, England.

July 1-18 (Saint-Flour, France) **Twentieth Summer Session on Probability Theory**
Contact P.L. Hennequin, Mathématiques Appliquées, F63177 Aubiere Cedex, France.

July 2-6 (Budapest) **XVth International Biometric Conference**
Contact Ms Eva Sos, Computer and Automation Institute, Hungarian Academy of Sciences, H-1502 Budapest, P.O. Box 63, Hungary.

July 2-6 (Townsville) **34th Annual Meeting of the Australian Mathematical Society**
Contact Professor R.J. Hosking, Department of Mathematics, James Cook University, Townsville, Queensland 4811, Australia.

July 2–6 (Sydney) **10th Australian Statistical Conference and 2nd Pacific Statistical Congress**
Contact Dr. S.H. Huxham, School of Mathematical Sciences, University of Technology, Sydney, P.O. Box 123, Broadway, New South Wales, Australia.

July 2–6 (Laugarvain, Iceland) **The Jonsson Symposium—an International Symposium on Algebras, Lattices and Logic (in honour of Bjarni Jonsson's 70th birthday)**
Contact B. Davey, Department of Mathematics, La Trobe University, Bundoora, Victoria 3083, Australia.

July 2–31 (Mineapolis, Minnesota) **Time series**
Contact IMA: see (3) below.

July 3–6 (Dundee, Scotland) **Eleventh Dundee Conference on Ordinary and Partial Differential Equation**
Contact R.J. Jarvis, Department of Mathematics and Computer Science, the University, Dundee DD1 4HN, Scotland.

July 3–6 (Stirling, Scotland) **The Unified Computational Laboratory**
Contact IMA: see (7) below.

July 5–10 (Hobart) **13th Joint Conference of the Australian Association of Mathematics Teachers and the Mathematics Education Research Group of Australasia**
Contact AAMT Biennial Conference, P.O. Box 313, Sandy Bay, 7005, Tasmania, Australia.

July 6–7 (Hamburg) **International Colloquium on Applications of Mathematics on the occasion of the 80th birthday of Lother Collatz**
Contact B. Fischer, Institute of Applied Mathematics, Bundestrasse 55, Universität Hamburg, D–200 Hamburg 13, Federal Republic of Germany.

July 8-14 (Oberwolfach, West Germany) **Variationsrechnung**
Contact MFOG: see (1) below.

July 9–10 (Townsville, Australia) **Miniconference on Analysis**
Contact Professor J.R. Giles, Department of Mathematics, University of Newcastle, NSW 2308, Australia.

July 9–11 (Genova, Italy) **Universitá di Genova – Ohio State University Joint Conference on New Trends in Systems Theory**
Contact NTST Secretariat, C/- G. Conte, Dip. Mat. Univ. Genova, via L.B. Alberti 4, 16132 Genova, Italy.

July 9–13 (Sydney) **5th World Conference on Computers in Education**
Contact Doug Shaw, Siromath Pty Ltd, 156 Pacific Highway, St. Leonard's NSW 2065, Australia.

July 9-20 (Hamilton, Ontario) **Geometry and Topology of Four-Manifolds**
Contact I. Hambleton, Department of Mathematics, McMaster University, Hamilton, Ontario, Canada L85 4K1.

July 12–14 (Melbourne) **Conference on Semigroup Theory in Honour of Professor G.B. Preston**
Contact T.E. Hall, Department of Mathematics, Monash University, Clayton, Victoria 3168, Australia.

July 15-21 (Oberwolfach, West Germany) **Stochastic Image Models and Algorithms**
Contact MFOG: see (1) below.

July 15–22 (Helsinki) **Logic Colloquium '90**
Contact Logic Colloquium, C/- J. Väänänen, Department of Mathematics, University of Helsinki, Hallituskatu 15, Finland.

July 15-23 (Luminy, France) **Colloquium in Honour of Roland Fraisse**
Contact R. Bonnet, Department of Mathematics and Mechanics, Case Postale 322, Université Aix Marseille III, 13 397 Marseilles Cedex 13, France.

July 22-28 (Oberwolfach, West Germany) **Konvexgeometrie**
Contact MFOG: see (1) below.

July 26–29 (Madras, India) **International Conference on New Trends in Geometric Function Theory and Applications**
Contact Dr R. Parvatham, Ramanujan Institute for Advanced Study in Mathematics, University of Madras, Madras 600 005, India.

July 29-Aug. 4 (Oberwolfach, West Germany) **Mechanik Und Algebraische Geometrie**
Contact MFOG: see (1) below.

July 30-Aug. 3 (Winston-Salem, North Carolina) **Fourth International Conference on Fibonacci Numbers and their Applications**
Contact Dr John Turner, Dept of Mathematics and Statistics, University of Waikato, Private Bag, Hamilton, New Zealand.

July 31–August 2 (Bristol, England) **Dynamics of Numerics and the Numerics of Dynamics**
Contact IMA : see (7) below.

August 5–9 (Berkeley, California) **From Topology to Computation: Unity and Diversity in the Mathematical sciences (in Honour of Professor Stephen Smale's 60th Birthday)**
Contact D. Craig, Mathematics Department, University of California, Berkeley, California 94720, U.S.A.

August 5-11 (Oberwolfach, West Germany) **Mathematical Methods in Tomography**
Contact MFOG: see (1) below.

