

# THE NEW ZEALAND MATHEMATICAL SOCIETY

## NEWSLETTER

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## Editorial

### EDUCATIONAL POLICIES IN NEW ZEALAND

The report with this title was prepared for the O.E.C.D. Examiners by the Department of Education in March 1982. It caused some comment at the time; perhaps the two extracts below may excite a little more discussion now.

§12 Education has long been seen by New Zealanders as a means of personal betterment ... A statement made in 1939 by Hon. Peter Fraser ... has come to be seen by New Zealanders as the clearest formulation of what they expect ... "The Government's objective, broadly expressed, is that every person, whatever his level of academic ability, has a right, as a citizen, to a free education of the kind for which he is best fitted and to the fullest extent of his powers."

§28 The system is now largely free from teacher shortage ... Some secondary schools still have difficulty recruiting teachers of English, mathematics and science. There is, at all levels, a lessening demand for teachers and the quality of the new recruits is improving.

However, cost-cutting had already begun to undermine these liberal ideals, and now monetarist philosophy threatens to finish the job. In these times of hardship, the direct simplicity of such ideas carries instant conviction to many voters, who are thereby spared the effort of thinking over their long-term consequences or over alternatives: mob democracy by slogan.

Along with this philosophy goes a network of procedures and attitudes which does not (and perhaps can not) accommodate

- values and value-judgments, which tend to be ignored, or imposed from outside,
- long term or speculative research, with no guarantee of pay-off,
- basic research, without immediate external goals, to give just a few examples.

Further, many people involved in education and research have little capacity or liking for the combination of self-advocacy, administrative expertise and political know-how which seems to be needed for success in a commercial world.

To survive, we may have to

- become much more public than we are used to (and this may involve paying for commercial expertise),
- try to find a compromise philosophy, incorporating more acceptable ideas such as 'accountability', and
- get actively involved in the processes of government, by getting mathematicians, scientists and so on onto the parliamentary (research) staff, say. (So far, statutory bodies such as the R.S.N.Z. tend to react and respond rather than initiate and lobby.)

We are neither the first to have such problems, nor alone in having them. For example, see the Proceedings of the 1985 Mathematics-In-Industry Study Group, a recent and helpful CSIRO report edited by N.G. Barton and J.D. Gray.

M. Schroder

# Sub-editorial

In the last Newsletter, I commented, "This Centrefold really is a fraud..." Some readers took that more literally than I intended, and thought that the facts were wrong or that the photo was of someone else. As far as I know, the facts are true and the photograph does portray Dr Saunders. I apologise for any confusion or pain my comment caused.

In the last Newsletter, Bob Long's report from Canterbury referred to Graham Wood's "account of the meeting" on global optimization "elsewhere in this issue". In fact it appears in this issue. Again, I must apologise.

This issue offers the first FORUM, an occasional feature in which readers and contributors can raise and discuss mathematical, political and educational topics.

## COUNCIL, 1986/7

|                          |                     |            |           |
|--------------------------|---------------------|------------|-----------|
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|                          | Dr Gillian Thornley | Massey     | (to 1989) |
|                          | Dr Brent Wilson     | Canterbury | (to 1988) |
| Editor:                  | Dr Mark Schroder    | Waikato    |           |

## ACTION ON THE GLOBAL OPTIMISATION PROBLEM

In early December of last year, in the depths of the Hungarian winter, about forty mathematicians from all over the globe gathered in a hotel in Sopron (a small and historic town just behind the iron curtain) to exchange ideas on the global optimisation problem. The problem is to find a satisfactory algorithm to locate the global optimum of an objective function with many local optima.

Broadly speaking those attending fell into two schools: those who proposed deterministic methods (based usually on the value of a Lipschitz constant which constrains the variation of the objective function) and proponents of stochastic sampling methods (who typically follow a random sampling of starting values by a series of local searches using a Newton-type algorithm). I confess to being a member of the first group. For the user, what this really means is that either you opt for certainty in your conclusion and pay the price of an enormous number of function evaluations, or you settle for a reasonable number and uncertainty at the end concerning your answer.

The workshop was organised by the System and Decision Sciences Program at IIASA, the International Institute for Applied Systems Analysis. This is a non-governmental research institute founded in Europe in 1972 and supported by 16 countries (New Zealand is not a member). One of the goals is to promote gatherings such as the one in Sopron where a key problem is scrutinised, reviewed and promising directions for future research discussed.

One of the outcomes was a decision to assemble a set of standard test problems for global optimisation routines (within the next few months) with a view to isolating the most promising algorithms. At the moment the lack of any such "industry standards" is making comparisons very difficult. Then within eighteen months or so the permanent staff of the SDS program (a handful of mathematicians in Laxenburg, Austria) hope to issue a library of the best available global optimisation routines. This will be the first step in remedying the thoroughly unsatisfactory situation which exists today.

Graham Wood  
Canterbury

# Forum

## MATHEMATICS SYLLABUS REVIEW:

### FORMS 5 TO 7

On 7 May this year, Mr A. Begg, the Education Officer (Mathematics) in the Department of Education, distributed a discussion paper on this topic to "Individuals and Groups Interested in Mathematics Education". Nevertheless, it was not widely distributed in this University at least: none of us had heard of it.

To give professional mathematicians an opportunity to take part in this discussion, I reproduce the entire paper, along with responses from D. Vere-Jones (Victoria University) and from the Auckland Mathematical Association.

The Editor

## DISCUSSION PAPER # 1

### CONTENTS

- 1 Introduction
- 2 Concerns
- 3 Assumptions
- 4 Aims
- 5 Modular Structure of a Course
- 6 Possible Structure of a Module Guideline
- 7 Future Action
- 8 List of Members
- 9 Response Sheet

### 1 INTRODUCTION

This year a review committee was set up to consider the mathematics syllabus in the forms 5 to 7 area. It was recognised that the four examination prescriptions for forms 5 to 7 had recently been altered but that some aspects of senior school mathematics may still need attention.

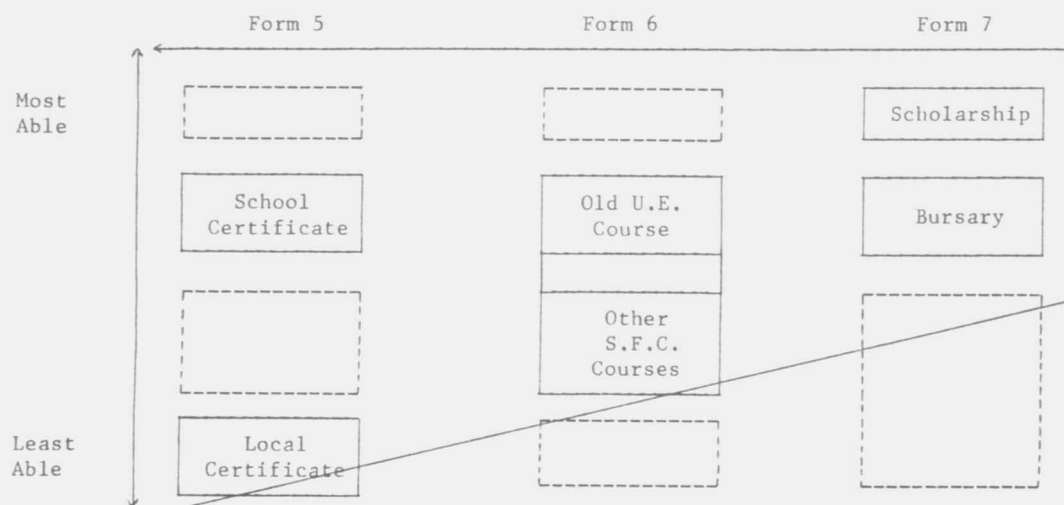
The committee was set up with a broad range of interest groups nominating members although not all members were able to attend the first meeting. For the list of members see 8.

The committee decided it wished to involve as many teachers and other interested people as possible in the review and decided to circulate a discussion paper at each stage of its proceedings. This paper is the first of at least 4 papers which will be seeking feedback in the next year or two. The committee is keen to hear of any aspects of senior school mathematics that people wish to comment about.

### 2 CONCERNS

The committee discussed concerns about existing senior mathematics. These fell into seven areas.

- (i) The needs of all students are not being met by present courses. This diagram shows the ability ranges catered for by present courses (in solid blocks) and the ability ranges not at present being catered for (in broken blocks). Above the oblique line represents the present school population while below the line represents the probable population if retention rates increase as expected.



Other groups may not have their needs satisfied, these may be students in particular geographic regions, or other groups.

- (ii) The Cockcroft report states that at present teaching methods give insufficient emphasis to: discussion, practical work, consolidation, problem solving, applications, and investigational work.
- (iii) Local Certificate satisfies a real and proven need but students are not getting appropriate recognition for their efforts.
- (iv) Assessment has often, through examination prescription, dominated senior mathematics programmes. This has led to an emphasis on easily examinable skills.
- (v) Syllabuses often seem to have no link between their aims and suggestions in the introduction, and their content part.
- (vi) Changes in mathematics have overwhelmed some teachers. Future change should be evolutionary rather than sudden, it should follow some experimentation and evaluation, and it should arise from student needs (i.e. be bottom-up rather than top-down development.)
- (vii) Support needs to be given to teachers when involved with curriculum change.

### 3 ASSUMPTIONS

The committee established assumptions that they considered basic to a curriculum structure. These fell into four main categories:

#### Teaching Approach

- : should be regarded as more important than content
- : should put greater emphasis on processes (interpreting, testing, justifying, selecting appropriate methods, etc.) rather than skills (computation, factorising, etc.)
- : should emphasise practical work, investigations, problem solving, applications.

#### Structure of a Curriculum

- : should allow for individual (school, class, student) choice
- : should enable schools to fit existing patterns into the structure
- : should allow for ongoing curriculum development
- : should allow for experimentation and new developments
- : should encourage bottom-up rather than top-down development
- : should cater for students who wish to participate in external courses.

#### Implementation

- : resources and guide notes should be provided for schools before they are expected to implement new parts of a course
- : pre-service and in-service training should be provided
- : should encourage teacher development by providing opportunities to participate in experimentation and curriculum development.

#### Assessment

- : should be the servant of the curriculum rather than dictate it
- : should evaluate the aims of the course rather than assessing mainly the skills related to the content.

#### 4 AIMS OF MATHEMATICS EDUCATION

Mathematics education in forms 5 to 7 must achieve the general aims of the broad secondary school curriculum (see A) and needs to ensure that all students should:

- enjoy their learning of mathematics (see B)
- be actively involved in exploring mathematics (see C)
- appreciate and feel confident with the place of mathematics in the world (see D).

##### A: General

Mathematics education should:

- promote personal development
- develop self esteem
- engender a concern for others
- encourage an attitude of enquiry
- develop critical awareness
- develop creativity, resourcefulness, self reliance and perseverance
- develop the skills of communication
- encourage accurate and precise expression of ideas
- prepare students for everyday life including work, leisure and further education.

##### B: Learning

Students should:

- develop research and study skills
- develop patterns of logical reasoning
- develop a feeling for generalisations, informal and formal proof including counter-examples
- appreciate mathematics in the physical and aesthetic environment
- experience a variety of mathematical activities for the intrinsic satisfactions that they produce through feelings of enjoyment and success.

##### C: Explorations

Students should:

- undertake mathematical investigations
- make observations, draw conclusions and form generalisations
- develop the ability to analyse, plan and interpret.

##### D: Mathematics in the world

Students should:

- use diagrams, symbols and notation appropriately
- identify patterns and relationships in mathematics and elsewhere
- apply mathematics to new situations
- relate mathematics to other subjects in the curriculum
- be alert to the reasonableness of results
- make use of appropriate technology
- appreciate the contribution of mathematics to all cultures
- explore real and simulated problems using mathematics.

#### 5 MODULAR STRUCTURE OF COURSE

The committee considered various types of course structure and concluded that the assumptions and aims previously mentioned were best met using a modular structure.

##### 1. What is a modular course?

A module represents about 12 hours of coursework (i.e. about 3 weeks' work).

At each form level there would be a number of modules from which a selection would be made and an appropriate course of study organised.

A course would consist of 10 modules (under some conditions this could be varied).

Sufficient modules would be available to cater for the full range of student needs at each level.

The structure allows for the retention of existing courses while also encouraging experimentation and development.

## 2. What modules would there be?

Initially modules would be available to give coverage of existing courses at each form level, e.g., at fifth-form level the range of modules would cover the requirements of the present school certificate, local certificates, levels schemes, etc.

Further modules would be available to add immediate flexibility.

Later modules would be developed (nationally or locally) to meet specific needs not already catered for, e.g. career-related modules, modules for independent study, subject-related modules, modules for special groups (ethnic-related, ability-related, etc.).

## 3. How would courses be designed?

The selection of modules for a course could be made by the school, the teacher, or the students, depending on the school's policy and resources.

Some modules would require the study of previous or concurrent modules and these links would need to be established.

The selected modules would be arranged into a course that may have some modules spread throughout the year and others done in single blocks.

## 6 POSSIBLE STRUCTURE OF A MODULE GUIDELINE

| Headings  | Example  |
|---|--|
| Aims  | Appreciation of mathematics in the real world...   |
| Justification   | Enable the measurement of inaccessible distances...  |
| Target Group  | Form 5, whole class  |
| Prerequisite knowledge  | Parts of a triangle, ratio...  |
| Content   | Establish definitions for sin, cos, tan...<br>application the heights of...  |
| Approaches  | Problem solving "How do you find the height of that tree over there?"...<br>Use of practical equipment - clinometer, tape measures...  |
| Activities - introductory<br>- remedial<br>- extension<br>- maintenance             | Drawing and measuring sides of triangles, finding the height of a tree on sloping ground   |
| References - teacher<br>- student   | Reference books<br>Text  |
| Resources - teacher<br>- student  | Clinometers, trees...<br>Calculators   |
| Timing (+ order)  | Total module to take approximately 12 hours<br>(a) in term 1                      (b) in term 2<br><br>(a) 8 hours: trig ratio and right-angled triangles<br>(b) 4 hours: extension into other triangles |
| Links to - other modules<br>- other subjects  | Pythagoras' theorem...<br>technical drawing, workshop technology...  |
| Applications  | Design, navigation...  |
| Assessment - student evaluation<br>- module evaluation<br>- teacher self-evaluation | Assignment, practical work, interview, tests, examination...   |

## 7 FUTURE ACTION

In planning, the programme was divided into five stages:

- (1) Deciding on a course structure
- (2) Organising the content to suit the course structure
- (3) Formulating assessment procedures
- (4) Producing draft resources
- (5) Obtaining final approvals

Each stage includes a discussion and feedback phase and if the feedback is negative, the stage will be repeated. This discussion paper is the discussion phase of stage 1. To help you in the discussion phase it may be worthwhile to arrange regional meetings and get a member of the review committee to it.

## 8 LIST OF MEMBERS

The syllabus review committee membership includes 15 full members and 6 consulting members.

|                             |   |  |
|-----------------------------|---|--|
| Department                  | Andy Begg<br>Monte Ohia<br>Bevan Werry                                    | Curriculum Development<br>Maori and Island Education<br>Curriculum Development         |
| PPTA                        | Annette Joyce<br>Paul Towers  | Tauranga Girls College<br>South Otago High School                                      |
| AHISS                       | Dawn Jones  | Diocesan School  |
| Teachers (Nominated by ISS) | NRO Sue Barr<br>HM Jim Wilkinson<br>CRO Jeanette Aker<br>SRO Alison Price | Rodney College<br>Western Heights High School<br>Kapiti College<br>Waimate High School |
| Advisers                    | Murray Carr   | Education Department, Hamilton   |
| TCA                         | John Good   | Auckland College of Education  |
| AAVA/ATTI                   | John Sealy  | Auckland Technical Institute   |
| SCEB                        | Mike Murtagh  | University Entrance Board  |
| UEB                         | Ivan Reilly   | University of Auckland   |

... and consulting members nominated by:

Combined State Unions  
National Youth Council  
NZ Employers' Federation  
NZ Federation of Labour  
NZ Maori Council  
Secondary Schools Board Association

## 9 RESPONSE

from \_\_\_\_\_  
of \_\_\_\_\_

Please send your answers to the following questions to:  
Andy Begg (Ed O Mathematics),  
Department of Education, Private Bag, Wellington,  
by October 1986.

- (a) What are your reactions to the committee's concerns? Would you add or delete any?
- (b) What are your reactions to the assumptions the committee made?
- (c) What are your reactions to the committee's choice of aims for mathematics education?
- (d) What are your reactions to a modular structure for form 5 to 7 mathematics?
- (e) Any other comments?



RESPONSE from D. Vere-Jones

I am taking advantage of the invitation to respond to the first discussion paper of the Review to raise a number of concerns. While some are specifically related to the content of the discussion papers, other are more general. If you feel that are not properly the concern of the Review Committee itself, I would be grateful if you could pass them to the appropriate authorities.

Part of my concern is to involve a wider range of professional groups in this discussion, and for this reason I have sent copies of this letter to the Editor of the Mathematics Magazine, as well as to the Newsletters of the NZ Maths Society, the NZ Statistics Association, the NZ OR Society, the NZ Society for Market Research, the New Zealand Society for Quality Assurance, the Society of New Zealand Actuaries, and to the Council of the Royal Society of New Zealand.

#### 1. Constitution of the Syllabus Review Committee

I am deeply concerned at the paucity of professional and university mathematicians on your Committee, and the total lack of representation of the professional mathematical organisations. The latter are not even listed among the groups nominating consulting members. The school syllabus directly involves elements of statistics, mathematics, insurance, etc., and we are repeatedly advised that the aims of the upper school programme should include preparing students for life, showing them how mathematics is applied in real life situations, how it is used in New Zealand, etc. Why then are none of the relevant groups actually consulted about the syllabus?

Turning to the paucity of the University representation, while it is true that their particular interest in entry standards is recognized through the appointment of a representative of the Entrance Board, in my view this is a rather narrow aspect of their interest and is not the overriding reason for seeking their views more fully. The more serious reason, in my view, is that the universities contain, in their departments of mathematics, statistics, operations research, etc., the major source of knowledge in New Zealand concerning new developments in mathematics and likely trends for the future. Moreover, many staff have a long-standing personal interest in mathematical education in the schools, and some a professional interest in this subject also. I hardly need remind you of the dedication shown by the many university staff who worked side by side with school teachers in preparing texts for the new 6th and 7th form courses, nearly always on top of their normal teaching and research duties. Surely they deserve a better recognition of their concern than just one representative of the Universities' Entrance Board!

My anxieties on this particular issue spill over into a more general concern about the constitution of syllabus review committees likely to be set up under the proposed Board of Studies, if such comes into being. One of the better features of the old UE arrangements was the collaboration on syllabus matters forced onto both schools and universities by the need to devise a 6th form programme that could also serve as a basis of university entrance. I have felt able to support the Board of Studies concept because of repeated assurances that this collaboration would be maintained. The constitution of the present syllabus review committee is not at all reassuring from this point of view, and a matter which I intend to raise at the next Entrance Board meeting.

Finally I would like to draw attention to the service aspects of mathematics in the upper secondary schools. The present users of mathematics go well beyond those disciplines traditionally regarded as having a mathematical or quantitative orientation. A first attempt to ascertain the actual needs of such groups was made in developing the 7th form "Mathematics with Statistics" course. I would like to see a more systematic attempt made to ascertain the needs of user disciplines, both traditional and recent, and some representation of those groups on the Committee itself. The future of mathematics in the upper schools may well revolve around its success in serving those needs, and these may be rather different from the perceptions of them by mathematicians or mathematics teachers.

#### 2. Discrepancy between the seriousness of the problems and the resources available to the committee

In the last few decades, mathematics education has been recognised as a major problem area in almost all western countries, and indeed more widely. In the UK, recognition of these issues led to the setting up of a major national committee, and the production of a substantial, path-breaking report (the Cockcroft Report). Our situation in New Zealand is hardly less serious, and may well be worse, to judge from the dismal performance of our students on the basis of international comparisons. Presumably the present review should be regarded as one

major attempt to get to grips with these issues, at least insofar as they affect the upper secondary school. My concern here is that the Committee has not been set up in a way which gives due cognizance to this situation. It does not appear to me that it sees its task in this light, nor that its resources are likely to be such as to enable it to give more than superficial consideration to the underlying issues. It will take more than a Lopdell House course and a series of bland questionnaires to resolve the problems of mathematical education in New Zealand.