August 5–11 (Hungary) **International Conference on Approximation Theory**
Contact Janos Bolyai Mathematical Society, Budapest, Anker Köz 1-3. I.111, H-1061 Hungary.

August 6–9 (Anaheim, California) **7th International Conference on the New Quality Philosophy in Statistical Research and Statistical Education**
Contact V. Shryrkov, IS-SSE, 536 Oasis Drive, Santa Rosa, California 95407, U.S.A.

August 12-18 (Oberwolfach, West Germany) **Algebraische Zahlentheorie**
Contact MFOG: see (1) below.

August 12-18 (Honolulu) **Pre-Congress Topology Conference**
Contact K.H. Dovermann, Department of Mathematics, University of Hawaii, Honolulu, Hawaii 96822, U.S.A.

August 13–16 (Fairbanks, Alaska) **Alaska Conference: Quo Vadis, Graph Theory?** Contact J.G. Gimbel, University of Alaska, Fairbanks, Alaska 9975, U.S.A.

August 13–17 (Cedar, Falls, Iowa) **Fifth International Conference on Hadronic Mechanics and Nonpotential Interactions**
Contact H.C. Myung, Department of Mathematics, University of Northern Iowa, Cedar Falls, Iowa 50614, U.S.A.

August 13–17 (Tokyo) **Algebraic Geometry and Analytic Geometry**
Contact Y. Miyaoka, Department of Mathematics, Tokyo Metropolitan University, Fukazawa, Setagaya, Tokyo 158, Japan.

August 13–17 (Debrechen, Hungary) **Third International Colloquium on Group Theory**
Contact Edit Szabo, Kossuth Lajos University, Mathematical Institute, Debrechen, PF.12, H–4010, Hungary.

August 13–17 (University Park, Pennsylvania) **1990 International Conference on Parallel Processing**
Contact P.C. Yew, Center for Supercomputing Research and Development, 305 South Wright Street, University of Illinois, Urbana, Illinois 61801–2932, U.S.A.

August 13–18 (Uppsala, Sweden) **53rd Annual Meeting of the Institute of Mathematical Statistics and 2nd World Congress of the Bernoulli Society**
Contact Lynne Billard, Department of Statistics, University of Georgia, Athens, Georgia 30602, U.S.A.

August 13–18 (Tsukuba, Japan) **Tsukuba International Conference on Representations of Algebras and Related Topics**
Contact H. Tachikawa, Institute of Mathematics, University of Tsukuka, Tsukuka, Ibaraki 305, Japan.

August 14–18 (Hong Kong) **Asian Mathematical Conference 1990**
Contact Mr H.K. Chow, Assistant Secretary, Asian Mathematical Conference 1990, Department of Mathematical Studies, The Hong Kong Polytechnic, Hung Hom, Kowloon, Hong Kong.

August 15-19 (Osaka, Japan) **International Conference on Knot Theory and Related Topics**
Contact A. Kawauchi, Department of Mathematics, Osaka City University, Osaka 558, Japan.

August 15–20 (Nagoya, Japan) **Conference on Random Gaussian Fields**
Contact T. Hida, Department of Mathematics, Nagoya University, Chikusa-ku, Nagoya 464, Japan.

August 16–18 (Tokyo) **SIGAL International Symposium on Algorithms**
Contact T. Asano, Osaka Electro-Communication University, Matsucho, Neyagawa, Osaka 572, Japan.

August 16–21 (Waterloo, Canada) **First International Conference of the World Federation of National Mathematical Competitions**
Contact Professor R. Dunkley, Faculty of Mathematics, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada.

August 19-24 (Dunedin, N.Z.) **Third International Conference on the Teaching of Statistics**
Contact the Secretary, ICOTS 3, Department of Mathematics and Statistics, University of Otago, P.O. Box 56, Dunedin, New Zealand.

August 19-25 (Oberwolfach, West Germany) **Mathematische Methoden Des VLSI-Entwurfs Und Des Distributed Computings**
Contact MFOG: see (1) below.

August 21-29 (Kyoto, Japan) **International Congress of Mathematicians**
Contact ICM-90 Secretariat, RIMS: see (4) below.

August 23–Sept.1 (Graz-Mariatrost, Austria) **28th International Symposium on Functional Equations**
Contact Professor Ludwig Reich, Institut für Mathematik, Universiät Graz, A–8010 Graz, Bandhofgasse 18, Austria.

Augg. 26-Sept. 1 (Oberwolfach, West Germany) **Komplexe Analysis**
Contact MFOG: see (1) below.

August 28-30 (Esztergom, Hungary) **IMACS European Simulation Meeting on Problem Solving by Simulation**
Contact A. Javor, Central Research Institute for Physics of the Hungarian Academy of Sciences, H-1525 Budapest 114, P.O. Box 49, Hungary.

August 28–31 (Vienna) **Operations Research 1990**
Contact G. Feichtinger, Institut für Ökonometrie, OR und Systemtheorie, Technische Universität Wien, A-1040 Wien, Argentinierstrasse 8, Austria.

August 30-Sept. 4 (Nagoya, Japan) **International Conference on Potential Theory**
Contact M. Kishi, Office of the Organizing Committee of International Conference on Potential Theory, Department of Mathematics, College of General Education, Nagoya University, Nagoya 464-01, Japan.