If, on the other hand, this is not to be seen as the role of the Syllabus Review Committee, when may we, as parents and New Zealand citizens, be reassured that the issues are in hand? Granted these more general problems, should a syllabus review be the top priority?

As a specific instance of these larger issues consider the question of teacher shortages. I share with, I believe, most of my colleagues, the view that the single most serious problem facing mathematics teaching in New Zealand is the shortage of qualified mathematics teachers. The tendency in the past has been for syllabuses to be developed by outstanding teachers, only to be put into operation by teachers who are lucky if they have any relevant training at all. Moreover, the school scene itself is changing very rapidly, for example, with the advent of microcomputers, and not least in mathematics. These factors require a substantial input of resources, first to recruit new teachers, and second to retrain old teachers. I do not think it can be argued that the two aspects, syllabus change and teacher shortage, can be divorced from each other - indeed it would be more logical to argue the reverse, that there is no point in changing syllabuses until there is some guarantee of suitably qualified staff to teach them.

As another, possibly more recondite but still important instance, let me raise the question of teaching mathematics to children with a Maori or Polynesian background. In all the years that I have been at Victoria I can recall only one Maori student in my 3rd year mathematics class, and one part-Maori student at graduate level. This is in sharp contrast to Chinese or even Vietnamese minorities, which comprise only a tiny proportion of the community, but furnish significant numbers of 3rd and 4th mathematics students. Although the differences here are no doubt based on rather profound differences in culture, yet the schools might play some role in so addressing mathematical topics that they seem more relevant, accessible, or attractive to Maori children. So far as I know, mathematics in our schools is almost exclusively Western in concept, deriving ultimately from the influence of Greek thought and culture. By contrast, mathematics as such hardly exists in Polynesian cultures, or if so, in a totally different framework to that in which it is taught in our schools. Are such points relevant to the syllabuses, and if so, how should they be taken into account?

As increasing percentages of the age cohort pass into the upper secondary schools, both of these questions, which are only instances of the deeper issues underlying the problems of mathematical education, will come to be felt with increasing force. My concern is that neither this committee, nor any other that I have heard of, will have the resources or even the intention to study the underlying problems in depth. As a consequence, I fear that we cannot look to more than superficial improvements arising from their recommendations, however desirable these may seem in isolation.

### 3. The Structure of the Course

Turning to the matters covered in Discussion Paper 1, I would like to seek clarification from the Committee of the grounds on which it decided to support a modular structure for the Form 5-7 programme. I am not necessarily against this proposal, and certainly one can recognise it as one important option. However, my concern is that, in recommending such a major move, the Committee should set out its reasons; otherwise its choice appears as a mere arbitrary decision of the group who happened to be concerned at the time.

In making this comment I have particularly in mind that the GCSE National Syllabus recommendations recently promulgated in the UK take a quite different view. They suggest that a series of different levels should be available for the same examination, more specifically that

"[Any scheme of assessment should] offer differentiated examination papers so that, by choosing papers at an appropriate level, pupils are enabled to demonstrate what they know and can do rather than what they do not know and cannot do."

I take this to be something rather different from the modular approach suggested by the Committee.

Another view again was expressed in a commentary on mathematics teaching in the Japanese secondary schools prepared by Professors Fujita and Terada for the ICME Conference in Adelaide.

They suggest:

"According to our experience, any mathematics subject intended for low attainers can never become popular. Students and their parents reject explicit remedial courses. They prefer 'one and single track'."

I take this to be an argument in favour of a single integrated curriculum.

#### 4. Teacher Support

The section of the report labelled "concerns" is that with which I can identify most easily. Point (7), meeting teachers' support needs when changing curricula, is particularly poignant, in view of the difficulties teachers have faced just this year in trying to get hold of support material for the new Form 7 courses. When the proposals to introduce the new courses for 1986 were passed by the Entrance Board, my impression was that all parties concerned were committed to the aim of getting the teaching materials ready by the end of 1985. Indeed, I saw much of the draft Guide Note material during 1985 and understood that its preparation was well in hand. What, then, went wrong?

I believe that a clear explanation is owed to mathematics teachers by the Department not so much to apportion the blame, but to understand what steps should be taken to be really sure that the same difficulties will not recur the next time. I have been back in Wellington for a month, and have already heard at least two different versions of what went wrong. This seems to me an undesirable situation.

I also doubt in retrospect whether one-day refresher courses, of which I attended several, are really adequate when substantial syllabus changes are in view. More substantial opportunities for retraining, particularly with teachers whose initial qualifications in mathematics may be minimal, are really essential if the changes are to be effective. Of course this reverts to the general point already made in §2 above.

In conclusion let me say that, notwithstanding the critical nature of the above comments, I fully endorse the Committee's efforts to obtain an overall view of the progression in mathematics teaching from Forms 5-7, something which has been badly needed for many years. I shall be glad if my comments help to emphasise the broad dimensions of this task, and to dissuade the Committee from trying to side-step some of the underlying problems relating to mathematics teaching in New Zealand schools. I look forward to receiving its further Discussion Papers.

#### RESPONSE from the Auckland Mathematical Association

"MINISTERIAL REVIEWS: CURRICULUM AND ASSESSMENT" - AMA Responds  
The Auckland Mathematical Association Executive

On consideration of the questionnaire in the pamphlet 'Look at Learning in Schools' it seemed most appropriate for us to comment in particular on our view of the place of mathematics in schools since we represent that sectional interest.

Mathematics has, and will continue to have, an important role to play in our schools due to the ongoing need for pupils to develop basic numeracy skills for everyday life, for schools to prepare pupils for a technological world and technological careers, for maths to act as a service subject for other subjects/disciplines that use its skills and for the place mathematics holds in higher order things such as helping develop reasoning/logic skills, giving an appreciation of the order/pattern/number in the world around us and (for some) providing a deep interest for its own sake (i.e. a 'love of maths'). The question is not, then, 'should mathematics be included in our schools' but rather 'how and to what extent?'

There is ample evidence that our current patterns in mathematics education are not especially good (notably the 1981 I.E.A. study). Some of the factors which appear to contribute to this are worth identifying as they are factors needing attention in this review of Curriculum and Assessment.

1. A disturbing number of teachers of mathematics are themselves weak in both content knowledge and understanding in mathematics. For example mathematics performance is not part of the criteria for entry to primary teachers colleges (in general) and many F3-5 mathematics teachers are untrained (in mathematics at teachers college) and insufficiently qualified (often without any tertiary mathematics). This situation is being made worse in the current drive to fill quotas in mathematics at secondary teachers colleges even if that means recruiting people deemed marginally suitable to teaching. *We believe suitable standards should be established and adhered to* regarding the (matheamtical) standards of all

teachers of mathematics and that *stopgap measures should not be considered* as they have, in good part, contributed to the current situation in mathematics.

In this context the need for in-service training needs mention. It is quite clear that the changes needed in Mathematics are (mostly) a change in method and approach rather than major changes in content. To bring this about will require major retraining of teachers many of who have not mastered the content let alone come to terms with the need for a changed approach. We would welcome any moves that increased opportunity for in-service work. The current Teacher Only days only allow a minimum of (valuable) work but necessarily not at the depth that is needed to change teacher attitudes and practices.

2. The relationship mathematics has with the real world is central to quality of the learning. It is apparent that much mathematics is learnt in New Zealand schools devoid of any reason and without any real links with other subjects/everyday life, etc. It is often rote learning of mechanical procedures with little, or no, understanding of their purpose or of why they work. Hence any reorganisations of the curriculum should facilitate:

- opportunities for links with other subjects, (e.g. the maths teacher to work with the social studies teacher when they use graphs, the maths teacher able to work with the science teacher when difficult formulae are being manipulated, etc.).

- opportunities for *practical activities* in mathematics. This may require a reduction in content to be covered and a review of the spiral curriculum in mathematics in order to provide sufficient time for this to occur. Physical resources may be required as well to help accomplish this. Problem solving, discussions, project work, etc. are other important facets that currently are sacrificed to the race against time and the rote learning model used.

3. More recognition needs to be given to the mixed ability nature of classes. Vast differences in achievement are rapidly evident on entry to school but, currently, not fully attended to (if at all). We believe that the *mathematics equivalent of the Reading Recovery Programme* should be operating and that many more resources be put into remedial programmes at all levels of the school. Multi-level courses for pupils would be quite desirable here so that pupils would not be repeating all of a previous year's work but could consolidate a weak subject if needed. We are asking for a more flexible system please.

4. The move in mathematics education has been towards criterion referenced assessment and the existing national normative assessments (e.g. School Certificate) are quite counter-productive to these efforts. Mastery learning approaches have been used with some success but run into the same difficulties. We believe that assessment procedures for mathematics should, as much as possible be in the hands of mathematics educators, e.g. mathematics teachers, as a body, decide on appropriate assessment procedures *and* moderation procedures for School Certificate (if remaining), Sixth Form Certificate and the rest and that School Certificate marks not be used to generate (normative) Sixth Form Certificate grades. Different subjects will require different procedures and inter-subject moderation is unjust so, we believe, some form of (national) moderation within a subject is all that is required.

5. Mathematics learning is a continual development process and we would favour any steps that improved links Primary-Intermediate and Intermediate-Secondary. The current lack of communication (and lack of understanding of another's courses and requirements) is a real problem in mathematics.

6. Current courses have tended to emphasise mathematics for the academic and we would favour a greater flexibility at all levels. This would include more provision than at present for our able students. The existing Local Certificates at F5 should be given more status and recognition.

There is no doubt much more of a specific nature that would be valid comment but we have attempted to attend to principles and guidelines that focus on the needs within mathematics learning and how it relates to student needs in general.

Thank you for the chance to make this submission.

- Reprinted from the New Zealand Mathematics Magazine 23.1 (1986), by permission of the editor.

# Secretarial

## MINUTES OF A SPECIAL GENERAL MEETING OF THE NEW ZEALAND MATHEMATICAL SOCIETY

held in Room S4 of the Science Block at the University of Canterbury, Christchurch, on Tuesday, 20 May 1986, commencing at 5.15 p.m.

### PRESENT:

I.L. Reilly (in the Chair), G.C. Arnold, R.L. Broughton, B.D. Calvert, M.R. Carter, M.D.E. Conder, M.J. Curran, R. Davies, S.D. Forbes, F.C. Gair, H.J. Gardiner, W.D. Halford, J.F. Harper, D.C. Harvie, E. Kalnins, C.H.C. Little, R.S. Long, J.H. Maindonald, A.W. McInnes, G. Olive, G. Palmer, K.E. Pledger, I. Rinsma, J.A. Shanks, D.J. Smith, G.M. Thornley, M.K. Vamanamurthy, G.C. Wake, W.B. Wilson, B.A. Woods.

Moved from the chair that the NZMS ratify the decisions made at its Eleventh Annual General Meeting (held, although inquorate, at the University of New South Wales in Sydney on 13 May 1985)

CARRIED

The meeting closed at 5.16 p.m.

## MINUTES OF THE TWELFTH ANNUAL GENERAL MEETING OF THE NEW ZEALAND MATHEMATICAL SOCIETY

held in Room S4 of the Science Block at the University of Canterbury, Christchurch, on Tuesday, 20 May 1986, commencing at 5.16 p.m.

### PRESENT:

I.L. Reilly (in the Chair), G.C. Arnold, R.L. Broughton, B.D. Calvert, M.R. Carter, M.D.E. Conder, M.J. Curran, R. Davies, S.D. Forbes, F.C. Gair, H.J. Gardiner, W.D. Halford, J.F. Harper, D.C. Harvie, E. Kalnins, C.H.C. Little, R.S. Long, J.H. Maindonald, A.W. McInnes, G. Olive, G. Palmer, K.E. Pledger, I. Rinsma, J.A. Shanks, D.J. Smith, G.M. Thornley, M.K. Vamanamurthy, G.C. Wake, W.B. Wilson, B.A. Woods.

### 1. APOLOGIES:

D.B. Gauld, M.A. Jorgensen

Moved (J. Harper/G. Thornley) that the apologies be received

CARRIED

### 2. MINUTES OF THE ELEVENTH ANNUAL GENERAL MEETING

Moved (B. Woods/M. Carter) that the minutes be taken as read, and confirmed

CARRIED

### 3. MATTERS ARISING FROM THE MINUTES:

#### (a) NZMS Auditor:

J. Shanks reported that it had taken some time to find a new Auditor, but Council had empowered him to approach a commercial Auditor, and he had found Mr E.S. Taylor, who works for the firm Peat, Marwick, Mitchell and Company (Dunedin), and who had agreed to act as NZMS Auditor on an informal basis.

Moved (J. Shanks/J. Harper) that the previous year's Auditor be thanked.

CARRIED with acclamation

## (b) NZMS Research Support Fund:

I. Reilly announced that Council had set up a fund for support of mathematical research, details of which would be published in the next NZMS Newsletter (with permission of the Editor). The amount allocated to the fund for 1986/87 would be \$2,000.00.

## (c) NZMS Visiting Lectureship:

I. Reilly reported (on behalf of M. Jorgensen) that Dr Terry Speed had been appointed as NZMS Visiting Lecturer for 1986, and would be visiting in September and early October, and that Professor Saunders MacLane had accepted the offer of the Lectureship for 1987 and he would be visiting in March 1987. Enquiries regarding the latter may be directed to either Murray Jorgensen or Gloria Olive.

It was noted also that the new Forder Lectureship would be offered every second year, in addition to the annual NZMS Visiting Lectureship.

## (d) National Committee on Basic Skills:

K. Pledger asked that it be noted that no action had been taken on this matter.

## 4. PRESIDENT'S ANNUAL REPORT:

I. Reilly presented his report as President of the NZMS, highlighting the fact that two of the Society's members had received awards during the year: Professor J.T. Campbell the O.B.E., and Dr Alex McNabb a fellowship of the Royal Society of New Zealand. He also thanked members of Council for their services to the Society.

G. Olive asked about the term of NZMS Outgoing Vice-President, and the matter was clarified by I. Reilly.

J. Harper asked that members be reminded that the first Forder Lecturer, Professor Christopher Zeeman, was a member of the British S.R.C., and suggested that his visit could be politically effective for the Society. I. Reilly reported that it was hoped that a meeting could be arranged for Professor Zeeman and NZMS representatives with the Minister(s) of Education and Science.

Dr Harvie asked about publication of the prizewinning entries in the 1985 Mathematics Project Competition for Teachers. I. Reilly answered that this could be undertaken by "Mathematics Magazine", but it was perhaps inappropriate because of the nature of the entries.

D. Smith asked about the Society's donation to the 1986 Colloquium. I. Reilly replied that this matter was under consideration, and that some members felt that a \$500.00 donation, more than in previous years, would be reasonable.

Moved from the chair that the President's Annual Report be adopted.

CARRIED

## 5. TREASURER'S REPORT:

J. Shanks presented his report as Treasurer, emphasising in particular that there had been a very large increase in the Society's turnover due to publications ventures, which will provide further increases in the coming year. He mentioned that subscriptions and publications activities would be subject to the proposed new Goods and Services Tax (G.S.T.), but felt he could handle the changes. With regard to the expenditure on travel, he reported that Council had met in Wellington twice in 1985, as no meeting could be arranged to coincide with the Society's Annual General Meeting in Sydney.

Publications income was discussed briefly. I. Reilly reported there would be a 50/50 split with the NZAMT of profits obtained from those texts produced by joint writing teams (specifically "Secondary School Mathematics", "Mathematics with Calculus" and "Mathematics with Statistics" at present), and that formal agreements would be drawn up with the NZAMT on shared responsibility in case of future losses.

Replying to suggestions that a portion of NZMS funds be placed into high-interest term deposit accounts, J. Shanks reported that there were large fluctuations to deal with, and I. Reilly added that the system was complicated, with holding accounts for the publications ventures in four different places. J. Shanks agreed to look into the matter, and J. Harper suggested the use of high-interest "on-call" deposit accounts.

Moved (J. Shanks/M. Conder) that the Treasurer's Report be received.

CARRIED

## 6. PUBLICATIONS COMMITTEE REPORT:

C. Little presented his report as Publications Convenor, concluding that the preceding year had been one of consolidation for the Society's publications. He suggested it might be time for some new venture, possibly a University text in Linear Algebra, or Discrete Mathematics, and he called for suggestions and volunteers. He also thanked the heads of local teams (specifically Ivan Reilly and Joel Schiff; Dean Halford; Bob Broughton; Lindsay Johnston and Sharleen Forbes; Graeme Wake) for their substantial efforts and the rewards they have produced for the Society. This was greeted with acclamation.

Moved (C. Little/G. Wake) that the report of the Publications Committee be received.

CARRIED

## 7. ELECTION OF OFFICERS:

I. Reilly announced that Professor Brian Woods had been nominated for the position of Incoming Vice-President, and Drs Gillian Thornley and John Shanks for the two vacant positions on Council. There being no further nominations, these people were duly elected (with acclamation).

Moved (J. Shanks/J. Harper) that Mr E.S. Taylor be appointed as NZMS Auditor for 1986.

CARRIED

## 8. SUBSCRIPTIONS FOR 1987:

I. Reilly advised that the Council was recommending no increase in subscriptions for the following year, but that the New Zealand Government would require a 10% increase in subscriptions due to the proposed Goods and Services Tax. Overseas members would be exempt from paying the G.S.T. supplement. There were no objections to Council's recommendation.

## 9. INTERNATIONAL MATHEMATICAL OLYMPIAD 1988:

I. Reilly reported that Derek Holton, Gordon Hookings and Gus Gale were working towards sending a New Zealand contingent to the 1988 Olympiad to be held at Canberra, and that the Council supported this movement. Sponsorship would need to be obtained, but there was a pressing demand also for "mentors" for team-members, and for potential team-members themselves. General discussion ensued and it was suggested that NZMS members ought to seek suitable fifth form pupils (and younger) in their own region, possibly by writing to all schools in their region, and pass on the names to Gordon Hookings.

## 10. GENERAL BUSINESS:

(a) Moved (M. Schroder/D. Harvie) that the NZMS Council consider the appointment of an Honorary NZMS Solicitor.

CARRIED

(b) Replying to a question from G. Wake about the Society's endeavours in the Human Rights area, B. Calvert said that Massera and Scharansky had been released, but that Orlov was still imprisoned, and the NZMS had added its name to the campaign to free Orlov.

(c) I. Reilly reported on a suggestion from the Council that the NZMS offer one year's free membership of the Society to all New Zealand students completing their first year of post-graduate study in mathematics. This was seen to be a good idea, provided that care was exercised with its operation. I. Reilly mentioned also that the Council was about to produce a booklet on the aims and activities of the Society, and that it would be sent to prospective members. B. Calvert suggested that one year's free membership could be offered to all new members of mathematics departments at New Zealand Universities coming from overseas.

(d) B. Wilson announced the results of the 1986 Pre-doctoral Thesis Competition, with first prize of \$150.00 going to Shane Wood (Massey University) and second prize of \$100.00 to John Connolly (University of Canterbury). These were greeted with acclamation. B. Wilson added that the prizes were awarded for quality of presentation, rather than mathematical originality, and that Burroughs Limited had been approached with regard to sponsorship.

(e) I. Reilly mentioned that the Council had considered setting up the position of Membership Secretary, to assist the Treasurer. He called for volunteers, but J. Shanks indicated that he was prepared to continue with this part of his duties in the meantime.

- (f) M. Schroder reported as Editor of the NZMS Newsletter that he would soon distribute a questionnaire to survey members' opinions on (and suggestions for) the content and format of the Newsletter, and called for possible questions. He also advised that commercial printing of the Newsletter had proved a costly exercise, and had led to a misordering of the pages in the December 1985 issue.
- (g) I. Reilly announced that he would be going overseas on study leave at the end of 1986 and accordingly would not be present at the 1987 Annual General Meeting. In accordance with the Constitution, the Incoming Vice-President should become Acting President as from December 1986, and as also M. Conder would be going on study leave at that time, Council could co-opt a new Secretary and/or other replacement(s) if it sees fit.

There being no further business, the meeting was declared closed at 6.25 p.m.

Marston Conder  
Secretary, NZMS

#### PRESIDENT'S ANNUAL REPORT 1985/86

On behalf of the Council of the New Zealand Mathematical Society, I have the honour of presenting the twelfth Annual Report of the Society.