September–October (Bulgaria) **IMACS-GAMM Conference on Computer Arithmetic, Scientific Computation and Mathematical Modelling**
Contact U. Kulisch, Universität Karlsruhe, Institut für Angewandte Mathematik, Kaiserstrasse 12, Postfach 6980, D–7500 Karlsruhe 1, Germany.

September 2–7 (Shandong, China) **International Conference on Integral Equations and Boundary Value Problems**
Contact W. Guo-chun, Department of Mathematics, Peking University, Beijing, China.

September 2–7 (Cracow, Poland) **Twelfth International Conference on Nonlinear Oscillations**
Contact S. Marczyk, Twelfth ICNO Secretariat, Cracow University of Technology, Institute of Mechanics and Machine Design, Al. Planu 6-Letniego 19A, 31-864 Cracow, Poland.

September 2-8 (Oberwolfach,West Germany) **Topologie**
Contact MFOG: see (1) below.

September 3-6 (Tokyo) **Fourth Asian Logic Conference**
Contact K. Kakahi, Department of Mathematics, Waseda University, 3-4-1 Okubo, Shinjuku-ku, Tokyo 169, Japan.

September 3–6 (Beijing, China) **ICMI China Regional Conference on Assessment in Mathematics and Related Topics**
Contact Professor Deng Er Seng, Department of Mathematics, Beijing Normal University, Beijing, China.

September 3–7 (Marseille, France) **Représentation Des Groupes et Analyse Complex**
Contact Mne A. Zeller-Meier, CIRM, Luming, Case 91b, F-13288 Marseille, Cedex 9, France.

September 3-7 (Brussels) **IMACS Symposium on Intelligent Models in Systems Simulation**
Contact S. Tzafestas, National Technical University of Athens, Division of Computer Science, Department of Electrical Engineering, 157 73 Zographou, Athens, Greece.

September 9-15 (Obersolfach, West Germany) **Surgery and L-Theory**
Contact MFOG: see (1) below.

September 10-14 (Dresden) **Mathematiker-Kongress**
Contact Professor G. Burosch, Sektion Mathematik, Wilhelm-Pieck-Universität, Universitätsplatz 1, Rostock 1, 2500 German Democratic Republic.

Sept. 10-Oct. 5 (Trieste, Italy) **School on Qualitative Aspects and Applications of Nonlinear Evolution Equations**
Contact ICTP: see (5) below.

September 16-22 (Oberwolfach, West Germany) **Risikotheorie**
Contact MFOG: see (1) below.

September 17–21 (Minneapolis, Minnesota) **Evolution of Phase Boundaries**
Contact IMA : see (3) below.

September 23-29 (Oberwolfach, West Germany) **Random Graphs and Combinatorial Structures**
Contact MFOG: see (1) below.

September 18–20 (France) **European Conference on the Mathematics of Oil Recovery**
Contact IMA: see (7) below.

September 24–28 (San Sebastian, Spain) **International Symposium on Structures in Mathematical Theories**
Contact Professor Andori Ibarra, Departamento de Logica y Filosofia de la Ciencia, Universidad del Pais Vasco/Euskal Herriko Unibertsitatea, Apartado 1249, 20080 San Sebastian, Spain.

Sept. 30-Oct. 6 (Oberwolfach, West Germany) **Diophantische Approximationen**
Contact MFOG: see (1) below.

October 14-20 (Oberwolfach, West Germany) **Geometrie**
Contact MFPG: see (1) below.

October 15–19 (Minneapolis, Minnesota) **Shock Induced Transitions and Phase Structures in General Media**
Contact IMA: see (3) below.

October 21–27 (Peniscola, Spain) **International Functional Analysis Meeting on the Occasion of the Sixtieth Birthday of Professor M. Valdivia**
Contact J. Bonet, Univ. Politecnica de Valencia, E.T.S. Arquitectura, Dept. Matematica Aplicada, C. de Vera, E–46071 Valencia, Spain.

October 21–27 (Oberwolfach, West Germany) **Arithmetik der Körper**
Contact MFOG : see (1) below.

October 21-27 (Oberwolfach, West Germany) **Mathematische Methoden in der Robotik**
Contact MFOG: see (1) below.

Oct. 28-Nov. 3 (Oberwolfach, West Germany) **Mathematical Economics**
Contact MFOG: see (1) below.

November 4–10 (Oberwolfach, West Germany) **Wahrscheinlichkeitsmasse auf Gruppen**
Contact MFOG : see (1) below.

November 5–7 (San Francisco) **Second SIAM Conference on Linear Algebra in Signals, Systems and Controls**
Contact SIAM : see (6) below.

November 12–16 (New York) **Supercomputing '90**
Contact Supercomputing '90, IEEE Computer Society, 1730 Massachusetts Ave, N.W., Washington, DC 20036–1903, U.S.A.

November 12–16 (Minneapolis, Minnesota) **Microstructure and Phase Transitions**
Contact IMA : see (3) below.

November 18-24 (Oberwolfach, West Germany) **Komplexitätstheorie**
Contact MFOG: see (1) below.

November 25–Dec. 1 (Oberwolfach, West Germany) **Lineare Modelle und Multivariate Statistische Verfahren**
Contact MFOG : see (1) below.

November 25-Dec. 1 (Oberwolfach, West Germany) **Stochastische Approximation und Optimierungsprobleme In Der Statistik**
Contact MFOG: see (1) below.