The Council met twice during the year at the Science Centre, Wellington, on 27 May 1985 and 2 December 1985.

An important development in the life of our Society was Council's decision to join with the Council of the London Mathematical Society (LMS) in the setting up of the Forder Lectureship. Funded in part by a bequest from the late Professor H.G. Forder to the LMS, and by N.Z. University departments and our Society, this Lectureship will bring an eminent British mathematician to N.Z. every second year. The first Forder Lecturer will be Professor E.C. Zeeman who will visit N.Z. in May 1987. It is the view of the Councils of both Societies that this Lectureship is a very fitting memorial to Professor Forder who was a Life Member of the NZMS and a life-long member of the LMS.

After a successful first year of operation in 1985 of the fund to assist N.Z. post-graduate students to attend conferences, two students were awarded grants for travel during 1986. They are Robert Aldred, from University of Otago, who was awarded a \$500 grant towards his costs to attend a conference in Singapore, and Gerard Palmer of Massey University who received \$200 to enable him to attend this Colloquium.

In April and May 1985 we sponsored Professor Bill Luxemburg as the NZMS Visiting Lecturer. We are pleased to announce that the next NZMS Visiting Lecturers will be Dr Terry Speed in September and October 1986, and Professor Saunders Mac Lane in February and March 1987.

The Council has made a \$500 grant to the organizing committee of the Australian Applied Mathematics Conference to be held in New Zealand in February 1987.

The 1985 NZMS Teachers Project Competition was won by Alistair McNaughton for his entry "A book of polynomials".

The past year has seen a consolidation of the Society's publishing activities. The first year university text "Calculus" has now been adopted for courses at Auckland, Waikato, Massey, Victoria and La Trobe. The two-volume text covering the former University Entrance mathematics prescription is continuing to sell well in its second year of production. Sales of the seventh form books "Mathematics with Calculus" and "Mathematics with Statistics" have exceeded our expectations and both are now into third printings. These three school texts are joint ventures with the NZ Association of Mathematics Teachers. We wish to place on record our appreciation of the efforts of the writing and distribution teams convened by Lindsay Johnston, Dean Halford and Bob Broughton. The success of our publication activities is two-edged. It seems that our turnover will require us to register under the GST provisions, which is not a source a delight for the Treasurer.

During this year the NZMS Archives have been sorted out, and are now stored at the Royal Society of NZ Science Centre in Wellington. The Council wishes to thank Drs John and Margaret Harper for their work on this project, and to announce the appointment of John as NZMS Archivist.



We have agreed in principle to participate in a review of research in Mathematics in New Zealand, under the auspices of the National Research Advisory Committee. However, it seems that NRAC may not be with us very much longer, and this may place the proposal in jeopardy.

It is very pleasing to report the initiative and support of our Society in the award of honours to two of our members in the past year. Emeritus Professor J.T. Campbell received an O.B.E., and Dr Alex McNabb was elected to a Fellowship of the Royal Society of N.Z.

Let me conclude by thanking, on behalf of the Society, members who have taken special responsibility for the affairs of the Society during the past year. Mark Schroder, the new editor of the Newsletter, John Shanks, the Treasurer, Marston Conder, the Secretary, and retiring Council members Mike Carter and Charles Little, deserve special mention.

Ivan L. Reilly  
President

REPORT OF THE PUBLICATIONS COMMITTEE TO THE  
1986 ANNUAL GENERAL MEETING OF THE NZMS

For the Publications Committee, the past year has been a very successful year of consolidation, although no new publishing ventures have been initiated. Approximately 78% of all secondary schools in New Zealand have ordered *Mathematics with Calculus*, the new text for the seventh form mathematics syllabus. This book was published last year, and currently sells for \$19. Some delays were experienced in the production of *Mathematics with Statistics*, another seventh form text, and it became available in April. Some 5000 copies of this book have now been distributed, and a further 2000 have been ordered in a third printing. The cost is again \$19 per book. The sixth form text, *Secondary School Mathematics*, continues to sell well, and is now priced at \$12 for Volume I and \$10 for Volume II. An accompanying answer book sells for \$4. All of these texts have been produced jointly with NZAMT, and both Societies will benefit financially. *Calculus* has been adopted as a text by the universities in the North Island, and in addition 80 copies have been sold overseas, most of them to La Trobe University. A profit of more than \$4100 has accrued from sales of this text during the past year. The past year also saw the termination of the seventh form Applied Mathematics Syllabus Series, as new syllabi were introduced this year. This venture yielded a healthy profit to the NZMS throughout the period 1981-1985.

I believe that our Society can look forward to future publishing ventures with increased confidence in their profitability. At the same time it should be stressed that our aim is to provide a service at a reasonable cost, rather than to amass profits. It may well be that the time has arrived to consider a fresh publishing venture. Anyone with an idea on this matter is invited to convey it to the Council.

Finally, I wish to record the appreciation of the Publications Committee for all of the work done by many people in making its ventures so successful. The NZMS owes a great deal to the dedication and labour of the writing teams in particular, who have contributed substantially to the reputation and prestige of the Society.

Charles H.C. Little  
Convenor

## TREASURER'S REPORT 1985

The Society expanded its book publishing activities in 1985 with a resultant annual turnover (about \$95000) far exceeding that of previous years. The overall profit to the Society was of the order of \$10600 being marginally less than the profit made from sale of books. As such, the activities of the Society apart from publishing were almost funded from subscriptions, donations and interest alone.

The large numbers of books being printed have meant that the Society's finances have been subject to large fluctuations, with bills for payments in 5 figures not uncommon. This pattern of business will continue in 1986, possibly with an increased annual turnover.

There were 182 members of the Society with 143 financial. An increased effort will be made this year to collect subscriptions still owing.

John A. Shanks  
Treasurer

May 1986

Copies of the accounts and the auditor's report may be obtained from the Treasurer (at Otago).  
- The Editor

MINUTES OF THE NINETEENTH COUNCIL MEETING OF THE  
NEW ZEALAND MATHEMATICAL SOCIETY

held at the Mathematics Department of the University of Canterbury, Christchurch, on Sunday, 18 May 1986, commencing at 11.30 a.m.

PRESENT:

Ivan Reilly (in the chair), Michael Carter, Marston Conder, John Harper, Charles Little, John Shanks, Brent Wilson

APOLOGIES:

Murray Jorgensen, Ernie Kalnins

MINUTES OF 18TH COUNCIL MEETING (2 December 1985):

Moved (JH/MCa) that the Minutes of the last Council meeting be taken as read and approved.

CARRIED

MATTERS ARISING FROM THE MINUTES:

- (a) MCo reported that Gloria Olive had been nominated for a further three year term, and Roy Kerr and Mike Carter as new members on the National Committee for Mathematics, the elections to take place in May 1986.
- (b) Upon request from MJ, the RSNZ had produced a timetable of important dates for their various awards and elections.

Moved (JH/MCa) that this list be published in the Newsletter.

CARRIED

- (c) IR reported that Post-graduate Student Travel Grants had been awarded to Robert Aldred (University of Otago) and Gerard Palmer (Massey University). A third award had been made but returned because of the student's personal circumstances. Discussion took place on the proposal that one year's free membership be given to student award winners, and it was decided to put this matter to the Society's Annual General Meeting.

- (d) IR suggested that the December Council meeting could be re-scheduled to take place in October, at a time found by the Secretary to be convenient for all Council members. It was agreed that this be attempted in 1986, with Auckland as possible venue.

- (e) General discussion took place on the matter of nominations for fellowships of the Royal Society of New Zealand. It was agreed that BW should consult with MJ, survey the current mathematical fellows of the RSNZ and prepare a position paper on the profile of mathematicians in the RSNZ.
- (f) On the matter of support for mathematical conferences, it was felt that the level of donations could be increased as a result of the Society's healthy financial position, and that the conference organisers in each case be asked to give the Society the appropriate profile in their proceedings.

## CORRESPONDENCE:

Moved from the chair that the Inwards Correspondence be received and the Outwards Correspondence be noted.

CARRIED

## MATTERS ARISING FROM THE CORRESPONDENCE:

- (a) A reply from the Department of Education, outlining their policy on non-advertisement of textbooks on the New Zealand Education Gazette, was discussed and accepted.
- (b) The nominations for vacancies on Council were noted. IR reported that he and MCo would both be taking study leave towards the end of 1986, and accordingly the Incoming Vice-President would be asked to act as President, and a Secretary co-opted, for the few months preceding the Annual General Meeting in 1987. Some confusion arose as to whether or not further nominations could be accepted at the forthcoming Annual General Meeting, but MCo indicated that this possibility had been excluded in the Society's by-laws.
- (c) IR proposed that a booklet be produced, outlining the aims and activities of the Society. This was thought to be a good idea, and the use of a word processor was suggested.

Moved (BW/JS) that Ivan Reilly and Marston Conder be empowered to produce a document on the aims and activities of the NZMS, but to seek Council's approval before its publication.

CARRIED

## TREASURER'S REPORT:

JS tabled his report, commenting on the high turnover from publications activities, but noting also that the income from other sources seemed to have covered expenditure on activities not related to publications. IR noted that the profit margin on the text "Secondary School Mathematics" had been too close, and that future texts should be priced carefully (to avoid possible losses).

[The meeting adjourned for lunch at 12.30 p.m. and recommenced at 2.10 p.m.]

JS recommended no change in subscriptions for 1987, except for the addition of the proposed Goods and Services Tax (G.S.T.), and suggested that the Society could wear any additional G.S.T. for the 1986 year. Council agreed.

JS reported also that the system of holding accounts (for individual publications ventures) was working well, and that he would set up such an account in Wellington in place of the existing older publications accounts.

Considerable discussion took place on the important matter of the proposed G.S.T. It was decided that the Society ought not to attempt to separate its publications activities for financial purposes, as turnover greatly exceeded the non-taxable limit in any case. JS tabled an information sheet containing instructions for convenors of writing teams (regarding the taxation of illustrators and other employees), and Council thanked JS for producing it.

The duties of Treasurer were discussed, and IR suggested that a Membership Secretary could be appointed or co-opted, to assist the Treasurer with membership matters. It was decided to defer a decision on this until the next meeting.

Moved (JH/IR) that the Treasurer's Report be received, and presented to the forthcoming Annual General Meeting.

CARRIED

## PUBLICATIONS COMMITTEE REPORT:

CL tabled his report, noting that 1985/86 had been a year of consolidation for the Society's publications, and suggesting that a new venture, such as a text on linear algebra or discrete mathematics, might be in order.

General discussion ensued on some of the problems associated with pricing, printing and distribution, and on the matter of distribution of profits from those texts published jointly with NZAMT.

Moved (MCA/CL) that Ivan Reilly and John Shanks be empowered to prepare an agreement with NZAMT concerning the timing of payments of profits from joint publications.

CARRIED

It was resolved also to send a letter to Ms Esme Greig on the occasion of her retirement, thanking her again for her assistance with distribution of texts in the Applied Mathematics Series.

IR suggested that convenors of writing teams be invited to a "working luncheon" during the 1986 Colloquium, in return for their substantial efforts, and to discuss the matter of distribution payments. Council agreed this was a good idea.

It was also suggested that CL ask for suggestions and/or volunteers for new publications ventures at the forthcoming Annual General Meeting.

Moved (BW/MCo) that the Publications Committee Report be received, and presented to the Society's Annual General Meeting, and that Charles Little be thanked for his services as Convenor of the Publications Committee.

CARRIED with acclamation

## RSNZ MEMBER BODIES' REPRESENTATIVE'S REPORT:

MJ's report was tabled and discussed. Specific matters included the High School Curriculum, on which it was decided that it would be difficult to take a definite position, and the profile of mathematical sciences at the 1987 ANZAAS Congress, about which BW agreed to consult Dean Halford.

## SOUTH PACIFIC FUND REPORT:

In EK's absence IR noted that a junior lecturer from the University of the South Pacific had been awarded \$500.00 towards the cost of her attendance at the 1986 Colloquium, but JS reported that she had returned the award, being unable to attend. MCo reported that further enquiries had been received, so there is hope that the fund will be utilised in the near future.

## PRE-DOCTORAL THESIS COMPETITION:

BW reported that there had been seven entries for the 1986 Competition, supervisors' reports had been helpful, and the decision of the judges (Drs D.R. Breach, A.W. McInnes and M.H. Smith of the University of Canterbury) was based on the quality of writing rather than mathematical originality. BW agreed to approach Burroughs Ltd regarding sponsorship, and to announce the awards at the 1986 Colloquium.

## VISITING LECTURER CO-ORDINATOR'S REPORT:

MJ's report was tabled and accepted. It was noted that Dr Terry Speed will be the 1986 NZMS Visiting Lecturer, and that Professor Saunders Mac Lane had accepted the Lecturership for 1987.

## ARCHIVIST'S REPORT:

JH announced that there was nothing further to report concerning the Society's archives.

## PROPOSED REVIEW OF MATHEMATICS RESEARCH:

IR reported on discussions with Dr Bruce Miller of the National Research Advisory Council, and the immediate need to decide on the structure of the proposed review. It was agreed to form a Review Committee, and that membership of this committee be determined at the brief Council meeting immediately following the 1986 Colloquium.

## GOODS AND SERVICES TAX:

This matter was discussed earlier (see item 6.).

## CONTACT WITH OTHER SOCIETIES:

Upon IR's suggestion, it was decided that the proposed booklet on NZMS activities (see item 5(c)) be sent to related organisations such as the New Zealand Statistical Association and the London Mathematical Society, with a covering letter, inviting their suggestions on matters of common interest.

## MEMBERSHIP DRIVE:

It was noted that many members were not financial, and also that there were many prospective members of the Society, particularly amongst recent graduates and new members of University staffs. IR and MCo agreed to send the proposed booklet of NZMS activities to all staff of Mathematics departments at New Zealand Universities, with an invitation to join the Society if they are not already members. Also it was decided to suggest at the Annual General Meeting of the Society that one year's free membership of the Society be offered to all New Zealand students who are about to complete their first year of post-graduate study in Mathematics.

## NZMS RESEARCH SUPPORT FUND:

It was decided to set aside \$2,000.00 for the first year (1986/87) of operation of the newly established NZMS Research Support Fund, and publish this amount together with the rules for the fund in the Newsletter.

## ANNUAL GENERAL MEETING:

The proposed agenda for the Annual General Meeting was discussed and some minor alterations made.

## GENERAL BUSINESS:

It was noted that Graeme Wake and Mike Hendy are running the new "Problem/Queries" section of the Newsletter.

There being no further business, the meeting closed at 5.30 p.m.

Marston Conder  
Secretary

MINUTES OF BRIEF COUNCIL MEETING OF THE  
NEW ZEALAND MATHEMATICAL SOCIETY

held in the Science Block at the University of Canterbury, Christchurch, on Wednesday, 21 May 1986, commencing at 10.15 a.m.

## PRESENT:

Ivan Reilly (in the Chair), Michael Carter, Marston Conder, John Harper, Ernie Kalnins, Gillian Thornley, Brent Wilson, Brian Woods.

## APOLOGIES:

John Shanks, Murray Jorgensen

## APPOINTMENTS:

Moved from the Chair that the following appointments be made for the forthcoming year:

|                                   |                  |
|-----------------------------------|------------------|
| Secretary                         | Marston Conder   |
| Treasurer                         | John Shanks      |
| Newsletter Editor                 | Mark Schroder    |
| Publications Convenor             | Gillian Thornley |
| Visiting Lecturer Selector        | Murray Jorgensen |
| Human Rights Representative       | Bruce Calvert    |
| RSNZ Member Bodies Representative | John Harper      |
| Co-ordinator of Visitors          | Gillian Thornley |

Graduate Information Co-ordinator  
 South Pacific Fund Co-ordinator  
 Archivist

Michael Carter  
 Ernie Kalnins  
 John Harper

CARRIED

IR reported that JS would consider co-opting a colleague at the University of Otago to act as Membership Secretary. Council was happy with this course of action.

## 1986 COLLOQUIUM:

Moved from the chair that \$500.00 be donated to the 1986 New Zealand Mathematics Colloquium

CARRIED

Brian Woods expressed his thanks on behalf of the organisers of the 1986 Colloquium. Hope was expressed by Council members that this level of support for the annual Colloquium would be continued in future years.

## PROPOSED REVIEW OF MATHEMATICS AND STATISTICS RESEARCH:

IR informed Council that Professor Graeme Wake had agreed to convene a review committee based in Palmerston North and Wellington.

Moved (BWo/EK) that a Review Committee be convened by Graeme Wake, with Gillian Thornley as Council representative on that committee, to keep Council informed on the progress of the review.

CARRIED

## COPYRIGHT PROBLEM:

IR reported about a possible breach of the Society's copyright on the "Secondary Schools Mathematics" text. A school in Wellington appeared to have reproduced a substantial number of exercises from that text in a booklet which was being sold at \$20.00 per copy. IR suggested discussing the matter with NZAMT (joint publisher) and drafting a letter to the Principal of the school in question. Council supported these moves. IR reported also that JS had suggested circulating a blurb on copyright and other matters to all recipients of NZMS texts. Again Council agreed this was a good idea.

## NZMS LEGAL ADVICE:

BWo agreed to approach an associate (having legal experience) with a view to asking him to act as honorary NZMS legal advisor. Council saw this as an interim measure, possibly leading to the appointment of an NZMS solicitor at a later date.

## ANZAAS DONATION:

IR reported that Dean Halford had arranged a good programme of talks in Mathematical Sciences for the 1987 ANZAAS Congress.

Moved from the chair that \$500.00 be donated to the organisers of the 1987 ANZAAS Congress.

CARRIED

## GENERAL BUSINESS:

The proposed changes to degrees in Engineering at New Zealand Universities were discussed briefly. It was agreed that individual Mathematics departments ought to make their own submissions on this matter (if they wished).

There being no other business, the meeting closed at 10.25 a.m.

Marston Conder  
 Secretary, NZMS

# Problems

## Mind your P's and Q's

From this edition and thereafter an expanded section on PROBLEMS AND QUERIES will be carried by the NZMS Newsletter. This will be edited by Professor Graeme Wake and Dr Mike Hendy of the Department of Mathematics and Statistics, Massey University. We believe that the dialogue and interaction stimulated by these problems will serve to enrich the mathematical activity within our community. At least it will help fill those sleepless nights! The success of this section (which builds on the work of our predecessors) DEPENDS ON YOUR INPUT. To facilitate this we invite (implore) you to send us your most easily understood problem or query. P/Q's from all areas within the mathematical sciences are welcome.

Responses to the P/Q's below should be received by us by 15 December 1986 so as to appear in the April 1987 issue. Have fun.

PQ editors: Mike Hendy, Graeme Wake,  
Massey University,  
Palmerston North, N.Z.

P1 (from Graeme Wake, M.U. and IMO 1985):

Construct the sequence  $(x_n)$  by the iterative formula

$$x_{n+1} = x_n \left( x_n + \frac{1}{n} \right), \quad n \geq 1; \quad x_1 \text{ given.}$$

Prove that there exists exactly one value of  $x_1$  for which  $0 < x_n < x_{n+1} < 1$  for every  $n$  (and  $(x_n) \rightarrow 1$  as  $n \rightarrow \infty$  in this case). Find this unique value of  $x_1$ .

P2 (from John Harper, VUW):

(a) Construct examples to show that the mean value theorem fails for analytic functions, in the sense that even if  $f : \mathbb{C} \rightarrow \mathbb{C}$  is analytic in the whole complex plane the solutions  $w$  of

$$\frac{1}{z} \int_0^z f(t) dt = f(w) \quad \dots (1)$$

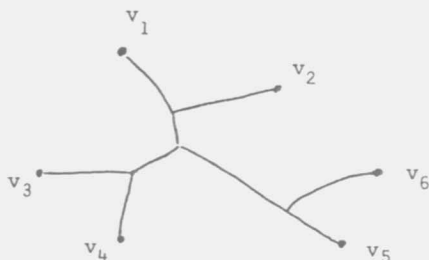
may not exist, or could all lie arbitrarily far from  $z$  if they do exist. (Contrast this with the mean value theorem in the real case, which only needs continuity.)

(b) Find simple conditions which can be imposed to ensure that a solution of equation (1) exists, with  $|w| < |z|$ .