December 2-8 (Oberwolfach, West Germany) **Multigrid Methods**
Contact MFOG: see (1) below.

December 3–5 (College Park Maryland) **First International Symposium on Uncertainty and Analysis: Fuzzy Reasoning, Probabilistic Methods and Risk Management**
Contact B.M. Ayyub, Department of Civil Engineering, University of Maryland, College Park, Maryland 20742, U.S.A.

December 3–7 (Palmerston North) **Sixteenth Australasian Conference on Combinatorial Mathematics and Combinatorial Computing**
Contact Dr C.H.C. Little, Department of Mathematics and Statistics, Massey University, Palmerston North, New Zealand.

December 9-15 (Oberwolfach, West Germany) **Allgemeine Ungleichungen**
Contact MFOG: see (1) below.

December 13–18 (Osaka, Japan) **Osaka International Conference on Complex Geometry and Related Topics**
Contact Professor S. Murakami, Department of Mathematics, Osaka University, Toyonaka 560, Japan.

December 16-22 (Oberwolfach, West Germany) **Mathematische Logik**
Contact MFOG: see (1) below.

Dec. 25-Jan. 1 (Oberwolfach, West Germany) **Lineare Modelle Und Multivariate Statistische Verfahren**
Contact MFOG: see (1) below.

** 1991 **

January 21–25 (Minneapolis, Minnesota) **Statistical Thermodynamics and Differential Geometry of Microstructured Material**
Contact IMA : see (3) below.

March 11–15 (Minneapolis, Minnesota) **Free Boundaries in Viscous Flows**
Contact IMA : see (3) below.

April 15–19 (Minneapolis, Minnesota) **Variational Problems**
Contact IMA : see (3) below.

May 13–17 (Minneapolis, Minnesota) **Degenerate Diffusions**
Contact IMA: see (3) below.

June 10–14 (Nahariya, Israel) **Bernoulli Society Twentieth Conference on Stochastic Processes and their Applications**
Contact R. Adler, Industrial Engineering and Management, Technion, Haifa 32000, Israel.

June 17–21 (Kobe, Japan) **1991 International Symposium on the Mathematical Theory of Networks and Systems**
Contact H. Kimura, Department of Mechanical Engineering for Computer-Controlled Machinery, Faculty of Engineering, Osaka University, Yamada-oka, Suita, Osaka 565, Japan.

July 1–5 (Bath, England) **The Mathematics of Nonlinear Systems**
Contact J.F. Toland, School of Mathematical Sciences, University of Bath, Claverton Down, Bath BA2 7AY, England.

July 8-12 (Washington D.C.) **Second International Conference on Industrial and Applied Mathematics**
Contact IMA: see (7) below.

July 22-26 (Dublin) **Thirteenth IMACS World Congress on Computing and Applied Mathematics**
Contact J.H. Miller, University of Dublin, School of Mathematics, 39 Trinity College, Dublin 2, Ireland.

August 16–23 (Quebec City, Canada) **ICME7 : Seventh International Congress on Mathematics Education**
Contact D. Wheeler, Department of Mathematics, Concordia University, 7141 ouest, rue Sherbrooke, Montréal, Québec H4B 1R6, Canada.

September (Minneapolis, Minnesota) **SIAM Conference on Applied Linear Algebra**
Contact R.A. Brualdi, Depàrtment of Mathematics, University of Wisconsin, Van Vleck Hall, 480 Lincoln Drive, Madison, Wisconsin 93706, U.S.A.

September 9–17 (Cairo, Egypt) **International Statistical Institute: 48th Biennial Session**
Contact ISI Permanent Office, 428 Prinses Beatrixlaan, P.O. Box 950, 2270 A2, Voorburg, The Nertherland.

Special Contact Addresses:

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

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(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, Maitland House, Warrior Square, Southend-on-Sea, Essex SS1 2JY, England.

M.R. Carter

PROBLEMS AND QUERIES

We have two new problems posed for this issue, a full solution to **P8**, and additional comments to solutions to **P7** and **P15** published in Newsletter number 47. The editors have yet to receive any solutions to **P4** (December 86), **P10** (April 88) and **P16** (December 89).

Problem P17 Squares in triangles II (Ted Zulauf, Waikato University)

Let T be a triangle containing a unit square, and let Δ be the area of T.

(i) Prove that $\Delta \geq 2$,

(ii) Find all triples of interior angles for which $\Delta = 2$.

[See solution to **P8**, below.]

Problem P18 Pythagoras in the limit (Kit Withers and Donal Krouse, AMD Wellington)

Let $q_x(N)$, [$q_y(N)$, $q_z(N)$, respectively] be $1/N$ times the number of distinct positive integer solutions to $x^2 + y^2 = z^2$, $0 < x < y$, with $x \leq N$ [$y \leq N$, $z \leq N$ respectively.] Find

$$\lim_{N\to\infty} q_x(N), \quad \lim_{N\to\infty} q_y(N), \quad \lim_{N\to\infty} q_z(N).$$

[Note Kit and Donal compute $q_x(50) = 0.70$, $q_y(100) = 0.18$, $q_z(100) = 0.13$.]

SOLUTIONS

P8 Squares in Triangles (December 87, posed by T Moore, Massey University.) Find the square of maximal area which fits inside a given triangle. Solution submitted by Ted Zulauf, Waikato University.

Let T be a triangle with angles α,β,γ, where $\alpha \geq \beta \geq \gamma > 0$. Let S be a square that lies entirely inside or on T. Let R be the ratio of the area of T to the area of S, and let R* be the minimum value of R. Let

$$\lambda(\gamma) = \frac{\pi}{2} + \arctan\frac{(1-\tan\gamma/2)^2}{2}.$$

RESULT: If $\alpha \leq \pi/2$ then $R^* = 1 + \frac{1}{2}\left(\cot\alpha + \cot\beta + \frac{1}{\cot\alpha + \cot\beta}\right)$, and $R = R^*$ when S is positioned as in Diagram 1. If $\pi/2 \leq \alpha \leq \lambda(\gamma)$ then $R^* = \frac{1+\sin 2\gamma}{2}\left(\cot\beta + \cot\gamma\right)$, and $R = R^*$ when S is positioned as in Diagram 2. If $\alpha \geq \lambda(\gamma)$ then $R^* = 1 + \frac{1}{2}\left(\cot\beta + \cot\gamma + \frac{1}{\cot\beta + \cot\gamma}\right)$, and $R = R^*$ when S is positioned as in Diagram 3.

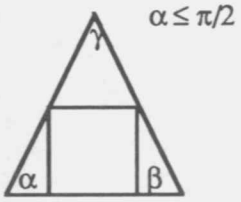


Diagram 1

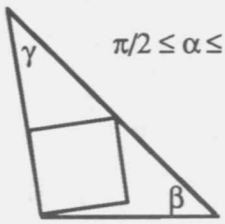


Diagram 2

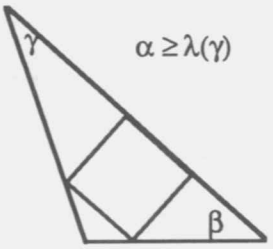


Diagram 3

PROOF: Without loss of generality we may assume that S is a unit square, so that R is the area of T. It is clear that if R is minimal, then each side of T must contain a vertex of S. Let $T(\theta) = ABC$ be the unique counter-clockwise oriented triangle with the following properties: The angles at A, B, C are α, β, γ, and $T(\theta)$ is so circumscribed on S that the vector AC makes the angle θ with a fixed side of S. Let $L(\theta)$ be the length of AB, let $R(\theta)$ be the area of $T(\theta)$, and note that

$$R(\theta) = \frac{\sin\alpha\sin\beta}{2\sin\gamma}\,L(\theta)^2$$

Obviously, $L(\theta)$ and $R(\theta)$ have period $\pi/2$, so that

$$R^* = \frac{\sin\alpha\sin\beta}{\sin\gamma}\,(L^*)^2$$

where L^* is the minimum value of $L(\theta)$ for $0 \leq \theta \leq \pi/2$. We have to consider the cases $\alpha \leq \pi/2$ and $\alpha \geq \pi/2$ separately.

Case(i) Suppose that $\alpha \leq \pi/2$. Then $0 \leq \pi/2 - \gamma \leq \alpha \leq \pi/2$. We note that CA lies along a side of S if $\theta = 0$, BC does if $\theta = \pi/2 - \gamma$, and AB does if $\theta = \alpha$.

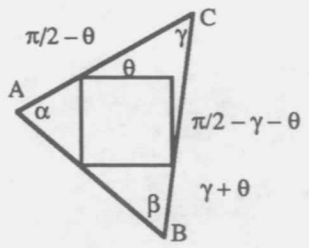


Diagram 4
$0 \le \theta \le \pi/2 - \gamma$

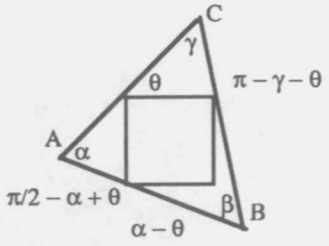


Diagram 5
$\pi/2 - \gamma \le \theta \le \alpha$

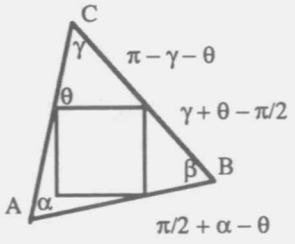


Diagram 6
$\alpha \le \theta \le \pi/2$

If $0 \le \theta \le \pi/2 - \gamma$ (see Diagram 4) then

$$L(\theta) = |AB| = \frac{\cos\theta}{\sin\alpha} + \frac{\cos(\gamma+\theta)}{\sin\beta}.$$

If $\pi/2 - \gamma \le \theta \le \alpha$ (see Diagram 5) then

$$L(\theta) = \frac{\sin\gamma}{\sin\beta}|CA| = \frac{\sin(\gamma+\theta)}{\sin\beta} + \frac{\sin\gamma\cos(\alpha-\theta)}{\sin\alpha\sin\beta}.$$

If $\alpha \le \theta \le \pi/2$ (see Diagram 6) then

$$L(\theta) = \frac{\sin\gamma}{\sin\alpha}|BC| = \frac{\sin\gamma\cos(\theta-\alpha)}{\sin\alpha\sin\beta} + \frac{\sin\theta}{\sin\alpha}.$$