J.H. comments: This problem arose when I asked my third-year students to prove l'Hôpital's rule for analytic functions. Some attempted to do so by assuming that  $w$  in (1) was on the line segment from 0 to  $z$ .

P3 (from Mike Hendy, MU):

Let  $T$  be the tree, with edge set  $E$ , labelled as below. The path  $p_{ij}$  is the set of edges in  $E$  which connect  $v_i$  to  $v_j$ , and  $D = (d_{ij})$  is a  $6 \times 6$  symmetric matrix with zero diagonal and integer entries.



A function  $w: E \rightarrow \mathbb{R}_0^+$  which satisfies the 15 constraints:

$$\sum_{e \in p_{ij}} w(e) \geq d_{ij}, \quad 1 \leq i < j \leq 6.$$

is a *weighting* of  $T$ . A *minimal weighting* of  $T$  is a weighting which minimises

$$w(T) = \sum_{e \in E} w(e).$$

Prove: 1. For all such  $D$ , there is a minimal weighting  $w$  such that  $w(e) \in \frac{1}{4} \mathbb{Z}$  for all  $e \in E$ .

2. There is a matrix  $D$  and a corresponding minimal weighting  $w$  such that  $w(e) \leq \frac{1}{4}$  for all  $e$  in  $E$ .

P4 (Graeme Wake, MU):

Find dimensionless ratios  $r$  involving  $V$  and  $S$  for closed convex shapes in 3 dimensions of volume  $V$  and surface area  $S$  for which the sphere represents an extreme (for example  $r = \frac{36\pi V^2}{S^3} \leq 1$  for all shapes, and  $r = 1$  for a sphere) and for which the diameter of the shape is bounded, say by  $D$ .

Determine whether there exists a ratio like the example and a bound  $r(D) > 0$  so that, for all shapes,

$$r(D) \leq r \leq 1.$$

If so find  $r(D)$  for your  $r$ .

Note: In chemical engineering the value  $r$  is used to describe the "departure" of the given shape from a sphere.



Q1 (From Mike Carter, MU)

Which topics are currently being taught, or being considered for teaching, in the discrete mathematics area at an elementary level on the boundary between mathematics and computer science? Do you have adequate textbook support for your course(s)?

## News and Notices

### R.S.N.Z. TIMETABLE

|              |   |
|--------------|---|
| 25 February  | Closing date for information for RSNZ March Newsletter  |
| 28 February  | Closing date for applications for the Prince & Princess of Wales Science Awards (operative period May to October).    |
| 1 March      | Closing date for applications for Young Scientists' Fund Grants (operative period May to December).                   |
| 15 March     | Closing date for annual applications for Skinner Fund Grants.   |
| 18 March*    | Member Bodies' Management Committee meeting.  |
| 26 March*    | Closing date for nominations for Member Bodies' Management Committee representatives.                                 |
| 31 March     | Annual Reports of National and other Committees due.  |
| 8 April*     | Member Bodies' Annual Meeting in Wellington.  |
| 15 April     | Annual Reports of of Member Bodies due.   |
| 30 April     | Closing date for National Committee nominations.  |
| 1 May        | Closing date for applications for Science Fair grants.  |
| 25 May       | Closing date for information for RSNZ June Newsletter.  |
| 15 July*     | Member Bodies' Management Committee meeting.  |
| 25 August    | Closing date for information for RSNZ September Newsletter.   |
| 31 August    | Closing date for annual applications for:<br>Hutton Fund Grant, and<br>Mappin Fund Grant.                             |
|              | Closing date for applications for the Prince & Princess of Wales Science Awards (operative period November to April). |
| 1 October    | Closing date for applications for Young Scientists' Fund (operative period November to April).                        |
| 15 November  | Closing date for nominations to Fellowship and Honorary Membership.   |
| 18 November* | Member Bodies' Management Committee Meeting.  |
| 25 November  | Closing date for information for RSNZ December Newsletter.  |
| 31 December  | Closing date for nominations for:<br>Hamilton Award, and<br>E.R. Cooper Award.  |
|              | Closing date for National Committee applications for travel to ICSU business meetings.                                |

\* These dates change somewhat from year to year.

Further information on these activities may be found in the Proceedings of the Royal Society of New Zealand or obtained from the Executive Officer, RSNZ, Private Bag, Wellington.

WHEN WILL YOU PAY ME?

Say the bells of Old Bailey

Have you paid this year's subscription? For that matter, have you paid last year's subscription? In case you don't know, the answer now lies on your address label:

|   |    |
|---|----|
| Dr J A Shanks<br>Dept of Maths & Stats<br>University of Otago<br>P.O. Box 56<br>Dunedin | 85 |
|---|----|

The date shows the latest year for which you have paid. If it is "87" thank you; if "86" well done; if "85" you owe NZMS this year's subscription (\$23, or \$11.50 if you are a Reciprocal Member, or \$3.85 if you are a Student Member), and so on. Other codes will indicate non-paying membership as follows:

"H" = Honorary, "L" = Life.

Send any arrears to the Treasurer, address shown above (looks like I'd better pay too!).

J.A.S.

## MASSEY UNIVERSITY

Palmerston North, New Zealand

Department of Mathematics and Statistics  
 Department of Biotechnology

## UGC POSTDOCTORAL FELLOWSHIP

A UGC Postdoctoral Fellowship has been granted to assist a interdepartmental research team to develop shape factors for the freezing and thawing times of irregularly-shaped foods.

Our requirements are for a graduate who has recently completed (or is nearing completion of) a PhD in Applied or Engineering Mathematics with skills in the analytical and numerical solution of partial differential equations, with possibly some experience in moving boundary value problems. Experience in applying finite difference and finite element techniques to engineering problems would be an advantage.

Analytical and numerical techniques will be used to solve the partial differential equations which describe the heat transfer process in freezing and thawing in irregular shapes, such as occur in practical industrial situations.

Results from this work, augmented by an existing large data base, will enable precise estimates to be determined for the shape factors required for industrial situations.

This will be a joint appointment between the two departments above and will imply responsibilities to the activities of both departments.

The conditions of appointment are as set out in the 1986 New Zealand UGC Grants Committee Handbook pp. 73-75. Tenure is for up to two years, commencing any time from February 1987 to July 1988 and with salary level equal to the first step of NZ University Scale for Lecturers (currently \$30,500 p.a.). The fellow will be expected to be involved in the activities of both the Departments of Mathematics/Statistics and Biotechnology.

For further enquiries, concerning the nature of the research envisaged, please write to the researchers involved:

Professor G.C. Wake, Department of Mathematics/Statistics,  
 Dr A.C. Cleland, Department of Biotechnology,  
 Massey University,  
 Palmerston North,  
 New Zealand.

Formal applications will be sought via advertisements in the Times Higher Educational Supplement, the Australian, and SIAM News, with a proposed closing date for applications of 30 September 1986.

ANNUAL MEETING,  
 AUSTRALIAN MATHEMATICAL SOCIETY

11-15 May 1987, Thirty-first Annual Meeting of the Australian Mathematical Society, Deakin University, Geelong, Victoria, Australia.

Call for papers: original and survey papers in any area of mathematics, application of mathematics, mathematics education, and history of mathematics are solicited.

Deadline for Abstracts: 31 March 1987.

Information: K.L. McAvaney, Division of Computing & Mathematics, Deakin University, Victoria, 3217, Australia. Phone: (052) 471376. Telex: DUNIV AA35625. Telefacsimile (052) 442777.

NZMS RESEARCH SUPPORT FUND

The Council of the NZMS has established a fund for the support of mathematical research in New Zealand. This shall be interpreted in the widest possible sense, and may include such things as the funding of items such as books or computer software, the funding of temporary research assistance, and the support of travel either by New Zealand mathematicians in furtherance of their research, or by overseas mathematicians travelling to New Zealand to assist or co-operate in research in New Zealand.

The amount of the fund for each year (between successive Annual General Meetings of the NZMS) shall be determined by the Council of the NZMS at the Council meeting immediately preceding each Annual General Meeting. The manner in which the fund for a particular year shall be spent shall be determined by the NZMS Council. Any amount not spent in a particular year shall revert to the general funds of the Society.

The amount of the fund for the 1986/87 year has been set at \$NZ 2,000.00.

Applications are now invited for assistance from the NZMS Research Support Fund. Every application should state clearly the nature and amount of assistance required, and the details of the research which is to be supported, and be sent to:

Dr Marston Conder,  
 Secretary NZMS,  
 Department of Mathematics & Statistics,  
 University of Auckland,  
 Private Bag,  
 AUCKLAND.

Applications for assistance may be made at any time, but will not necessarily be considered before the next regular Council meeting following receipt of such applications.

(The next Council meeting is likely to take place in October 1986.)

# Centrefold

## VAUGHAN JONES AND KNOT THEORY A NEW ZEALAND MATHEMATICIAN UNRAVELS A NEW INVARIANT WHICH LINKS DIVERSE SCIENCES IN AN UNFORESEEN THREAD

What is so fascinating about Vaughan Jones's new polynomial invariant is not just that it has settled one of the most fundamental unresolved problems in topology - the development of a topological invariant which can distinguish left and right-handed simple knots - but that it also provides one of those rare instances where abstract pure mathematics provides an unforeseen relationship between diverse scientific disciplines.

Vaughan graduated from the University of Auckland in 1973 with an M.Sc. with first class honours in Mathematics. He had also taken Physics to stage III. He then moved overseas to take his Ph.D. at the Université de Genève, Switzerland, under the supervision of André Haefliger. He is now a Sloan Foundation Fellow and Professor of Mathematics at the University of California, Berkeley.

Vaughan Jones's work leading up to the discovery, was in Von Neumann algebras. This branch of quantum mechanics deals with the mathematical treatment of such observables as energy, position and momentum. In quantum mechanics, observables are represented by operators in Hilbert space. Commuting operators represent observables which can be measured simultaneously. The set of operators which commute with a given operator forms an algebra and provides a basis for the definition of Von Neumann algebras. A Von Neumann algebra on a Hilbert space is an algebra of bounded operators which is closed under the transpose-conjugacy of operators  $\langle Ap, q \rangle = \langle p, A^*p \rangle$ , where  $\langle, \rangle$  is the inner product.

A factor is a Von Neumann algebra whose centre is  $C^1$ . Any Von Neumann algebra can be built out of a collection of factors. Vaughan Jones's discovery arose from work he was doing on a class of factors called  $II_1$  factors. These in addition possess a trace, a linear functional into  $C$  such that  $\text{tr}(1) = 1$  and  $\text{tr}(ab) = \text{tr}(ba)$ . The trace, which in matrix notation corresponds to the sum of the diagonal entries, is all important in the development of the Jones polynomial. The most striking feature of the trace is that its range on projections ( $e: e^2 = e, e = e^*$ ) is the whole unit interval. By contrast, the normalized trace on projections of matrix algebras  $M_n(C)$  are the  $n+1$  values  $\{0, 1/n, 2/n, \dots, 1\}$ . Projection operators correspond to choosing an axis with which to measure observables such as spin. The trace thus gives a measure of dimensionality which, in the case of a  $II_1$  subfactor, provides for continuous dimensions. Another example of continuous dimensionality is provided by the fractal dimension of such structures as space-filling curves, where the dimensionality gives a measure between 1 and 2 for fractals whose length grows on a change of scale.

Vaughan was considering the relationship between a  $II_1$  factor  $M$  and a subfactor  $N$  when the connection with knot theory emerged. Subfactors correspond to studying a subsystem of a quantum mechanical system. Trace theory (for operators) then leads to the definition of the index of  $N$  in  $M$  as

$$[M : N] = \dim_N(L^2(M)),$$

a real number  $\geq 1$ . In fact, though this index can take any value  $\geq 4$ , its only values  $< 4$  are the numbers  $4 \cos^2(\pi/n)$ , for integral  $n \geq 3$ .

The proof of this result threw up a set of relations which so resembled those of the braid group that it provoked a meeting between Vaughan Jones and knot theorist Joan Birman and the new polynomial emerged.

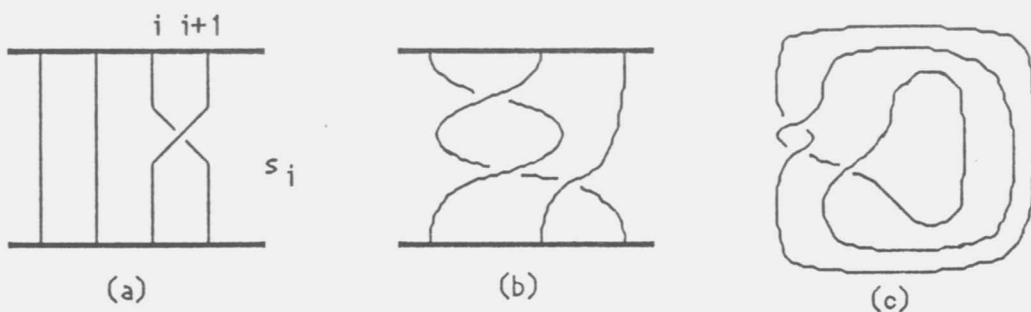


Figure 1

A braid differs from a knot in that it is a set of descending curves that begin and end at a corresponding set of points, as shown above (b). No curve can turn upwards at any point. Any two n-braids are concatenated by joining one above the other. The resulting group is easily generated by the elementary braids  $s_i$  as in (a), as in Artin's presentation:

$$\{s_1, s_2, \dots, s_n : s_i s_{i+1} s_i = s_{i+1} s_i s_{i+1}, s_i s_j = s_j s_i \text{ if } |i-j| \geq 2\}$$

In the proof of the dimensionality theorem, Jones was led to study a tower of subfactors generated by the identity and n projections  $e_1, \dots, e_n$ . The relations between the  $e_i$  were so similar to the braid presentation that the substitution

$$q_i = t^{1/2}(t e_i - (1 - e_i))$$

has the correct relations and enables the definition of a representation  $r_t$  sending  $s_i$  to  $q_i$ .

A tame link in 3-space is an embedding of one or more circles which can be represented as polygons (so that for example they do not have an infinite sequence of smaller knots). The above braid (b), denoted (b,3) can be converted into the link (c) by joining corresponding points to form  $b^\wedge$ . Conversely, Alexander had proved that any tame link L can be represented by some (b,n). This ultimately enables the definition of the Jones polynomial in terms of the trace:

$$V_L(t) = (-t+1)/t^{1/2})^{n-1} \text{tr}(r_t(b))$$

where (b,n) is the braid corresponding to L.

The definition may also include a factor of  $t^{e/2}$  (see the Notices article). The relation is so indirect that it is essential to find a more amenable relationship to use for calculation.

Alexander discovered his polynomial in 1928. Subsequently in 1970 Conway, elaborating on a theme of Alexander's original paper showed that the Alexander polynomials could be calculated inductively as follows: Consider a knot or set of links and concentrate on a single crossing point of a plane projection. Let  $L_+, L_0, L_-$  denote oriented links which agree except on a small disk, where they vary as shown below. The unoriented figure is eliminated in the oriented case, but will be discussed later.

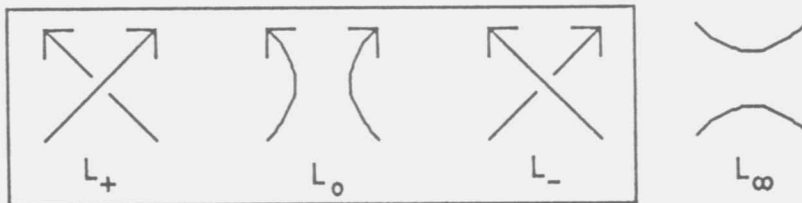


Figure 2

This sequence is very interesting, because it relates three knots rather than just the two which are involved in the usual process of 'passage' in which a strand is divided and passed over another before being rejoined (left versus right diagrams). The central diagram results from exchange of strands so that the sequencing order on the knot is changed. This has profound consequences in the case of DNA where the unknotting enzymes of such processes as supercoiling cause passage, but the second process of recombinational exchange is also possible. The two operations combined constitute the full repertoire of transformations under the new polynomial and the only transformations possible for DNA.

Conway showed that the normalized Alexander polynomial obeys the recurrence relation

$$AL_+(t) - AL_-(t) + (t^{1/2} - t^{-1/2})AL_0(t) = 0$$

Vaughan Jones's polynomial proved to obey a slightly different recurrence relation

$$tVL_+(t) - t^{-1}VL_-(t) + (t^{1/2} - t^{-1/2})VL_0(t) = 0$$

The announcement of the Jones polynomial led to another astounding piece of mathematical serendipity when eight mathematicians in five different groupings independently and simultaneously produced a two variable generalization of both the Jones and Alexander polynomials which could even more sensitively distinguish links up to the two shown below.

This can be represented most conveniently as a homogeneous three variable polynomial,  $P$  with all terms having zero net power in  $x$ ,  $y$ , and  $z$ . In particular  $P$  obeys the recurrence relation

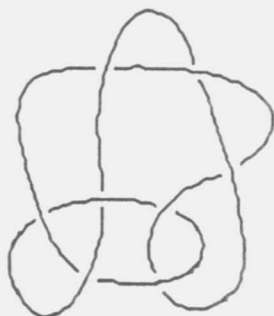
$$xPL_+(x,y,z) + yPL_-(x,y,z) + zPL_0(x,y,z) = 0$$

The other polynomials can be expressed in terms of  $P$  as follows

$$AL(t) = PL(1,-1,t^{1/2} - t^{-1/2}), \quad VL(t) = PL(t,-t^{-1},t^{1/2} - t^{-1/2})$$

The two variable form,  $P'$  can be constructed in various ways but a convenient form is  $P'L(x,z) = PL(x,x^{-1},z)$  which then obeys the recurrence relation

$$xP'L_+(x,z) + x^{-1}P'L_-(x,z) + zP'L_0(x,z) = 0$$



8<sub>8</sub>



10<sub>129</sub>

Figure 3

$$P'L(x,z) = (-x^{-4} - x^{-2} + 2 + x^2) + (x^{-4} + 2x^{-2} - 2 - x^2).z^2 + (-x^{-2} + 1).z^4$$



Vaughan Jones

The traditional methods for computing the Alexander polynomial via the group of the knot enable a knot with many crossing overs to have  $A$  calculated in one step via determinants associated with the overpasses or through the homotopy group. By contrast, the algorithms above grow exponentially with the complexity of the knot and become excessively complex for more elaborate knots, however they have an intrinsic intuitive appeal in that the polynomial of any knot can be calculated by building it up successively from the above triplet relation beginning with the trivial polynomial 1 for a single unknotted circle. The first such step is shown below:

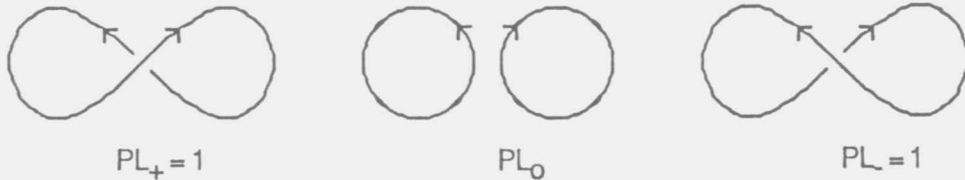


Figure 4

hence by the recurrence relation we have

$$x \cdot 1 + y \cdot 1 + z \cdot PL_0 = 0 \quad \text{or} \quad PL_0 = (x+y)/z.$$

A further development of the polynomial saga has been the discovery of an independent polynomial on unoriented links which involves all four diagrams of fig. 2. In particular,  $QL(x)$  is defined by

$$QL_+ + QL_- = x \cdot (QL_0 + QL_{00})$$

whence

$$\begin{aligned}
 Q8_8(x) &= 1 + 4x + 6x^2 - 10x^3 - 14x^4 + 4x^5 + 8x^6 + 2x^7 \\
 Q10_{129}(x) &= 1 - 12x - 2x^2 + 26x^3 + 4x^4 - 20x^5 - 4x^6 + 6x^7 + 2x^8
 \end{aligned}$$

As is shown above, this invariant can distinguish the knots of fig. 3, but it cannot tell links from their mirror images. Kaufmann has refined  $Q$  to include orientation by a clever route which can also enable a computation of the Jones polynomial without having to consider the order of the decompositions of individual nodes. Because the  $Q$  polynomial relationship involved two uncrossed types, it is possible to use it to reduce the projection of a link to unknotted components. Study of the writhe of the resulting graph enables orientation to be included in the new polynomial  $R$ . In fact it has been shown that

$$VL(t) = RL(t^{-3/4}, -(t^{-1/4} + t^{1/4}))$$

so the Jones polynomial is a special case of both  $P$  and  $R$ .

The connection with molecular biology is every bit as interesting as the connection with quantum mechanics. The double helix of DNA and RNA has one complete turn for every ten base pairs. The human haploid genome contains  $3 \times 10^9$  base pairs, and hence approximately  $10^8$  twists per cell. In addition supercoiling, linking and recombination between strands gives nucleic acid dynamics an exceedingly complex knotting behaviour. Single nucleic acid strands are oriented by their sugar-phosphate polarity. Over the last few years several types of topoisomerase enzyme have been discovered which permit a variety of knotting and linking operations. Type 1 topoisomerases cut a single DNA strand and permit the passage of another strand. They can relax supercoiling by allowing a double helix to unwind around one strand and can link and knot single stranded loops. Type 2 gyrases can perform similar operations on double-stranded loops. Resolvase by contrast can extrude a specific portion of a twisted loop to form two linked loops. In addition, recombinational processes such as occur in sexual crossing-over in meiosis relate  $PL_0$  to  $PL_+$  and  $PL_-$ .

The Newsletter is the official organ of the New Zealand Mathematical Society. It is produced in the Mathematics Department of the University of Waikato and printed at the University of Otago Printery. The official address of the Society is:

New Zealand Mathematical Society (Inc.)  
c/- The Royal Society of New Zealand  
Private Bag  
WELLINGTON

However correspondence should normally be sent direct to the Secretary, Dr M.D.E. Conder, Department of Mathematics and Statistics, Auckland University, Auckland, New Zealand.

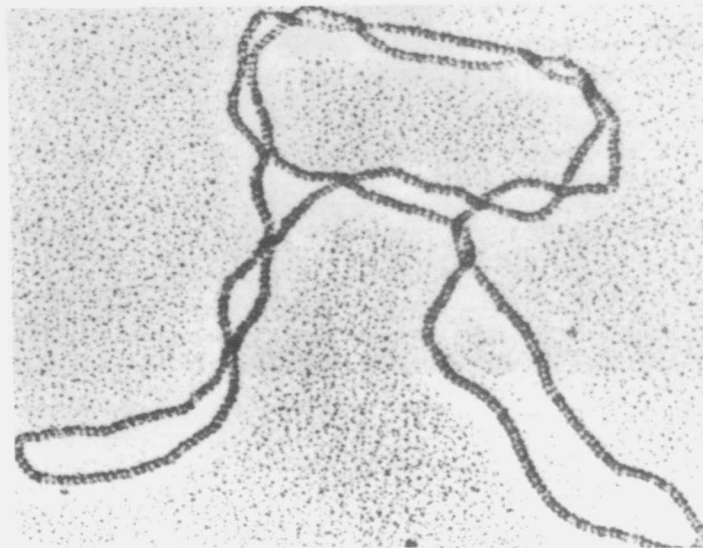
A graphic impression of the complexity of these processes can be gained in electron micrographs of chromosomes in the process of coiling and uncoiling. These techniques have actually enabled the development of the biochemical-topological technique in which electron microscopy and gel electrophoresis are combined to predict properties of unknotting enzymes. As Nicholas Cozzarelli, a front-runner in biochemical topology has pointed out "All of a sudden the math is relevant. Before Jones the math was terribly arcane. The way knots were classified had nothing to do with biology. But now you can calculate the things which are important to you."

Vaughan is described by his friends as very much a human and a New Zealander in addition to being a world-class mathematician. Fond stories abound of playing Mozart on the violin in a field in his gumboots, of his play as a prop forward, and not least of the "Vaughan Jones memorial-mile", a personally organised festival for his departure to Switzerland. Not to mention some more serious prime-hunting contests in the Kiwi, the student oasis in Auckland.

#### BIBLIOGRAPHY

- R.H. Fox, "A quick trip through knot theory" in "Topology of 3-manifolds and related topics" Edited by M.K. Fort, Prentice-Hall 1962.
- J.W. Alexander, "Topological invariants of knots and links", Transactions of the American Mathematical Society, 30 (1928), p.275-306.
- J.H. Conway, "An enumeration of knots and links, and some of their algebraic properties" in "Computational problems in abstract algebra" edited by J. Leech.
- P. Freyd, D. Yetter; J. Hoste; W.B.R. Lickorish, K. Millett; and A. Ocneanu, "A new polynomial invariant of knots and links", Bulletin of the American Mathematical Society, 12 (1985), p.103-111.
- V.F.R. Jones, "A new knot polynomial and von Neumann algebras", Notices of the American Mathematical Society, 33 (1986), p.219-225.
- L.H. Kauffman, "State models and the Jones polynomial", preprint.
- S.A. Wasserman and N.R. Cozzarelli, "Biochemical topology: applications to DNA recombination and replication: Science, 232 (23/5/86), p.951-960.
- James C. Wang, "DNA Topoisomerases" Scientific American, July 1982, p.82.

C.C. King  
Auckland University



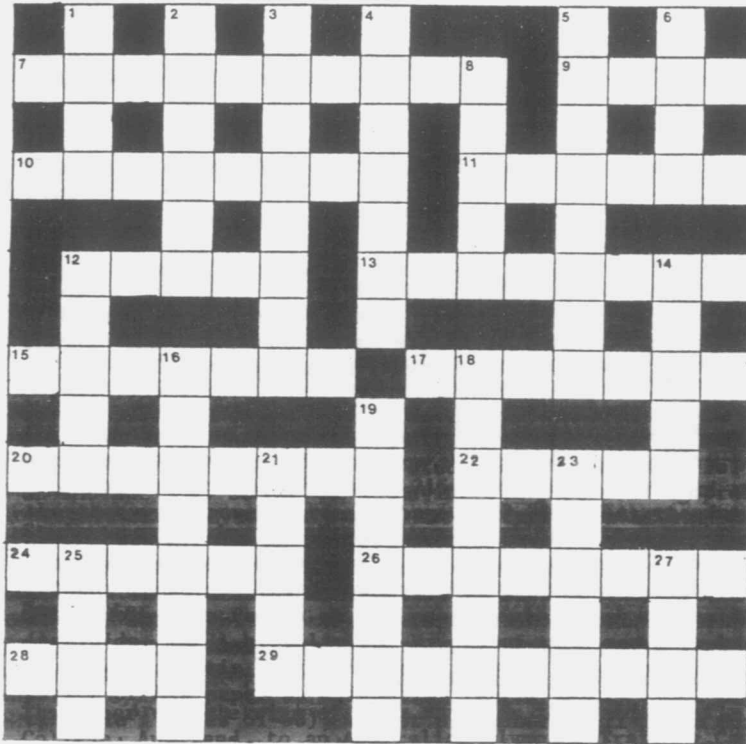


CROSSWORD #19

'STILL WE ARE SEVEN'

by Matt Varnish

DOWN



1. A birth omen against drowning (4)
2. To make one throw up (don't cite me) (6)
3. Recognition of the benighted? (8)
4. Many ran from her (4-3)
5. For waiting or to mean displaced (8)
6. Used for washing the bloomer down (4)
8. Of a Greek temple part or a malady's gradual remission (5)
12. The noise of the layabout (5)
14. A piece aside is at about the mean (5)
16. The United Nations concurred then upset the cloth (8)
18. Such notes are extra long (8)
19. The fish vessel in which to leave the vehicle (3-4)
21. The group has style (5)
23. About the handout, Keats's are of gold (6)
25. Three ran riot (4)
27. In which we hold the navy (4)

ACROSS

7. Lawren Harris, A.Y. Jackson, Frank Johnston, Arthur Lismer, J.E.H. MacDonald, Frederick H. Varley (10)
9. Francis Rupert Burnand Woolcot, Bunty, Baby, Judy, Pip, Meg. (4)
10. Envy, sloth, anger, avarice, pride, lust (8)
11. Mainz, Cologne, The Rhine, Saxony, Brandenburg, Bohemia (6)
12. Nancy, Pamela (Pam), Thomas (Tom), Diana, Unity (Boud), Deborah (Debo) (5)
13. Stephen, Philip, Prochorus, Nicanor, Timon, Parmenas (8)
15. Infant, schoolboy, lover, justice, pantaloons, second childishness (7)
17. Rhetoric, logic, geometry, arithmetic, music, astronomy (7)
20. Kent, Wessex, East Anglia, Sussex, Mercia, Deira (8)
22. Pierre de Ronsard, Joachim du Bellay, Jean-Antoine de Baif, Rémy Belleau, Pontus de Tyard, Étienne Jodelle (5)
24. Corfu, Cephalonia, Paxos, Cerigo, Zante, Sante Maura (6)
26. Bias, Thales, Chilo, Cleobulus, Periander, Solon (8)
28. Sacrifice, truth, power, beauty, memory, obedience (4)
29. Sir Rupert, Sir Jasper, Sir Lionel, Sir Conrad, Sir Gilbert, Sir Mervyn (3,7)

CROSSWORD NO. 18 Solution

Across:

7. Brad Dexter; *The Magnificent Seven*
9. Hope; *The Seven Cardinal Virtues*
10. (Jacques) d'Amboise; the brothers of *Seven Brides for Seven Brothers*
11. (Peter) Gurney; *Widdecombe Fair*
12. Hotei; *The Seven Gods of Luck*
13. (Ruta) Kilmonis; *Seven Brides for Seven Brothers*
15. Electra; *The Pleiades*
17. Caelian; *The Seven Hills of Rome*
20. Serapion; *The Seven Sleepers of Ephesus*
22. Dubhe; *Seven Stars of Ursa Major*
24. (Bartholomew) Amidei; *The Seven Holy Founders*
26. Adrastus; *Seven Against Thebes*
28. Lake; *The Seven Bishops*
29. Gelderland; *The United Provinces*.

Down:

1. Area 2. Odd bit 3. Verifier 4. Streaks 5. Charcoal 6. Apse 8. Regal 12. Halve  
14. Inane 16. Chandler 18. Aldermen 19. Entails 21. Icing 23. Basalt 25. Mean 27. Ulna

## Notes and comment

### THOMAS HARRIOT AND LONG-NOSED CHIMAERAS

At the 3rd Australasian Mathematics Convention, held at UNSW in May 1985, Dr Peter Fenton (of the Mathematics Department at the University of Otago) delivered a lecture on "Thomas Harriot (1560-1621)". His interesting paper on "Events in the life of the mathematician Thomas Harriot (1560-1621)" was published in The Australian Mathematical Society Gazette, v.12, no.4, December 1985, 85-93.

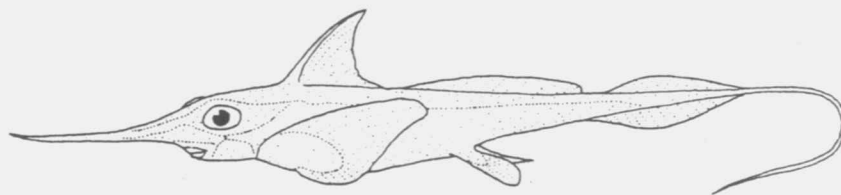
Thomas Harriot was employed by Sir Walter Raleigh, for instruction in navigation and other services. When Raleigh sent a fleet of 7 ships to colonise Virginia in 1585, Harriot was second in command of the colony. After the collapse of the colony in 1586, Harriot wrote a tract entitled "A Briefe and True Report of the New Found Land of Virginia" (1588 and later editions), which is one of the most important early accounts of America. Harriot dared not publish anything further during his lifetime, but he made careful arrangements for his mathematical researches to be published after his death. The inadequate selection from his mathematical manuscripts which did get published in 1631 was sufficient to establish his reputation as an eminent mathematician.

Since 1950, Harriot's bulky manuscripts have been studied by a world-wide team of researchers, and Harriot is now recognised as one of the outstanding intellects of his period, who was famed throughout Europe and had much influence upon many eminent people. John W. Shirley's excellent biography Thomas Harriot, A Biography, was published by OUP in 1983.

It is curious to note that a fish which is common in deep water off Otago is named Harriotta raleighana! The American zoologists George Brown Goode and Tarleton H. Bean wrote a large monograph "Ocean Ichthyology, a Treatise on the Deep-Sea and Pelagic Fishes of the World" which was published as a Special Bulletin of the Smithsonian Institution in 1895. They explained (p.xxxi) that they had named the genus Harriotta "in honor of Thomas Harriott, the first English man of science who made explorations in America".

Tony Ayling's handsome drawing of that Long-nosed Chimaera is reproduced here, from his Collins Guide to the Sea Fishes of New Zealand, Collins, Auckland, 1982.

Garry J. Tee



#### LONG-NOSED CHIMAERA *Harriotta raleighana*

Including the long tapering snout and the filamentous tail this species is usually between 1 and 1.5m long. The body is more elongate than the other chimaerids and this is further accentuated by the slender snout and tail. The snout is hard and resilient and rich in sensory organs, being used to dig in soft mud bottoms for the shellfish and crustaceans that make up the bulk of its diet. The long-nosed chimaera is orange-brown in colour, paler beneath, with some irregular darker markings. They are common on the deep continental slope in water between 350 and 750m deep off southern New Zealand. Similar species are found in deepwater in other cool temperate seas.

## MATHEMATICS AND ANZAAS

The Editorial in Newsletter 35 (December 1985) pointed out the lack of comprehension of mathematics by the general public, and the meagre communication between mathematicians and other scientists. "Where scientists gather, mathematicians flee. Much nearer the present in time and place, recent ANZAAS meetings provide further confirmation".

However, if we examine earlier meetings of ANZAAS, then we see that such insularity of mathematics was not then such a prominent feature.

The Australian and New Zealand Association for the Advancement of Science was founded in 1888, under the name of the Australasian Association for the Advancement of Science, in emulation of the British Association for the Advancement of Science (founded in 1831). The published Proceedings of many of the Congresses do include a significant number of mathematical papers, as well as some papers on physics and engineering with much mathematical content. Also, abstracts or titles of numerous other mathematical papers presented at the Congresses are listed in many volumes of the Proceedings.

The 1888 Congress at Sydney did not include any mathematical papers, but the Proceedings of the 2nd Congress (Melbourne, 1890) contain Alexander McAulay's paper "Note on the Eulerian equations of hydrodynamics" (pages 365-366), and the 5th Congress (Adelaide, 1893) published G. Fleuri's paper "On Stokes's theorem" (pages 297-301). At the 6th Congress (Brisbane, 1895) McAulay delivered the Presidential Address to Section A (Mathematics, Physics and Astronomy) "On some popular misconceptions of the nature of mathematical thought", and Sir Robert Ball (Lowndean Professor of Geometry at Oxford) delivered a paper "On a form of the differential equations of dynamics" (pages 215-217), with G. Fleuri presenting "An elementary exposition of the theory of power series" (pages 217-228). At the 8th Congress (Melbourne, 1900) E.G. Hogg spoke "On certain surface and volume integrals of an ellipsoid" (pages 191-195); whilst at the 9th Congress (Hobart, 1902) Hogg spoke on "The geometry of an axis of homology" (pages 72-80) and "On certain related factorial expressions" (pages 69-71). At the 10th Congress (Dunedin, 1904) Hogg gave Part 2 of his paper on homology (pages 78-86), and at the 11th Congress (Adelaide, 1907) he delivered Part 3 of that paper on homology (pages 297-308) and "On Steiner's quartic surface" (pages 309-317). At the 12th Congress (Brisbane, 1909) Hogg gave part 2 of his paper on ellipsoids (pages 58-61) and a paper "On the symmedian point of a triangle" (pages 61-66), whilst Sir Robert Ball (from Oxford) spoke "On the quaternion expression for the coordinates of a screw reciprocal to five given screws" (pages 52-56).

At the 17th Congress (Adelaide, 1929) Professor D.M.T. Somerville (of Victoria University College, in Wellington) delivered the Presidential Address to Section A on "The development of the ideas of space and time" (pages 140-153), and at the 21st Congress (Sydney, 1933) Professor C.E. Weatherburn delivered the Presidential Address to Section A on "The development of multidimensional differential geometry" (pages 12-29).

At the 23rd Congress (Auckland, 1937) Professor Henry George Forder spoke "On matrices related to Dirac's matrices" (brief abstract on page 23), and D.K. Picken spoke on "What is number?" (abstract on p.24). By that period, few papers got published in full in volumes of Proceedings of the Congresses. At the 24th Congress (Canberra, 1939) T.M. Cherry spoke on "The problem of stability in dynamical systems" (abstract on pages 27-28), at the 28th Congress (Brisbane, 1951) Professor Keith Bullen delivered the Presidential Address to Section A, on "Indirect inference as illustrated in geophysics" (pages 10-14), and at the 30th Congress (Dunedin, 1957) Professor Frederick Chong spoke on "The commuting operator theorem of quantum mechanics" (Abstract A31), and Dr John A. Kalman spoke on "A theorem related to Hölder's inequality" (Abstract A92).

At the 49th Congress (Auckland 1979) Section 8, on "Mathematical Sciences", was a joint meeting with the Biometric Society (Australasian Region). There were 31 lectures on statistics and its applications to biology, and a symposium on Industrial Mathematics.

The 56th Congress is scheduled to be held at Palmerston North, from 1987 January 26 to 30, with the theme of "Science in a changing society". The sectional programme on Physical Mathematical and Communication Sciences is being coordinated by Dr Ian Watson, Department of Chemistry and Biochemistry, Massey University, with topics including "Scientific and Mathematical Teaching", "Mathematical Sciences in the Community" and "Advances in Information Technology". People who feel concerned about "the isolation of mathematics from its potential clients in science, industry and government" (Editorial, Newsletter 35) could consider participating in ANZAAS 56, at Palmerston North.

## NEW ZEALAND AND THE INTERNATIONAL MATHEMATICAL OLYMPIAD

The International Mathematical Olympiad is an international mathematics competition which is held annually for students of a very high calibre. In practice the students have two  $4\frac{1}{2}$  hour sessions in each of which they have to try to solve 3 quite difficult problems. I would venture to suggest that most of us would be quite happy to get a good solution to one in the time available. Have a look at the '85 questions and see what you can do.

FIRST DAY: July 4, 1985

Time allowed:  $4\frac{1}{2}$  hours

Each problem is worth 7 points.

1. A circle has centre on the side AB of the cyclic quadrilateral ABCD. The other three sides are tangent to the circle. Prove that  $AD + BC = AB$ .
2. Let n and k be given relatively prime natural numbers,  $0 < k < n$ . Each number in the set  $M = \{1, 2, \dots, n-1\}$  is coloured either blue or white. It is given that
  - (i) for each  $i \in M$ , both i and  $n-i$  have the same colour, and
  - (ii) for each  $i \in M$ ,  $i \neq k$ , both i and  $|i - k|$  have the same colour.

Prove that all numbers in M must have the same colour.

3. For any polynomial  $P(x) = a_0 + a_1x + \dots + a_kx^k$  with integer coefficients, the number of coefficients which are odd is denoted by  $w(P)$ . For  $i = 0, 1, 2, \dots$  let  $Q_i(x) = (1+x)^i$ . Prove: If  $i_1, i_2, \dots, i_n$  are integers such that  $0 \leq i_1 < i_2 < \dots < i_n$ , then

$$w(Q_{i_1} + Q_{i_2} + \dots + Q_{i_n}) \geq w(Q_{i_1}).$$

SECOND DAY: July 5, 1985

Time allowed:  $4\frac{1}{2}$  hours

Each problem is worth 7 points.

4. Given a set M of 1985 distinct positive integers, none of which has a prime divisor greater than 26. Prove that M contains at least one subset of four distinct elements whose product is the fourth power of an integer.
5. A circle with centre O passes through the vertices A and C of triangle ABC, and intersects the segments AB and BC again at distinct points K and N, respectively. The circumscribed circles of the triangles ABC and KBN intersect at exactly two distinct points B and M. Prove that angle OMB is a right angle.
6. For every real number  $x_1$ , construct the sequence  $x_1, x_2, \dots$  by setting

$$x_{n+1} = x_n \left( x_n + \frac{1}{n} \right)$$

for each  $n \geq 1$ . Prove that there exists exactly one value of  $x_1$  for which  $0 < x_n < x_{n-1} < 1$  for every n.