Now $L(\theta)$ is seen to be continuous for all θ, and if θ is not congruent mod $\pi/2$ to 0, $\pi/2-\gamma$ or α, then $L''(\theta) = -L(\theta) < 0$. Hence L^* must equal either

$$L(0) = \frac{1}{\sin\alpha} + \frac{\sin\gamma}{\sin\beta} \quad \text{or} \quad L(\pi/2-\gamma) = \frac{1}{\sin\beta} + \frac{\sin\gamma}{\sin\alpha} \quad \text{or} \quad L(\alpha) = \frac{\sin\gamma}{\sin\alpha\sin\beta} + 1.$$

But

$$\sin\alpha\sin\beta\,[L(\pi/2-\gamma) - L(0)] = (\sin\alpha - \sin\beta)(1 - \sin\gamma) \ge 0;$$
$$\sin\alpha\sin\beta\,[L(0) - L(\alpha)] = (\sin\beta - \sin\gamma)(1 - \sin\alpha) \ge 0$$

Hence $L^* = L(\alpha)$ and, by (1),

$$R^* = \frac{(\sin\alpha\sin\beta + \sin\gamma)^2}{2\sin\alpha\sin\beta\sin\gamma} = 1 + \frac{\sin\gamma}{2\sin\alpha\sin\beta} + \frac{\sin\alpha\sin\beta}{2\sin\gamma}$$

$$= 1 + \frac{1}{2}\left(\cot\alpha + \cot\beta + \frac{1}{\cot\alpha + \cot\beta}\right).$$

Case(ii)

Now suppose that $\alpha \geq \pi/2$. Then $0 \leq \alpha - \pi/2 \leq \pi/2 - \gamma < \pi/2$. We note that CA lies along a side of S if $\theta = 0$, AB does if $\theta = \alpha - \pi/2$, and BC does if $\theta = \pi/2 - \gamma$.

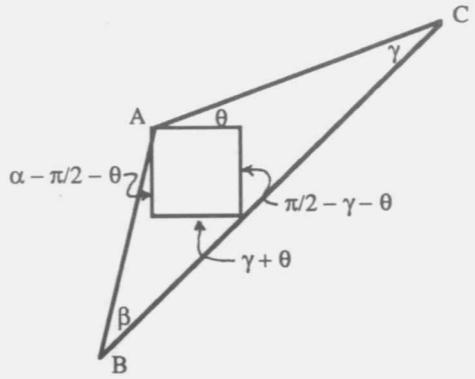


Diagram 7
$0 \leq \theta \leq \alpha - \pi/2$

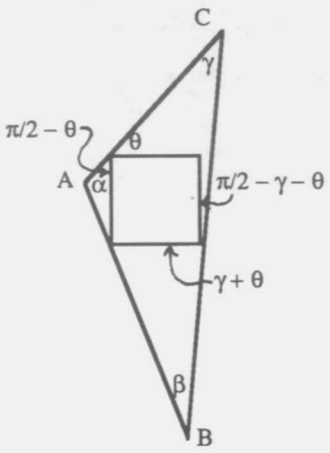


Diagram 8
$\alpha - \pi/2 \leq \theta \leq \pi/2 - \gamma$

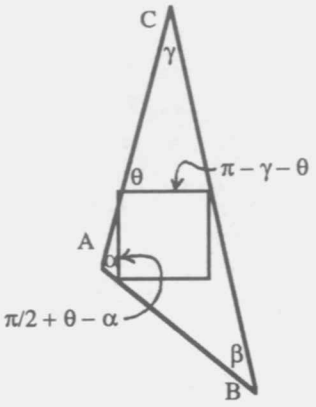


Diagram 9
$\pi/2 - \gamma \leq \theta \leq \pi/2$

If $0 \leq \theta \leq \alpha - \pi/2$ (see Diagram 7) then

$$L(\theta) = |AB| = \frac{\sin\left(\frac{\pi}{4} + \gamma + \theta\right)\sqrt{2}}{\sin\beta}.$$

If $\alpha - \pi/2 \leq \theta \leq \pi/2 - \gamma$ (see Diagram 8) then

$$L(\theta) = |AB| = \frac{\cos\theta}{\sin\alpha} + \frac{\sin(\gamma + \theta)}{\sin\beta}.$$

If $\pi/2 - \gamma \leq \theta \leq \pi/2$ (see Diagram 9) then

$$L(\theta) = \frac{\sin\gamma}{\sin\beta}|CA| = \frac{\sin(\gamma + \theta)}{\sin\beta} + \frac{\sin\gamma\cos(\alpha - \theta)}{\sin\alpha\sin\beta}.$$

Arguing as in Case (i) we see that L* must equal either

$$L(0) = \frac{\sin\left(\frac{\pi}{4} + \gamma\right)\sqrt{2}}{\sin\beta} = \frac{\sin\gamma + \cos\gamma}{\sin\beta},$$

or

$$L(\alpha - \pi/2) = \frac{\sin\left(\frac{\pi}{4} + \beta\right)\sqrt{2}}{\sin\beta} = 1 + \cot\beta \quad \text{or} \quad L(\pi/2 - \gamma) = \frac{\sin\gamma}{\sin\alpha} + \frac{1}{\sin\beta}.$$

But

$$\frac{\sin\beta}{\sqrt{2}}\left(L(\alpha - \pi/2) - L(0)\right) = \sin\left(\frac{\pi}{4} + \beta\right) - \sin\left(\frac{\pi}{4} + \gamma\right) = 2\cos\left(\frac{\pi}{4} + \frac{\beta + \gamma}{2}\right)\sin\left(\frac{\beta - \gamma}{2}\right) \geq 0;$$

$$\sin\beta\left(L(0) - L(\pi/2 - \gamma)\right) = \sin\gamma + \cos\gamma - 1 - \frac{\sin\beta\sin\gamma}{\sin\alpha}$$

$$= \sin\gamma + \cos\gamma - \cos\gamma\sin\gamma - \cot\alpha\sin^2\alpha$$

$$= \sin^2\gamma \left[\tan(\alpha - \pi/2) - \frac{1}{2}\left(1 - \tan\frac{\gamma}{2}\right)^2\right].$$

Hence $L^* = L(0)$ or $L(\pi/2 - \gamma)$ according as $\alpha \leq$, or $\geq, \lambda(\gamma)$, and

$$R^* = \frac{(\sin\gamma + \cos\gamma)^2 \sin\alpha}{2\sin\beta\sin\gamma} = \frac{1 + \sin 2\gamma}{2}(\cot\beta + \cot\gamma) \quad \text{if } \alpha \leq \lambda(\gamma),$$

$$R^* = \frac{(\sin\beta\sin\gamma + \sin\alpha)^2}{2\sin\alpha\sin\beta\sin\gamma} = 1 + \frac{\sin\alpha}{2\sin\beta\sin\gamma} + \frac{\sin\beta\sin\gamma}{2\sin\alpha}$$

$$= 1 + \frac{1}{2}\left(\cot\beta + \cot\gamma + \frac{1}{\cot\beta + \cot\gamma}\right) \quad \text{if } \alpha \geq \lambda(\gamma).$$

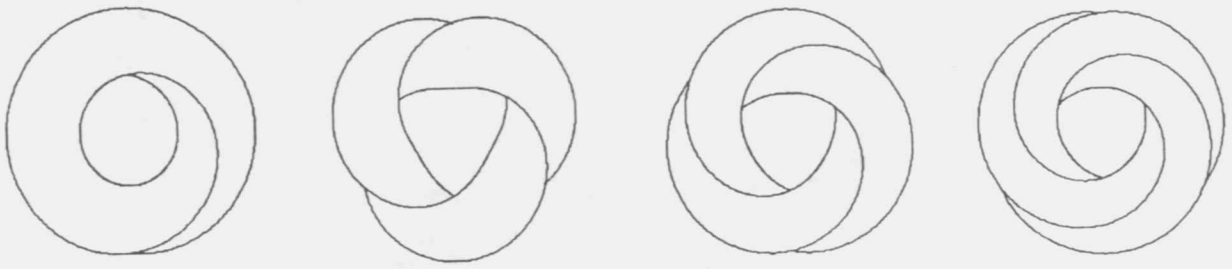
This completes the proof.

John Harper, Victoria University, has the following comment on the bowling problem (**P7**) and the solution submitted by M Steel (December 88):

> The bowling problem is not new. It has already been analysed by a member of the VUW Physics Department, T.G.L. Shirtcliffe, Phys. Educ. 14, 78-81, (1979), "Lawn bowls and Newton's laws of motion". Steel assumed friction and bias forces proportional to velocity without physical justification, Shirtcliffe assumed them independent of velocity and explained physically why that approximation is good in both cases. Shirtcliffe also concluded that the same bowl projected in a given direction at various initial speeds will stop at various points along a given straight line, and he gave the paths followed for various ratios of bias to frictional acceleration. The former has international variations (0.11 ms^{-2} standard in NZ), the latter depends on the state of the green (0.16 to 0.86ms^{-2} in practice).
>
> I am sorry I did not remember Shirtcliffe's work and tell NZMS about it when Problem P7 was first published.

Philip Ngan and Donald Bailey, of the Image Analysis Unit, Massey University comment on problem **P15** (August '89), pointing out that The Massey logo is in fact a square rotated by $3\pi/2$ per revolution, not an equilateral triangle rotated $2\pi/3$ per revolution. They have produced four toroidal figures (reproduced below) for comparison.

Consider a torus T of circular section with internal radius a and sectional radius a/2. Inscribed in this torus is a ring with regular N-gon section, such that the verices of the N-gon are on the surface of the torus. On rotation θ around the torus the N-gon section rotates ϕ.



(a) (b) (c) (d)

(a) $N = 3$, $\phi = \theta/3$. An equilateral triangle rotated by $2\pi/3$ per revolution of the ring.
(b) $N = 3$, $\phi = \theta$. An equilateral triangle rotated by 2π per revolution of the ring.
(c) $N = 4$, $\phi = 3\theta/4$. A square rotated by $3\pi/2$ per revolution of the ring.
(d) $N = 5$, $\phi = 3\theta/5$. A regular pentagon rotated by $6\pi/5$ per revolution of the ring.

[Editors' Note: Our apologies for this inaccuracy. The problem was inspired by the toroidal figure on the poster displayed at the 1989 Colloquium which does fit the given description. However, it was difficult to reproduce, we selected the Massey logo in its place.]

Graeme Wake will be absent from Massey for the next six months, so contributors are asked to send their contributions for this section to Mike Hendy (E-mail address: M.Hendy@Massey.ac.nz FAX: (063) 505611) for the next issue.