So here we have a top level competition involving at most 6 students from any one country competing for gold, silver and bronze medals. These medals are perhaps dispersed more liberally than at the Olympics. About half the students who participate gain a medal and the numbers of gold, silver and bronze awarded are roughly in the ratio 1:2:3.

Now Gordon Hookings (currently controlling the executive arm of the NZ Olympiad robot) has written an interesting article on the IMO in the June issue of the NZ Maths Magazine. I'll try not to go over too much of that article here. (You might also like to read the article by Nura D. Turner "A historical sketch of Olympiads: USA and International" in the College Mathematics Journal 16, 1985, 330-368.)

There are a number of us who would like to see New Zealand send a team to the IMO on a regular basis. Why? What value is this obviously elitist activity?

One of the aims of the IMO is

the discovering, encouraging and challenging of mathematically gifted students.

Now this is certainly a worthwhile and laudable aim. As a newcomer to NZ I can't say for sure, but I suspect that here, as in Australia, very little is done for the mathematically gifted student. I think we should seek out and encourage these people. However the Olympiad only allows 6 students from each country. In being involved in aiming to send a NZ team for the first time to an Olympiad in Australia in 1988 my primary motivation is not the good of the 6. I believe that the Olympiad movement can do a lot of good for a lot of students and also for a lot of teachers.

The first visible activity to date has been a Newsletter or two which we have sent out to 50 or so students that were identified via the Australian Mathematics Competition run by the Canberra College of Advanced Education and also at the suggestion of teachers. The aim of the Newsletter is to provide a range of interesting and stimulating problems which will lead some students Olympiad-wards and give enjoyment to others. (Some of this enjoyment I've seen first hand when I met with a group of 10 students at a local girls' school. Clearly they can't all go to an IMO but they seemed to be having fun just solving problems.)

Students receiving the Newsletter are linked to a mentor from a university maths department and the aim is for student and mentor to correspond, meet if possible, and thus for the student to progress. Any good solutions to Newsletter problems will come to me for inclusion in a later Newsletter.

I'm sure that Gordon Hookings will be more than happy to hear from anyone who'd like to be a mentor.

The other visible sign of life has been the sending of a student, Mark Copeland of Glendowie College, Auckland, to an Australian Olympiad Training Camp. This was a valuable experience for Mark and provided us with ideas for the future because we will need a camp to help train the final 6. There are plans afoot to run a training camp in the Christchurch area with the aid of such people as Gillian Heald and Gus Gale in May 1987.

So that is the situation to date. There seem to be a number of people across the country who are keen and eager to see a New Zealand team in Canberra in 1988. What we need now is some formal status to bind together these people so that we can attract the financial support necessary to at least send 6 students across the Tasman at the appropriate time. Moves are afoot via the National Mathematics Committee. Watch this space for progress.

D.A. Holton  
Otago University

#### OLYMPIAD HISTORY

Hungary was the first country to organise a mathematical contest for high school students - away back in 1894. Russia followed suit forty years later in 1934, with the first contest in the U.S.A. not being until 1946. By 1951 most of the Eastern Bloc countries were running such contests and in 1959 Rumania invited six other countries from Eastern Europe to send a team of students to the first IMO. In 1965, with ten countries then participating, Finland became the first country outside Eastern Europe to join the IMO.

1967 saw England, Italy and Sweden participating, with the U.S.A. first attending in 1974. The first Western country to host an IMO was Austria in 1976. Since then the popularity of the IMO's has increased enormously and last year Finland was host to 38 countries. Thus the International Mathematical Olympiad is a prestigious event, although the average New Zealander probably remains unaware of its existence.

Australia first participated in 1981 and since then has improved in performance in a most noteworthy fashion. Since the Australian Bicentennial is to be celebrated in 1988 it is appropriate that Australia should be honoured that year to be host country for the IMO (the 29th) as one of its Bicentennial activities.

The New Zealand Association of Mathematics Teachers and the New Zealand Mathematical Society have taken the decision to enter a team in the 1988 Olympiad at Canberra and the organisation for this purpose is gaining momentum. All mathematics teachers in the country will be aware that there is the opportunity each year for secondary school mathematics pupils to take part in the B.N.Z. national contest and in the Westpac Australian contest. Mr Gus Gale, as the coordinator of the latter competition, has been able to provide the names of 50 students to whom Professor Derek Holton, of the University of Otago, has sent a newsletter concerning the 1988 IMO. A notice has also appeared in the "Education Gazette", so that hopefully every promising student will by now be aware that the chance of representing New Zealand in Canberra in July 1988 is available.

The team will comprise six students, who must be under 20 years of age in early July 1988 and must not have studied at a tertiary institution. The competition is an individual one with three questions over  $4\frac{1}{2}$  hours on each of two successive days. After marking the results are announced to the gathered competitors and numbers of gold, silver and bronze medals awarded to the best ones. An addition of marks is commonly used to give unofficial "team scores". The problems in the contest are on elementary topics but are nevertheless rather difficult. Technical skill and memorized knowledge are of little help, but instead a creative mind is necessary to solve the problems.

Selection of the team will obviously need to be done very carefully and it is proposed to encourage possible team members by "coaching" them by correspondence using questions from earlier IMO's, for example, and nearer July 1988 by holding a "camp" or camps for this purpose. The Australians have been most generous in offering to assist with training problems and also by offering a place for a N.Z. student at their training camp in Sydney.

It has also been suggested that New Zealand should have a representative at the IMO in Warsaw this July and at Havana in July 1987. Such representatives should be possible team leaders or deputy leaders, whose responsibilities include providing suitable questions to go into the pool. A meeting of team leaders selects the six questions to be used in the final.

How much financial support could be given for the Warsaw and Havana meetings will depend on the success of efforts to arrange sponsorship. There is no doubt that many international organisations value very highly the prestige to be derived from sponsoring national teams to the IMO's, as the list of such sponsors for various countries is quite impressive. New Zealand is already grateful to the B.N.Z. and to Westpac for their financial assistance with the national and Australian contests, but now is the time to prepare to enter the international contest scene.

At each of the New Zealand universities there are members of the staff of the Mathematics Department keen to assist with the encouragement of potential team members. Consequently New Zealand should be able to field a worthy team at its first IMO in July 1988.

G.A. Hookings  
Auckland University

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Mathematics Magazine 23.1 by permission  
of the author and editor.

## NATIONAL COMMITTEE FOR MATHEMATICS

The "National Committee for Mathematics" had always sounded like a mysterious body - until I became a member. Now that I am convenor, I thought that the "NZMS Community" might like to know about the Committee and some of its activities -

1. The National Committee for Mathematics (NCM) is a subcommittee of the Royal Society of New Zealand (RSNZ) Council "appointed by the Council to be channels of communication with international unions and scientific committees of the International Council of Scientific Unions (ICSU) and to coordinate New Zealand activities in relation to them".

2. "Representation at overseas meetings is the only way New Zealand's voice can be heard in discussions of the policies of the International Mathematical Union (IMU). The RSNZ endeavours to fund attendance at such meetings..." (Since New Zealand is in Group I, we are entitled to one delegate.)
3. This year our NCM nominated Professor Ivan Reilly, President of NZMS, as our Delegate to the 1986 General Assembly of the IMU to be held concurrently with the International Congress of Mathematicians (ICM) at the University of California, Berkeley, USA, 31 July - 11 August. The Council of the RSNZ was happy to support our nomination - and has allocated good financial assistance.  
Perhaps Ivan will present a report to us in the Newsletter - as well as at the 1987 Mathematics Colloquium.
4. The ICM is scheduled to be held every 4 years. In both 1978 and 1982, the NCM also selected the President of NZMS (Graeme Wake in 1978 and Jim Ansell in 1982) - and they were both allocated good financial assistance by the RSNZ Council. (However, Jim did not attend the meeting in 1982 - owing to the postponement of the international congress in Warsaw, Poland.)
5. In 1985, Professor John Butcher was convenor of NCM - and in that capacity, he compiled the list of New Zealand mathematicians who were eligible for inclusion in the World Directory of Mathematicians, 8th edition - and submitted it to the IMU.
6. The convenor of NCM is the "protector" of the NCM Archives. In looking through some of it, I learned
  - (a) NCM played a key role in the formation of the NZMS. Some of the correspondence reveals that some "big" New Zealand mathematicians opposed its formation - but in retrospect, I think we all agree that it plays a vital role for the New Zealand mathematical community, etc. Hence we owe a debt of gratitude to those who had the foresight and courage to establish NZMS. (Although many people were involved, the major thrust came from Professor David Vere-Jones, Foundation President.)
  - (b) The NZMS can celebrate its 25th Anniversary in 1999 - at which time parts of the NCM Archives may be put on display.
7. The present members of the NCM are John Butcher, Michael Carter, Murray Jorgensen, Roy Kerr, Wilf Malcolm, Gloria Olive.

G.O.

#### AN ABLE-BODIED SEAMAN'S VIEW OF MATHEMATICS

from: Reminiscences of a Wanderer

by "An A.B." (R.C. Bruce, M.H.R.)

Whitcombe & Tombs, Wellington, 1914

A Japanese mate (c1870) "had quite a talent for mathematics, and his great aspiration was to be able some day to penetrate the mysteries of the differential calculus. I had myself at some time similar aspirations, and bought some mathematical works, but how our tastes change in life! Mathematics ultimately became to me absolutely loathsome, and I arrived at the conclusion that it did not require a man to have any great ability to make a very respectable mathematician". (p.227)

An alcoholic captain in the West Indies "had a nice little library ... His books were quite a delight to me, as my own library consisted of Scott's poetry, Moore, Shakespeare and the Bible. Two works on mathematics I had thrown overboard ... I said one day to my newly-made friend, "I believe that the study of mathematics has a cramping, fettering effect upon the human mind, and must be calculated to restrain flights of imaginative fancy or of speculative thought. I cannot imagine a great poet being a great mathematician".

"Perhaps you are right", was the reply. "I never looked at it from that point before." (p.332)

## CONFERENCES

\*\*\*1986\*\*\*

- September 1-5  
(Rome) *COMPSTAT 1986 - Seventh Symposium on Computational Statistics*  
Details from COMPSTAT 1986, Dipartimento di Statistica Probabilità e Statistiche Applicate, Università degli Studi "La Sapienza", P. le A. Moro, 5-Roma, Italy.
- September 1-5  
(Marseille) *Théorie des Nombres*  
Details from Mme A. Zeller Meier, see below (d).
- September 2-3  
(Cambridge, England) *IMA Conference on Mathematical Modelling in Non-Destructive Evaluation*  
Details from I.M.A., see below (b).
- September 3-5  
(Oxford, England) *IMA Symposium on Control Theory*  
Details from K. Warwick, Department of Engineering Science, University of Oxford, Parks Road, Oxford OX1 3PJ, England.
- September 3-6  
(Montréal) *Workshop on Sign-Pattern Analysis of Linear and Nonlinear Systems*  
Details from S. L'Ecuyer, see below (c).
- September 4-7  
(Poznan, Poland) *Polish Symposium on Interval and Fuzzy Mathematics*  
Details from J. Albrycht, Institute of Mathematics, Technical University of Poznan, ul. Piotrowo 3a, 60-965 Poznan, Poland.
- September 7-9  
(Cardiff) *The Mathematics of Surfaces*  
Details from I.M.A., see below (b).
- September 8-13  
(Halle) *Algebra-Tagung Halle 1986*  
Details from Algebra-Tagung 1986, Sektion Mathematik, Martin-Luther-Universität, Universitätsplatz 6, Halle-Wittenberg, DDR-4010 Halle, German Democratic Republic.
- September 8-14  
(Tashkent, U.S.S.R.) *First World Congress of the Bernoulli Society for Mathematical Statistics and Probability*  
Details from K. Krickeberg, U.E.R. de Mathématiques, Logique Formelle et Informatique, Université de Paris V, 12 rue Cujas, F-75005 Paris, France.
- September 15-20  
(Marseille) *Journées de Probabilité*  
Details from Mme A. Zeller Meier, see below (d).
- September 15-26  
(Minneapolis, Minnesota) *Workshop on Computational Fluid Dynamics and Reacting Gas Flows*  
Details from I.M.A., see below (a).
- September 17-19  
(College Park, Maryland) *The Impact of Mathematical Analysis on the Solution of Engineering Problems*  
Details from B. Kellogg, IPST, University of Maryland, College Park, Maryland 20742, U.S.A.
- September 22-26  
(Vienna) *IFAC-IMACS Symposium on Simulation of Control Systems*  
Details from I. Troch, Technische Universität Wien, Wiedner Hauptstrasse 6-10, A-1040 Wien, Austria.
- September 22-27  
(Segovia, Spain) *Orthogonal Polynomials and their Applications*  
Details from F. Marcellan, Departamento de Matemáticas, Universidad Politécnica de Madrid, Calle Gutierrez Abascal 2, E-28006 Madrid, Spain.
- September 23-25  
(Reading) *Optimization and Simulation of Large Scale Systems*  
Details from I.M.A., see below (b).
- September 23-26  
(Innsbruck, Austria) *International Symposium on Probability and Bayesian Statistics*  
Details from Prof. R. Viertl, Inst. für Statistik und Wahrscheinlichkeitsth., TU Wien, A-1040 Wien, Austria.



- September 26-28  
(Trieste, Italy) *Congress on Variational Methods in Differential Problems*  
Details from E. Mitidieri, Ist. Mat. Univ., 1 piazzale Europa, I-34127, Trieste.
- September 29-30  
(Cardiff) *Computers in Mathematical Research*  
Details from I.M.A., see below (b).
- October 5-9  
(Ann Arbor, Michigan) *International Symposium on Information Theory*  
Details from F.J. Beutler, Department of E.E.C.S., East Engineering Building, The University of Michigan, Ann Arbor, Michigan 48109, U.S.A.  
(N.B. This meeting was incorrectly named in the previous issue of the Newsletter as an International Symposium on Operator Theory.)
- October 13 -  
November 29  
(Montréal) *Topology and Number Theory*  
Details from S. L'Ecuyer, see below (c).
- November 3-7  
(Minneapolis, Minnesota) *Workshop on Numerical Algorithms for Modern Parallel Computer Architectures*  
Details from I.M.A., see below (a).
- November 10-15  
(Montréal) *Workshop on Artin L-functions and Related Topics*  
Details from S. L'Ecuyer, see below (c).
- November 18-22  
(Marseille) *Didactique des Mathématiques*  
Details from Mme A. Zeller Meier, see below (d)
- November 24-28  
(Marseille) *Géométrie Symplectique*  
Details from Mme A. Zeller Meier, see below (d).
- December 3-5  
(Atlantic City, New Jersey) *Forty-second Annual Conference on Applied Statistics*  
Details from W.R. Young, Medical Research Division, American Cyanamid Company, Building 60, Room 203, Pearl River, New York 10965, U.S.A.
- December 15-17  
(Cirencester, England) *IMA Conference on Cryptography and Coding*  
Details from I.M.A., see below (b).
- \*\*\*1987\*\*\*
- January 12-16  
(Havana, Cuba) *Seminar on Approximation and Optimization*  
Details from H.T. Banks, Applied Mathematics Division, Brown University, Providence, Rhode Island 02912, U.S.A.
- January 26-30  
(Palmerston North, N.Z.) *56th Congress of the Australian and New Zealand Association for the Advancement of Science*  
Details from Dr M. Baxter, Dept of Microbiology & Genetics, Massey University, Palmerston North, New Zealand.
- February 8-12  
(Wairakei, N.Z.) *Australian Mathematics Society Applied Mathematics Conference*  
Details from Dr S.J. Byrne, Department of Theoretical and Applied Mechanics, University of Auckland, Private Bag, Auckland 1, New Zealand.
- May 25-29  
(Montréal) *Ninth International Symposium on Noise in Physical Systems*  
Details from S. L'Ecuyer, see below (c).
- May 28-June 1  
(Singapore) *Fourth South-East Asian Conference on Mathematical Education*  
Details from Dr Ong Sit Tui, Department of Mathematics, Institute of Education, Bukit Timah Road, Republic of Singapore 0511.
- June 8-19  
(Singapore) *Singapore Group Theory Conference*  
Details from Singapore Group Theory Conference, Department of Mathematics, National University of Singapore, Kent Ridge Road, Republic of Singapore 0511.

- June 15-July 3  
(Berkeley,  
California) *Microprogram on Commutative Algebra*  
Details from Mathematical Sciences Research Institute, 1000 Centennial Drive, Berkeley, California 94720, U.S.A.
- June 23-26  
(Bethlehem,  
Pennsylvania) *Sixth IMACS International Symposium on Computer Methods for PDE's*  
Details from IMACS Secretariat, Department of Computer Science, Rutgers University, New Brunswick, New Jersey 08903, U.S.A.
- June 23-27  
(Dubrovnik,  
Yugoslavia) *International Conference on Generalised Functions, Convergence Structures and their Applications*  
Details from Institute of Mathematics (GFCA-87), Dr Ilije Djuricica 4, 21000 Novi Sad, Yugoslavia.
- June 29-July 4  
(Paris) *First Joint International Conference on Industrial and Applied Mathematics*  
Details from I.M.A., see below (b).
- July 13-17  
(Karlsruhe,  
Germany) *Fourteenth International Colloquium on Automata, Languages and Programming*  
Details from International Colloquium on Automata, Languages and Programming, Institut für Angewandte Informatik und Formale Beschreibungsverfahren, University of Karlsruhe (TH), Postfach 6980, 7500 Karlsruhe, Federal Republic of Germany.
- August 9-15  
(Nedlands,  
W. Australia) *International Conference on Abelian Groups*  
Details from Dr P. Schultz, Mathematics Department, University of Western Australia, Nedlands, Western Australia 6009, Australia.
- August 17-20  
(Hobart,  
Tasmania) *International Conference on Rings, Modules and Radicals*  
Details from Dr B.J. Gardner, Mathematics Department, University of Tasmania, G.P.O. Box 2520, Hobart, Tasmania 7001, Australia.
- August 24-28  
(Xanthi,  
Greece) *Conference on Differential Equations "Equadiff '87"*  
Details from J. Schinas, Equadiff '87, Democritus University of Thrace Section of Applied Mathematics, 67100 Xanthi, Greece.
- August 24-28  
(Canberra,  
Australia) *Second International Conference on Combinatorial Mathematics and Computing*  
Details from B. McKay, Computer Science Department, Australian National University, P.O. Box 4, Canberra, ACT 2601, Australia.
- August 24-28  
(Seattle,  
Washington) *Sixth National Conference on Artificial Intelligence*  
Details from L. Cooper, American Association for Artificial Intelligence, 445 Burgess Drive, Menlo Park, California 94025, U.S.A.

\*\*\*1988\*\*\*

- July 27-Aug. 3  
(Budapest) *Sixth International Congress on Mathematical Education*  
Details from Dr M.F. Newman, Department of Mathematics, Research School of Physical Sciences, Institute of Advanced Studies, The Australian National University, P.O. Box 4, Canberra, ACT 2601, Australia.
- (a) Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street S.E., Minneapolis, Minnesota 55455, U.S.A.
- (b) The Deputy Secretary,  
The Institute of Mathematics and its Applications,  
Maitland House, Warrior Square,  
Southend-on-Sea,  
Essex SS1 2JY, England.
- (c) S. L'Ecuyer,  
Centre de recherches mathématiques,  
Université de Montréal, C.P. 6128,  
Succursale A, Montréal,  
Québec H3C 3J7, Canada.
- (d) Mme A. Zeller Meier, C.I.R.M.,  
Luminy Case 916,  
Route Léon-Lachamp 70,  
F-13288 Marseille Cedex 9, France.

## SUMMER RESEARCH INSTITUTE

The 1987 Summer Research Institute of the Australian Mathematical Society will be held at the University of New England, in the period January 19 - January 30. Accommodation will be available in Mary White College which is close to the Mathematics Department.

Professor I. Ekelund of the University of Paris has agreed to come to give a series of lectures entitled "New methods in Hamiltonian Mechanics". Professor Ekelund is well known for his work in this area. Moreover, he has done significant work in a number of other fields, including optimization, Banach spaces, duality for convex functions.

Professor M. Golubitsky of Houston University has agreed to give a series of lectures on singularity theory, symmetries, bifurcation theory and applications. Professor Golubitsky has developed variants of singularity theory where coordinates changes are restricted by distinguished parameters and by symmetries. He has used his ideas to obtain applications in bifurcation theory which are of considerable interest in applied problems (for example, in catalysis theory and fluid flow).

Andrew Coppel (Australian National University) will give a series of lectures on plane quadratic systems, and Professor A. Polczynski (Polish Academy of Sciences) will give a series of lectures on the theory of Banach spaces.

For further information and the 'second circular', please write to

Assoc. Prof. E.N. Dancer,  
University of New England,  
Armidale, N.S.W. 2351,  
Australia.

## 56th ANZAAS CONGRESS

26-30 January 1987

This will be held at Massey University, Palmerston North. The theme of the Congress is "Science in a Changing Society". Sectional programmes will be scheduled during the mornings, while interdisciplinary symposia and plenary sessions will feature during the afternoons and evenings. Mathematics is represented in a group containing physical, mathematical and communication sciences.

There will be a session on Friday morning, 30 January, entitled "Mathematical Sciences in the Community". The theme of this session is mathematical modelling and will be introduced by a keynote speaker, Dr R.S. Anderssen from CSIRO Division of Mathematics and Statistics, Canberra. He will be followed by other invited speakers presenting case studies, showing how they have gone about solving a specific problem from start to finish. It is anticipated that space will be found for the display of a limited number of posters on mathematical models of interest to the community.

There will also be a session on Thursday morning, 29 January, entitled "Scientific and Mathematical Teaching". There will be a panel of four speakers including one mathematician.

The First Circular has now been widely distributed. Further general information is obtainable from the ANZAAS Organising Secretary, Dr M. Baxter, Massey University, Palmerston North. Specific enquiries about the "Mathematical Sciences in the Community" session should be directed to Dr W.D. Halford, Department of Mathematics & Statistics, Massey University.

## Note:

The Australian Mathematical Society is holding its Applied Mathematics Conference in Wairakei, 8-12 February 1987. You may like to consider attending both ANZAAS and the AMC with some sightseeing in between. Contact for the AMC is Dr D. Ryan, Theoretical & Applied Mechanics, University of Auckland.

## Visitors

Correct at 9 July 1986

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

### Definite Visits

Professor C. Godsil; Simon Fraser University, Canada; Graph Theory, Group Theory; June-August 1986; University of Otago; Professor D.A. Holton.

Dr J.A. John; University of Southampton; spouse and children; design of experiments; 1 February 1986-31 January 1987; DSIR Applied Maths Auckland Substation; Dr J. Maindonald.

Professor Saunders MacLane; University of Chicago; Philosophy of Mathematics, topos theory, category theory; February-March 1987; University of Otago; Dr G. Olive; Professor MacLane will be the 1987 NZMS Visiting Lecturer.

Dr Peter M. Neumann; The Queen's College, Oxford; wife; group theory, algebra, history of algebra; 29 September 1986-10 October 1986; University of Auckland; Dr M.D.E. Conder; Dr Neumann will be a University of Auckland Foundation Visitor.

Professor Michael D. Perlman; University of Washington; wife and children; Multivariate Statistics; 21 February 1986-11 April 1987; University of Canterbury; Dr G.R. Wood; Professor Perlman will hold an Erskine Fellowship.

Professor M.D. Plummer; Vanderbilt University, Nashville, Tennessee; spouse and two children; graph theory; June-August 1986; University of Otago; Professor D.A. Holton.

Dr Terry Speed; CSIRO, Canberra; Statistics, September-October 1986; University of Waikato, Dr M. Jorgensen; Dr Speed is the 1986 NZMS visiting lecturer.

Professor Ivar Stakgold; University of Delaware; wife; nonlinear partial differential equations; January-February 1987; Massey University; Professor G.C. Wake.

Dr L.A. Szekely; Eotvos L. University, Budapest; combinatorics; January 1986-December 1986; University of Auckland; Dr N.C. Wormald.

Dr Alan B. Tayler; University of Oxford; wife; differential equations; mathematics in industry; 4-13 February 1987; Massey University; Professor Wake.

### Very Likely Visits

Professor John Buzacott; University of Waterloo, Canada; flexible manufacturing systems, scale in production, innovation modelling SDI; 1-10 August 1986; University of Canterbury/AMD Wellington; Grant Read (Department of Economics and OR, University of Canterbury), Hugh Barr (AMD).

The following people will be attending the Applied Mathematics Conference, 8-12 February 1987, Wairakei. Conference Director is Professor I.F. Collins, Department of Theoretical and Applied Mechanics, University of Auckland.

Dr R. Anderssen, DMS, CSIRO, Canberra.

Professor J.W. Miles, University of California.

Dr Mike Saunders, Stanford University.

Professor Ivar Stakgold, University of Delaware.

Professor Gil Strang, Massachusetts Institute of Technology.

Dr Alan B. Tayler, University of Oxford.

One of the main aims of this listing is to enable institutions other than the principal host institution to invite visitors to spend time with them. Anyone wishing to issue such an invitation should do so through the listed contact person.

Please Note: The production of these lists and the coordination of visits is dependent upon my receiving information. When you have information about a visit, whether it be definite, very likely or possible, would you please forward it to me at the earliest convenience.

Gillian Thornley, NZ Mathematical Society Visitors Coordinator, Department of Mathematics and Statistics, Massey University.

Next List closes on 10 November 1986.

#### COLLOQUIUM 1987

Planning for the Colloquium in Hamilton next May is well under way.

The Forder Lecturer, Professor E.C. Zeeman, will of course have the opportunity to speak.

With the new university entrance criteria, the new syllabuses and the syllabus review, education and the secondary/tertiary transition may well be a hot topic by then. Indeed, Professors Jean Pederson (Santa Clara, California) and Peter Hilton (SUNY, Binghamton), two speakers with some interest in this area, have already accepted invitations. Some of their other - more mathematical - interests are reflected in their joint article on "Folding Regular Star Polygons and Number Theory", which appeared in *The Mathematical Intelligencer* 7.1 (1985), 15-26.

The first circular, due towards the end of the year, will contain forms for participants and speakers, as usual. Meanwhile, on behalf of the Colloquium Committee, I would welcome your suggestions about speakers, themes and activities.

Colloquium 87:  
May 20-23, 1987.

Colloquium Secretary:  
Dr M.A. Jorgensen,  
Mathematics Department,  
University of Waikato,  
Hamilton, New Zealand.

#### MACHINERY

The apparatus of definitions, theorems and proofs needed to carry out this programme in detail demands a capital investment of intellectual work which may seem daunting to those not directly concerned; many readers may be able to remember feeling the same way about spectral sequences, sheaf-theory or whatever is now their favourite tool; let us be glad we don't work in algebraic geometry. Topologists commonly refer to this apparatus as 'machinery'.

Unfortunately, ..., the construction and use of machines takes work. Therefore this chapter will be written as an essay in machine appreciation; it is not intended to qualify the reader for a mechanic's certificate.

## Local News

D.S.I.R.

### Applied Mathematics Division Substation, Mt Albert

Jocelyn Dale spent four weeks during April and May visiting CSIRO Division of Mathematics and Statistics in Australia, and gave a number of seminars.

Dr Caroline Fisk starts work with the substation in August. She has an impressive record of research and practical experience in transportation. She has worked on traffic flow problems on congested networks, traffic management in downtown Chicago, and expected traffic loadings on long span bridges.

J.H.M.

### Applied Mathematics Division, Wellington

AMD's computer section has begun a joint research project with VUW Institute of Stats and OR and in association with the VUW Mathematics Department and Computer Services Centre are evaluating and developing the UNIX based software. Currently the Bell Labs statistical package S is being evaluated. There is also a joint project with VUW's Department of Computing Services to establish an experimental connection to USENET - the international network of UNIX users communicating with several thousand computers. Our AMD Wellington, Auckland and ISOR's machines are AT and T 3B2/400+ microcomputers (Unix system 5).

Dr Caroline Fisk is joining the OR section substation at Auckland. Caroline has a wide experience modelling large scale traffic flow problems on congested networks in North America. She will be working on similar problems as well as general OR problems in Auckland.

Dr John Burnell, formerly of VUW, has been appointed to the Maths Physics section. John will be working on geothermal problems, and is currently modelling the Kawerau geothermal field.

Dick Sedcole of AMD's Palmerston North substation is leaving to join the faculty of Lincoln College.

Dr Ray Brownrigg visited Australia in March to attend a DECUS meeting.

Professor Leonid Pismen of Technion University, Haifa presented a seminar in July on Methods of the Singularity Theory in the analysis of Dynamics of Reactive Systems.

G.J.W.

### OTAGO UNIVERSITY

Visitors have been Professor Chris Godsil of Simon Fraser University, Canada (April-August) and Professor Michael Plummer of Vanderbilt University, USA (June-August). They are both graph theorists who are collaborating with Professor Derek Holton.

Bau Sheng (from Huhhot, Inner Mongolia, China) is studying for an M.Sc. ("Cycles in Graphs") under Professor Holton - and is being sponsored by the Chinese government.

Stephen Crane field (who was awarded First Class Honours in Mathematics in 1985) has been awarded a Commonwealth Scholarship for post-graduate work in the Department of Artificial Intelligence at the University of Edinburgh, and will be leaving New Zealand in mid-September.

Allyson Seyb has been appointed a part-time Assistant Lecturer in Statistics.

Dr John Clark and Dr Dennis McCaughan will be attending the International Congress of Mathematicians at Berkeley, California in August. After the ICM, Dennis will be on a year's study leave at the University of Manchester.

A "Departmental Report Series" has been started for distribution to universities as well as the Departmental Library. The first four in the series have now been produced. They are:

(1) J. Clark, "On a question of Faith in commutative endomorphism rings:", (2) G. Olive, "A special class of infinite matrices", (3) D.J. Best and J.C.W. Rayner, "On Welch's approximate solution for the Behrens-Fisher problem", (4) R.E.L. Aldred and D.A. Holton, "Cycles through five edges in 3-connected cubic graphs".

Professor Derek Holton and Robert ("Tank") Aldred attended a few conferences during the May vacation. Derek was an invited speaker at the Australian Mathematical Society Meeting in Perth and at the First Japan International Conference on Graph Theory and Applications. In Perth his topic was "Why can't girls do mathematics?" and in Japan he spoke on "Cycles in 3-connected cubic planar graphs". At the National University of Singapore, they attended the Southeast Asian Mathematical Society Regional Conferences on Information and Combinatorial Mathematics held jointly with the 14th Conference of the Combinatorial Mathematical Society of Australasia - at which both Derek and Tank presented papers; Derek on "Cycles through specified vertices in 3-connected cubic graphs" and Tank on "Covers of symmetric designs".

Associate Professor Bryan Manly attended the meeting of the N.Z. Statistical Association in June in Wellington; and is now on the Association Committee as well as on the Survey Appraisal and Public Questions Committee.

A University Extension course on "Essential Mathematics for Commerce and the Sciences" attracted 75 students, and most of them attended all of the four evening sessions of two hours each. The course was organised and led by both Professor Derek Holton and Associate Professor Bryan Manly - and was assisted by 12 members of the Department. This course will be repeated next year.

Professor Derek Holton and Professor Brian Cox (Computer Science Department) have organised the "First New Zealand Computer Art Competition" in order to encourage "original works of art" which a computer has helped to produce. (Further information on this competition will appear elsewhere in this Newsletter.)

We hope to announce the recipient of the Applied Chair in the next Newsletter.

Short Course Seminars:

Professor Chris Godsil, "Distance Regular Graphs"

Dr John Clark, "Introductory Methods in Homological Algebra"

Dr Gerrard Liddell, "Software for Short Answer Tests in Mathematics"

Seminars:

Robert "Tank" Aldred, "Distance-Regular Antipodal Covering Graphs"

Dr Nick Wormald (University of Auckland), "Asymptotic Enumeration of Non-Planar Maps"

Dr Gerrard Liddell, "Mathematics Software"

Professor David Sherry (University of West Florida, USA), "Dual Taxation"

Professor Warren Wong (University of Notre Dame, USA), "Matrix Groups"

Professor John McKay (Concordia University, Canada), "Experimental Algebra"

G.O.

#### VICTORIA UNIVERSITY

We are very glad to welcome our two new lecturers: Rod Downey with his wife Kristin, and Colin Bailey with his wife Nancy and baby George. Colin has already given his first VUW research seminar, on recursion theory and the hierarchy of constructible sets.

David Vere-Jones has returned from sabbatical in Hong Kong, China, England, Sweden, Belgium and Italy. He was working on stochastic modelling of seismic data and risk, and on syllabus problems in upper secondary school mathematics and statistics.

Thora Blithe has gone on sabbatical to the University of Queensland.

The Institute of Statistics and Operations Research is happy with its new AT & T 3B2 computer and its interactive and graphical statistics package called S.

J.F.H.

## UNIVERSITY OF CANTERBURY

Ian Coope has returned from twelve months' study leave. He spent three months at the University of Waterloo and most of the remaining time at the Atomic Energy Research Establishment at Harwell. From there he visited several universities in the U.K., giving seminars at each. A final week was spent at the University of Namur, Belgium

Bill Barit left in May for one year's study leave. He first travelled to Europe, and is now at SUNY at Buffalo.

There has been a dearth of visitors to the department so far this winter, resulting in just one Seminar:

Professor Daniel Solow (Case Western Reserve University), "Finite search procedures in operations research and graph theory".

R.S.L.

## MASSEY UNIVERSITY

At the beginning of the first term, the Statistics section of the department was strengthened by the arrival of Dr Selvanayagam Ganesalingham (Ganes to his friends) to take up a lectureship. Ganes studied at the University of Ceylon (now Sri Lanka) and at the Indian Statistical Institute, Calcutta, before gaining a Ph.D. from the University of Queensland in 1980 for a thesis on cluster analysis. He has held several university appointments, the most recent being at the University of Reading, U.K. His research interests include estimation problems with finite mixtures, classification and discriminant analysis. Ganes is married with three children.

Adrian Swift returned at the end of June from a short period of overseas leave in the U.K. He attended the joint IMA/SIAM "State of the Art" conference on Numerical Analysis at the University of Birmingham, and spent the rest of his time based at the University of Aston, discussing nonlinear equations and Karmarkar's Algorithm. He also spend a useful day at Loughborough University of Technology discussing aspects of the joint research proposal he and Graeme Wake hope to commence with the Ministry of Works on analysis of vehicle coast-down data to determine aerodynamic drag and tyre rolling resistance.

The department had the pleasure of hosting two short-term visitors during June and July. Professor Leonid Pismen from the Technion, Haifa, Israel came to work with Graeme Wake on the dynamics of reactive systems, while Dr Chris Godsil (Simon Fraser University) visited Charles Little to work with him on graph theory.

We have recently instituted a Schools Extension Programme in which members of the department offer talks, on subjects of mathematical or statistical interest, to senior pupils in local schools. Several schools have already accepted some of the proffered talks. We hope by this means to encourage senior pupils to think positively about career opportunities in mathematics and statistics. We also hope the talks will be enjoyable!

The formation of a local special interest group in Operations Research (the Manawatu Operations Research Society) was marked by a public lecture on 20 June by Dr David Ryan (University of Auckland) on air-crew scheduling. The lecture attracted a large audience and generated considerable interest.

The arrival of a third Apricot computer means that we now have enough computer work stations for all our secretarial staff - a great gain in office efficiency. It also means that the results of a power failure are liable to be catastrophic!

Seminars:

Charles Little, "A colourful proof of MacLane's characterisation of planar graphs"  
John Hearne, "Analysis of lynx and hyrax control strategies in a South African sheep farming region"

Mike Hendy, "The distribution of lengths of evolutionary trees"

Prof. John McKay (Concordia University), "Experimental algebra" and "Moonshine in finite groups"

Hugh Morton, "A model of blood flow, fatigue and endurance in isometric muscle tension"

Alexander Davies (Dept of Veterinary Anatomy), "Do our expectations of muscles and bones shape up to functional reality?"

Dr Nye John (University of Southampton, and D.S.I.R., Auckland), "Analysis of block designs"



Prof. Leonid Pismen (Technion, Haifa), "Methods of singularity theory in the analysis of dynamics of reactive systems"  
 Dr Chris Godsil (Simon Fraser University), "The matchings polynomial of a graph"  
 Dr Brent Clothier (Plant Physiology Division, D.S.I.R.), "Soils, plants and mathematics"  
 Selvanayagam Ganesalingham, "A comparison of two clustering methods based on maximum likelihood"

## AUCKLAND UNIVERSITY

### Mathematics & Statistics

Professor Warren J. Wong, University of Notre Dame, departed after spending six months with the Department.

Professor David Gauld, Head of Department, returned from 12 months sabbatical leave at the end of May.

Dr Cathy Macken joined the Statistics Unit in April.

Also in April, Professor John Howie of St Andrew's University, Scotland, visited the Department. Professor Howie was a member of the Dunning Committee which met in the late 1970's and wrote a report "Assessment for All" on assessment in Scottish secondary schools.

On Saturday, 3 May, the Department made a very successful contribution to University Open Day with displays and demonstrations.

The First Inter-University Conference of Teachers of Operations Research was held in this Department commencing on Thursday, May 22 and concluding around midday, Saturday, May 24. Approximately 30 people participated with a wide representation from other New Zealand universities together with invited speakers from the D.S.I.R.

I.L.R.

### Seminars:

Dr László Székely (Eotvos L. University, Budapest), "Sets without distances in  $\mathbb{R}^n$ ".

Prof. C.W.J. Granger (University of California at San Diego), "Developments in the study of co-integrated economic variables"

Prof. John Howie (University of St Andrew's), "Some combinatorial results associated with finite transformation semigroups" and "Recent developments in Scottish secondary mathematics education".

Prof. Warren J. Wong (University of Notre Dame), "Matrix Groups"

Dr J.W. Hearne (Massey University), "Analysis of predation and competition problems in a sheep-farming region".

Dr Gerhard Schneider (University of Essen), "Cayley - a computer system for group theory".

Dr Richard D. Jenks (IBM Thomas S. Watson Research Centre, New York), "Scratchpad II: a new computational tool for mathematical research"

Dr Roger Marshall (Dept of Community Health, Auckland University), "Partitioning methods for classification and medical diagnosis".

Dr C.A. Macken (Statistics Unit, Auckland University), "A stochastic process in Immunology".

### Computer Science

Some documents by Alan Mathison Turing (1912-1954), which are highly significant in the history of computing, have been edited by Bob Doran and Brian Carpenter (formerly at Massey University) and published as "A.M. Turing's ACE Report of 1946 and other papers", Tomash Publishers, Los Angeles and San Francisco, with M.I.T. Press, 1986, 125 pages US \$20. The volume is published in the Charles Babbage Institute Reprint Series for the History of Computing.

Richard Lobb and Peter Fenwick took part in the Subject Conference on Computer Science, which was held at the University of Otago in May.

Garry Tee attended the 1986 Annual Meeting of the Australian Mathematical Society at the University of Western Australia, where he gave a lecture on "Beatrice Hill Tinsley (1941-1981), Cosmologist".

Peter Gibbons attended the 1986 Australia-Singapore Joint Conference on Combinatorial Mathematics and Computing, held at Singapore in May. He gave a lecture on "Group signings of symmetric balanced incomplete block designs".

Seminars:

Professor Ivan Flores (City University of New York), "Recent developments in microcomputer hardware and software".

John Powell (Computer Centre), "The PICK operating system - a user's view".

Kelvyn Flavall (Data General N.Z. Ltd), "Computerised scoring for televised cricket".

Professor Charlie Colbourn (University of Waterloo), "Improving bounds on network reliability".

John Rimmer (School of Music), "The making of 'Fleeting Images'".

Professor David Parnas (University of Victoria, British Columbia), "Starwars software - a critical assessment".

Garry Tee, "Dr Edmond Halley (1656-1742) - comets and numerical analysis".

G.J.T.

### WAIKATO UNIVERSITY

The life of the Department has been quite eventful in the last few months. Murray Jorgensen, formerly of the M.A.F. Biometrics Section in Wellington, joined our Statistics group in May. Already, he has greatly helped our efforts to forge closer ties with the Ruakura Research Station.

Philip Etheridge was appointed as our first programmer/technician, and is steadily putting our mathematical, statistical and pedagogical software in order.