G C Wake, M D Hendy
Massey University

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SPECIAL NOTICE

The Council of the New Zealand Mathematical Society would be very pleased to know about visitors who may be suitable candidates for the annual N.Z.M.S. Visiting Lectureship. This lectureship usually entails a 3-week tour of the main centres of New Zealand, giving two or three lectures to general and specialist audiences in each place. Suggestions or nominations may be sent either to the N.Z.M.S. President (Dr. Gillian Thornley, Department of Mathematics & Statistics, Massey University, Palmerston North), or to Dr. Marston Conder (Department of Mathematics & Statistics, University of Auckland, Private Bag, Auckland).

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Crossword No. 29 Solution

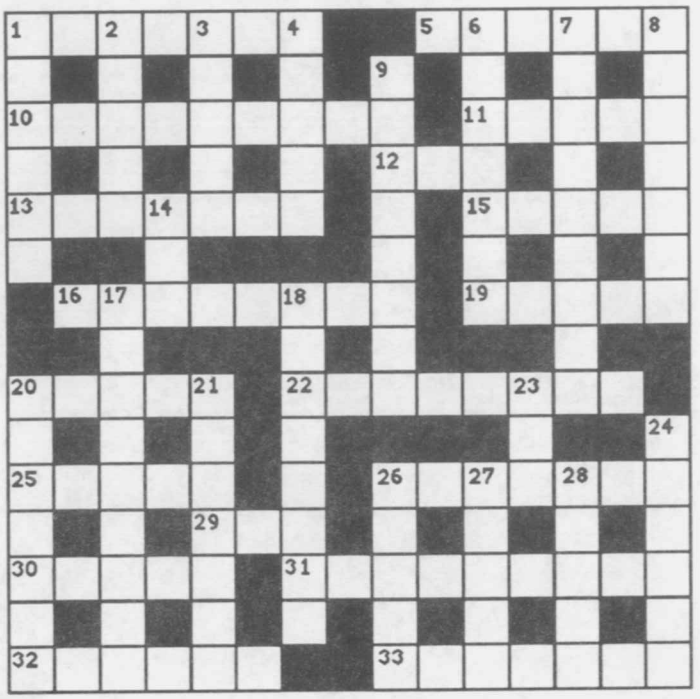
1 B	E	2 R	N	3 H	A	4 R	D	5 N	E	6 U	M	7 A	N	8 N
E	■	I	■	O	■	E	■	E	■	N	■	N	■	U
9 S	I	G	N	S	■	C	■	M	■	10 I	N	N	E	R
I	■	H	■	11 E	L	E	M	E	N	T	■	U	■	S
12 D	A	T	13 E	S	■	N	■	A	■	14 S	15 A	L	V	E
E	■	■	N	■	■	16 T	17 E	N	■	■	B	■	■	R
18 S	19 A	U	C	E	20 R	■	I	■	21 T	H	E	O	22 R	Y
■	R	■	L	■	23 E	A	G	L	E	■	L	■	O	■
24 E	C	H	O	E	D	■	H	■	25 E	L	I	X	I	26 R
N	■	■	S	■	■	27 E	T	28 A	■	■	A	■	■	E
29 T	I	30 M	E	31 S	■	Q	■	N	■	32 A	N	33 I	T	A
R	■	U	■	34 Y	O	U	N	G	E	R	■	R	■	P
35 E	N	R	O	L	■	I	■	L	■	36 G	R	O	U	P
A	■	A	■	O	■	37 T	O	E	■	O	■	N	■	L
38 T	O	L	L	W	A	Y	■	39 S	P	L	A	S	H	Y

CROSSWORD

No 30

by Matt Varnish

400+



Across

1. 200 (1,6)

5. 300 (6)
10. 400 (9)
11. Cubism not bowled made something to face (5)
12. Hard water in command of the east (3)
13. Two are needed for a match (7)
15. Worcester? My dear old thing! Caught batting amid laughter (5)
16. Non-batting author (8)
19. Having proboscis poked about (5)
20. 117 (5)
22. The many paramount working clothes of 24d? (8)
25. A ball, perhaps Hamlet has the catch (5)
26. Have we a chat field in Perth? (3,4)

29. 374 (3)
30. Aleph, oddly about garment (of byssus?) (5)
31. 1 (4,5)
32. Syd's got the decision where clerics meet (4,5)

33. Give the right, to be with Lords perhaps (7)

Down

1. 1a, 5d, 10a, 20a, 31a, and 17d give the 1d of the 7d by 8d 24d. The answers give the names (6)
2. Lightweight animal from Oz? (5)
3. Eager to concur (5)
4. Members of Amritsar sect (5)
6. Calm one bowled over about early Mexicans (7)
7. see 1d (9)
8. and 24d; see 1d (7,6)

9. Euclid's instrument? (8)
14. Contend opening with a six (3)
17. 100 (5,4)
18. Warship clothed with metal (8)
20. Gave up, batted an eyelid and died (7)
21. Those upholsterers about to bat salute 8d 24d affectionately (7)
23. In letters out (1,1,1)
24. see 8d.
26 More than once the King left a broken wicket (5)
27. Put out, the English start with six, caught before tea (5)
28. Game opening lacks gravity for region within boundary (5)

(The soolution to Crossword No. 29 is on the previous page.)