John Turner came back from leave at the beginning of the second semester. He worked at the Universities of Florida and Santa Clara, where he took an active role in a Bay Area Graph Theory Seminar, taught first-year calculus and felt the pulse of the Silicon Valley. He returned sufficiently refreshed to take up a heavy task and stern challenge: see below.

Bill Bolstad left for a well-earned leave, mostly at the University of Minnesota in the Department of Applied Statistics.

Kevin Broughan went to Oxford with the D.F.C. in April to sign up a distribution contract for the software system Naglink. Naglink provides an interface between the Nag library and MACSYMA (or soon, the smaller language Pipi under development at Waikato). Later, he spent a week at the NAG office in Chicago, training the NAG staff in the intricacies of the software.

In June, the University Council approved the establishment of the School of Computing and Mathematical Sciences. Besides Computer Science and Mathematics, Physics and Philosophy are also represented in it. The School has been under discussion for some years, and its establishment marks a very significant turning point in the life of the University and of the Department. John Turner was named as its Dean Designate, and he has to lead and co-ordinate the immense amount of detailed planning needed. Further details will appear...

The Department now has a Sun Workstation, connected by Ethernet to the main campus network. With the arrival of a second Sun Workstation in late August, this will give a substantial boost to our numeric, symbolic, graphic and type-setting capabilities. In addition, the VAX 730 used by the Department has changed to the UNIX operating system, which results in a highly integrated VAX/VMS and UNIX VAX/Workstation network.

K.A.B.

Seminars:

Prof. L.R. Foulds, (Waikato, Department of Management Studies), "Enumerating phylogenetic trees with multiple labels".

Dr M. Upsdell (Ruakura), "Bayesian inference for functions, with applications for numerical analysis".

Dr G. Schneider (Essen), "Cayley - a computer system for group theory".

Dr M. Jorgensen (Waikato), "Throwing knives at moving targets".

Prof. J.N. Crossley (Monash), "The interface between logic and computer science".

## NZMS PRE-DOCTORAL THESIS COMPETITION

Every two years, the NZMS mounts a competition for projects and theses on mathematical topics (up to M.Sc. level). The intention of the Society is to reward students who have produced well-organised, readable and interesting theses. Judging is therefore not based on mathematical originality (as this has already been assessed by the degree examiners), but on the quality of the writing.

The results of the 1986 Competition (judged by Drs D. Breach, A. McInnes and M. Smith at the University of Canterbury) are as follows:

First prize (\$150) to S.B. Wood for "The Bayesian Approach to Statistics - a review of methodology with selected applications" (M.Sc. in Statistics at Massey University; supervisor: Dr Howard Edwards).

Second prize (\$100) to T.J. Connolly for "Inverse Problems for an Elliptic Equation" (M.Sc. in Mathematics at the University of Canterbury; supervisor: Dr David Wall).

The Society is grateful to BURROUGHS INC. for their sponsorship of this competition.

B. Wilson  
Canterbury

## QUEEN'S BIRTHDAY HONOURS

In June this year, Prof. D.B. Sawyer received an MBE 'for services to mathematics'. In reporting this award, the Otago Daily Times noted his retirement to Wanaka, his two periods of service at Otago University, as well as his 'active role in forming Waikato University', the University of the South Pacific and the N.Z. Mathematical Society. (See also his Centrefold, in the Newsletter.)

## THE NATIONAL BANK JUNIOR MATHS COMPETITION

This nation-wide competition, for Forms 3, 4 and 5, was held on April 30. Run by a committee of four at Otago University, it involved more than 4000 contestants from 135 schools, with about 1300 in each form. At each level, about 100 certificates of merit, 25 prizes of \$20 and winners' prizes of \$80, \$60 and \$40 were awarded. (Editor's Remark: No country schools figure in the list below.)

In Form 3, the winners were

1. Vanessa Taler, Epsom Girls Grammar School (Epsom),
2. C.J. Hogg, Auckland Grammar School (Remuera), and
3. Philip Baysel, Burnside High School (Christchurch).

In Form 4, the winners were

1. Stuart Faulds, Otago Boys High School (Dunedin),
2. Roger Beggs, Naenae College (Lower Hutt),
3. Benjamin Caradoc-Davies, Otago Boys High School (Dunedin), and Sharyn Van Alphen, St Dominics College (Blockhouse Bay).

In Form 5, the winners were

1. P. Hirst, Palmerston North Boys High School (Palmerston North),
2. William Jones, Logan Park High School (Dunedin), and
3. Conrad Bullock, Scots College (Wellington).

We feel this competition should be run again next year: it should help to provide strong contenders for future International Mathematics Olympiad teams from New Zealand.

D. Holton  
Otago University

## Book Reviews

ELEMENTS OF ALGEBRA, by Leonard Euler. Springer-Verlag, New York etc; 1984, liv + 593 pages.

Leonard Euler's ELEMENTS OF ALGEBRA has been acknowledged as one of the most influential textbooks of algebra, ever since it was first published (in Russian) in 1768. The 5th English edition was published in 1840, and most of that edition is reproduced in facsimile in this 1984 edition.

Clifford Truesdell's informative essay on "Leonard Euler, Supreme Geometer" is reprinted (pages vii-xxxix) from An Idiot's Fugitive Essays on Science, (Springer-Verlag, New York etc, 1984) - with some omissions noted (p.xxxix). Truesdell refers (p.xxxiv) to a title-page reproduced as Figure 22, which is not reproduced here. The copyright notice for Truesdell's essay (on the reverse of the titlepage) states that it was copyrighted in 1972 - but this version of the essay tells that The Science Citation Index for 1975 through 1979 lists roughly 200 citations of some 100 of Euler's publications" (p.x). The addition theorem for elliptic functions is represented (p.xvii, note 7) as "in the notation of Jacobi,  $\text{sn}(u+v) = \dots$ " (etc.) - but Jacobi wrote the elliptic functions as  $\text{sn} \text{ am}(E, k)$  etc.; and Gudermann introduced the notation  $\text{sn}(u)$  etc. (cf. Karl Weierstrass, Mathematische Werke, t.1, 1894, p.120).

Euler was born at Basel in 1707, and he became the most prolific of all mathematicians, regarded by some mathematicians (including Truesdell) as ranking with Archimedes, Newton and Gauss. He was an Academician at St Petersburg from 1727 to 1741, then at Berlin until 1766, and then again at St Petersburg until his death in 1783. He had lost the sight of an eye in 1738, and he was almost totally blind throughout his second period in St Petersburg. The editors of the original German text of the ELEMENTS OF ALGEBRA (first published at St Petersburg in 1770) explained that: "We present to the lovers of Algebra a work, of which a Russian translation appeared two years ago. The object of the celebrated author was to compose an Elementary Treatise, by which a beginner, without any other assistance, might make himself complete master of Algebra. The loss of sight had suggested the idea to him, and his activity of mind did not suffer him to defer the execution of it. For this purpose M. Euler pitched on a young man, whom he had engaged as a servant on his departure from Berlin, sufficiently master of arithmetic, but in other respects without the least knowledge of mathematics. He had learned the trade of a tailor; and with regard to his capacity, was not above mediocrity. The young man, however, has not only retained what his illustrious master taught and dictated to him, but in a short time was able to perform the most difficult algebraic calculations, and to resolve with readiness whatever analytical questions were proposed to him."

This fact must be a strong recommendation of the manner in which this work is composed, as the young man who wrote it down, who performed the calculations, and whose proficiency was so striking, received no instructions whatever but from his master, a superior one indeed, but deprived of sight."

The ELEMENTS OF ALGEBRA does indeed start as a beginner's introduction to algebra, with Part 1 (pages 1-298) ending with solution of quartic equations; but Part 2 consists of advanced treatises on number theory by Euler (pages 299-462) and by Lagrange (pages 463-593). Euler's works are celebrated for their clarity, but not for the rigour of their reasoning. Indeed, this text contains several passages which will cause modern readers to raise their eyebrows. As an example, "for  $1/0$  signifying a number infinitely great, and  $2/0$  being incontestably the double of  $1/0$ , it is evident that a number, though infinitely great, may still become twice, thrice, or any number of times greater" (p.23, with uneasy comments in a footnote by one of the commentators). Imaginary numbers are expounded (pp.42-44) with the muddle typical of 18th century treatments of them. Euler expanded  $1/(1-a)$  and  $1/(1+a)$  in powers of  $a$ , initially with exact remainders (pp.89-97), but then he asserted that the infinite series  $1 + a + a^2 + a^3 + \dots$  is the same as  $1/(1-a)$  for all  $a$ . He attempted to justify this even for  $a = 2$ , giving the noteworthy sum  $1 + 2 + 4 + 8 + \dots = -1$ ; and similarly he claimed that  $1 - 1 + 1 + \dots = \frac{1}{2}$ . A footnote on page 93 (by Bernoulli) acknowledges uneasily that the remainder does need to be considered when summing infinite series. Nonetheless, Euler almost always ignored questions about convergence of series, in this text as elsewhere.

Euler's algebraic proof of the standard arithmetic algorithm for extraction of square roots (pp.100-104) was a striking innovation. In this text, variables are mostly used to represent real numbers, which could be positive or negative. However, there are lingering traces of the old prejudice against negative numbers. For instance, the general quadratic equation is represented as  $ax^2 \pm bx \pm c = 0$ , with  $a$ ,  $b$  and  $c$  each being positive or zero (p.217), and similarly for the general cubic equation (p.253); but the general quartic equation is written as  $x^4 + ax^3 + bx^2 + cx + d = 0$  (p.272). In addition to Ferrari's Rule for algebraic

ELEMENTS OF ALGEBRA,

BY

LEONARD EULER,

TRANSLATED FROM THE FRENCH;

WITH THE

NOTES OF M. BERNOULLI, &c.

AND THE

ADDITIONS OF M. DE LA GRANGE.

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FIFTH EDITION,

CAREFULLY REVISED AND CORRECTED.

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BY THE REV. JOHN HEWLETT, B.D. F.A.S. &c.

TO WHICH IS PREFIXED

*A Memoir of the Life and Character of Euler,*

BY THE LATE

FRANCIS HORNER, ESQ. M.P.

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LONDON:

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PATERNOSTER ROW.

1840.

solution of the general quartic equation, Euler gave his own method (pages 282-288). Euler expounded the Newton-Raphson method and Daniel Bernoulli's method for the numerical solution of an equation, illustrating the latter by applying it to solve the truly remarkable equation

$$x^{\infty} = x^{\infty-1} + x^{\infty-2} + x^{\infty-3} + \dots \quad (\text{p.296}).$$

The algebra in Part 1 is fairly conventional, but Euler published quite new results in number theory in Part 2. After a detailed treatment of integer solutions of linear indeterminate equations, he considered integer or rational solutions of various classes of indeterminate equations of degrees 2, 3 and 4. Lagrange was unimpressed by Part 1, but he was so impressed by Euler's work on number theory (in Part 2 of this text, and in the Commentaries of the St Petersburg Academy) that he wrote extensive additions for the French edition of 1774 (pages 463-593 in this edition). Lagrange proved that the continued fraction expansion of every quadratic irrational is periodic - no comparably general result has yet been found for roots of irreducible polynomial equations (with integer coefficients) of degree 3 or higher! He presented his general method for finding integer or rational solutions to indeterminate quadratic equations, showing in various cases (e.g.  $x^2 - 79y^2 = 101$ ) that there is no solution in integers.

#### Bibliographic Study:

The complicated bibliographic history of this text is not made clear to the reader of this 1984 edition. The titlepage is headed thus:

Euler  
Elements of Algebra  
Translated by Rev. John Hewlett, B.D. F.A.S. &c  
With an Introduction by C. Truesdell.

The date 1984 is obscurely indicated on the reverse of that titlepage.

Euler dictated his text in German, but it was first published in a Russian translation at St Petersburg in 1768, with the German text being published (as *Vollständige Anleitung zur Algebra*) at St Petersburg in 1770 (cf. C.E. Smith, *History of Mathematics*, 1923, p.522). After Truesdell's essay (pages vii-xxxix), this edition reprints most of the 5th English edition of 1840, with the titlepage opposite.

The first four pages of Francis Horner's Memoir of Euler are omitted. This edition omits much relevant information: to start with, which member of the Bernoulli dynasty is indicated on that 1840 titlepage? Consulting the articles in the *Dictionary of Scientific Biography* on the Bernoullis, one finds that Johannes 3rd (1746-1807) translated Euler's text into French, and that it was published in 1774 with the extensive additions by Lagrange. The English translation of that French version was first published anonymously at London, in 1797.

The 3rd English edition (Longman, Hurst, Rees, Orme & Co; London, 1822) contains an Advertisement by John Hewlett, which commences with the following sentence: "Having prefixed my name to the present edition of Euler's Algebra, it may be proper to give some account of the Translation; which I shall do with the greater pleasure, because it furnishes a favourable opportunity of associating my own labors, with those of my distinguished pupil, and most excellent friend, the late FRANCIS HORNER, M.P.". The article in the *Dictionary of National Biography* on Francis Horner (1778-1817) tells that he left Edinburgh University in 1795, "and having determined to go to the bar, was placed in the care of the Reverend John Hewlett at Shacklewell Middlesex, in order to rid himself of his broad Scottish accent"(!). Hewlett explained (in that Advertisement) that he suggested to Horner that he study Euler's Algebra and translate part of it from French into English. In fact, Horner translated the entire work, and also wrote the Memoir of Euler. After Horner returned to Scotland in 1797, Hewlett edited Horner's translation and published it in 1797: Horner was then 19 years old. Horner later became a politician, and he insisted upon anonymity for the first and second editions of his translation. (The 2nd edition was edited by Peter Barlow.) After Horner died in 1817, Hewlett was able to publish Horner's role as translator. But, it does seem rather odd that the titlepages of the editions of 1822, 1840 and 1984 should each indicate that Euler's Algebra had been translated by John Hewlett, rather than edited by him. The footnotes in those three editions include many which are signed by F.T.; who is not identified.

In future printings of this classic work, the publisher would be well advised to include the "Advertisement by the editors of the original, in German", and John Hewlett's "Advertisement", from the edition of 1822, together with the complete Memoir by Francis Horner. And the title page could declare that Euler's ELEMENTS OF ALGEBRA had been translated by Francis Horner from the French translation by Johannes Bernoulli 3rd of the original German text, and that the English translation had been edited by the Reverend John Hewlett.

G.J. Tee

Séminaire d'Algèbre Paul Dubreil et Marie-Paule Malliavin. Proceedings, Paris 1983-1984 edited by M.-P. Malliavin; Springer-Verlag, New York (1985), 420 pages.

This annual seminar on algebra was founded in 1947 and for many years was run under the direction of Paul Dubreil. The main aims of the seminar are to provide a means for the dissemination of recent theories which are not yet widely known and to give algebraists an opportunity to report on recent progress. This volume presents articles from eighteen algebraists from various countries and we will now briefly describe the content of these.

As an entrée, D. Bartels presents his 105 page article "Quasi-Homogene affine Varietäten für  $SL(2, \mathbb{C})$ ", dealing with linear actions of the group  $SL(2, \mathbb{C})$  on a vector space. J. Bertin's "Automorphismes des surfaces non complètes, groupes fuchsien et singularités quasi-homogènes" follows giving an investigation into the relationships between the algebraic and geometric properties of a surface and its topology. The next article "Quelques résultats et conjectures concernant les séries de Poincaré des invariants des formes binaires", by J. Dixmier, looks at three conjectures on Poincaré series, establishing their truth in special cases.

A novel title page introduces "Interpolation de Newton à plusieurs variables" by A. Lascoux and M.P. Schützenberger. This studies the action of the symmetric group on a polynomial ring using a generalisation of Newton's divided differences. Next comes an article showing how abstract algebra applies to coding and decoding of information, namely "A constructive characterization of all optimal linear codes" by U. Oberst and A. Dur. Oberst continues with "Actions of formal groups on formal schemes. Applications to control theory and combinatorics".

The second half of the volume takes on more of a ring theory flavour. It begins with T. Levasseur's "Complexe bidualisant en algèbre non commutative" which studies filtrations of modules. More filtrations are studied in J.C. McConnell's "The K-theory of filtered rings and skew Laurent extensions" where the aim is to give a sketch of a particular case of an important theorem in algebraic K-theory due to Quillen. T.A. Springer deals with an aspect of differential algebra in "Microlocalisation algébrique" while M. Sweedler presents an account of joint work with M. Takeuchi in "Introduction to the algebraic theory of positive characteristic differential geometry". The representation theory of finite dimensional algebras is next studied in K. Bongartz's "Quadratic forms and finite representation type".

Chains of prime ideals are studied by A. Bouvier and M. Fontana in "The catenarian property of the polynomial rings over a Prüfer domain". This is followed by a look at localisation in non-commutative Noetherian rings in the article "Ore sets in Noetherian rings" by K.A. Brown.

A D-ring is a commutative ring  $A$  where for every element  $x$  in  $A$  there exist elements  $a$  and  $e$  in  $A$  with  $e^2 = e$ ,  $e = ax$ , and  $x - xe$  in the Jacobson radical. These rings are investigated by M. Contess and L. Lesieur in their "D-anneaux et anneaux F-semi-parfaits". The final article is "Hereditary P.I. algebras" by S. Jondrup. Here a ring  $A$  is left hereditary if all its left ideals are projective while P.I. stands for polynomial identity, the class of P.I. rings containing the commutative rings as a subclass.

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Groups - Korea 1983: Proceedings, Kyoungju, Korea, edited by A.C. Kim and B.H. Neumann; Springer-Verlag, New York (1984), 183 pages.

This collection of papers came from an international conference on combinatorial group theory and related topics held in Korea in August 1983. Of the seventeen papers two deal with algorithmic problems for finitely presented groups, authored by G. Baumslag and F.B. Cannonito, while a third by D.J.S. Robinson on infinite soluble groups is also in this general area of word problems. Finite simple groups feature in an article by C.M. Campbell and E.F. Robertson and again, with applications to combinatorics, in a paper by C.E. Praeger. Isomorphisms of integral group rings are the topic in a further two articles by K.W. Roggenkamp and F. Köhl.

In "Extending groups via tree automorphisms" by N. Gupta a new construction of groups is presented which is useful for producing examples of finitely generated infinite  $p$ -groups. V. Huber-Dyson's article "HNN-constructing finite groups" shows how one can obtain all finite groups by repeated application of the HNN extension construction starting with  $S_3$ , the smallest non-abelian group. In "The concept of 'largeness' in group theory II", the authors M. Edjvet and S.J. Pride show how their concept helps in various classes of groups.

Coset graphs have long been used in the study of permutation groups and here R.C. Lyndon presents an article on further uses. D.L. Johnson has a paper investigating analogues of the braid group defined by means of a presentation. There is also a resumé of a survey talk on discontinuous groups given at the conference by J.L. Mennicke.

Some structural features of relatively free metabelian groups of prime-power exponent are described by an article of M.F. Newman while B.H. Neumann writes on commutative quandles, where a quandle is an algebraic system with two binary operations, one of them mimicking conjugation in a group, the other undoing the effect of the first.

Finally G. Rosenberger writes on the representation of elements and subgroups in free products while K.-I Tahara and A. Hosami look at circle groups of finite nilpotent rings.

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#### ERRORS - BOGUS AND REAL:

For the record (and its a chance to get the book mentioned again!), Alan Lee's review of my 'Statistical Computation' (NZMS Newsletter, April 1986, pp. 28-29) is mistaken in the claim that:

"The discussion of storage of upper triangular arrays on p.8 has the wrong formula for the location of the  $(i,j)$  element."

If rows and columns are both numbered from 0 to  $q$  and elements are then written out in the order  $(0,0), (0,1), (1,1), (0,2), \dots$ , then element  $(i,j)$  IS the  $[j(j+1)/2+i+1]$ th in the sequence.

Apart from giving wrongly the second initial of the names of a couple of New Zealand mathematicians, errors of which I am aware are:

1. On page 104, lines 3 and 4,  $T_p^{-1} T_p^{-1}$  is, contrary to what is stated, a generalised inverse of  $T_p^{-1}$ . In fact it is a reflexive  $g$ -inverse.
2. The formula for the Householder reflection is incorrect on three separate display lines on pages 137-138, though correct in the text.
3. In eq.(3.2) on page 266, the four '+'s should be '-'s.
4. In line 400 of the listing on page 323, add: \ DO = D.

These should be corrected in the next printing.

John Maindonald