

THE NEW ZEALAND MATHEMATICAL SOCIETY

NEWSLETTER

COUNCIL NOMINATIONS

Nominations are invited for four positions on the Council of the Society: three Councillors and an Incoming Vice-President. The Councillors normally hold their positions for three years, while the Incoming Vice-President will, in the two subsequent years, act as President and then as Outgoing Vice-President.

Candidates for these positions must be financial members of the NZMS. They must be nominated by two other financial members of the Society, and the nomination must be accompanied by the signed statement of the nominee that s/he is prepared to accept nomination. Nominations should reach the Secretary not later than 31st March. The election of an Incoming Vice-President and three Councillors will be held at the Annual General Meeting in May.

Candidates are invited to submit a short biographic description for inclusion in the Newsletter. This should accompany the nomination form.

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News and Notices

THIRD AND FOURTH AUSTRALIAN MATHEMATICS CONVENTIONS

The Council of the NZMS has accepted the offer of the Australian Mathematical Society to host the Third and Fourth Australasian Mathematics Conventions.

The Third AMC will be held during the week 13th-17th May, 1985 at The University of New South Wales. (UNSW is about four miles from the centre of Sydney). In response to comments from members who attended the Second AMC at the University of Sydney, the Secretary has already written to the Head of the School of Mathematics at UNSW, suggesting that the programme should include significant sections on Applied Mathematics and Statistics as well as on Pure Mathematics. A favourable reply to this letter has been received.

The Fourth AMC will be held during the week 16th-20th May, 1988 at The Australian National University in Canberra. This will be held as part of the Australian Bicentennial celebrations. Details of these have yet to be finalised, but it is certain that it will be difficult to obtain accommodation in Canberra during 1988. A booking has already been made in Bruce Hall, a residential college at ANU, and needs to be confirmed soon. The NZMS Council has advised the Australian Mathematical Society that it expects a group of at least 40 from New Zealand to attend. It would be appreciated if the Council could be given an idea of how accurate this estimate is.

Please advise the Secretary now if you think that you will be attending the Fourth Australasian Mathematics Convention in Canberra in 1988. This will not commit you to attending, but it may assist you in finding accommodation if you do go.

ROYAL SOCIETY OF NEW ZEALAND

Members will be aware that Professor David Vere-Jones (Victoria University of Wellington) was elected to a Fellowship of the RSNZ during 1982. The Society is keen to have other deserving mathematicians recognized in this way, and has made a nomination during 1982.

The Council invites suggestions of possible nominees, and will consider these at its meeting in May. If you wish to suggest someone for consideration, would you please notify the Secretary by 1st May. At this stage, only a brief description of the candidate's achievements is necessary.

DOWN UNDER CALCULUS

With some trepidation, the NZMS publications committee has embarked on what can euphemistically be called 'the Calculus project'. From initial discussions at the 1982 Dunedin Colloquium, it seemed that we might be able to produce co-operatively a text suitable for the bulk of first year NZ university students. Subsequent examination of the course outlines and curricula for all appropriate courses taught at NZ universities indicated that the few significant local variations could be accommodated within such a text.

Teachers of first year calculus in all six universities have been consulted, and a fairly representative writing team has been appointed. Departments not represented on the writing team have contributed relevant materials. Members of the writing team had their first meeting in Wellington early in December, and are now hard at work. We hope they're not feeling down, under calculus.

We Need Your Help!

1. If you have any exercises or problems related to calculus with a New Zealand flavour, we would like to use them in this text. Please send such items to the undersigned at your earliest convenience.
2. It is hoped to have the first draft of the manuscript available at the 1983 Massey Colloquium in May. This will enable everyone to peruse and criticize the product at a stage when changes can still be made.
3. The heading of this item is not necessarily the suggested title for the text. Perhaps we should run a competition (with prizes?) at the Massey Colloquium to find the best possible title?

Ivan Reilly,
Convenor, NZMS Publications Committee.

Local News

CANTERBURY UNIVERSITY

Gordon Petersen has left on a two months visit to Asia. He will be giving invited lectures at Universities in Hong Kong, Taiwan, Canton and Singapore, returning to Canterbury at the beginning of February.

Roy Kerr spent a month in Pakistan under the auspices of Unesco. He subsequently joined the New Zealand Contract Bridge team in Bangkok to contest the Far Eastern championship. New Zealand finished in second place.

The department has just produced its first female Ph.D. Loi Soh Loi has completed her doctorate with Alan McInnes, the title of her thesis being "Quadratic Approximation and its Application to Acceleration of Convergence". Dr. Loi has been appointed a lecturer in mathematics at the National University of Singapore.

Ting-On To has departed on study leave, initially in Hong Kong.

Bob Broughton, Philip Sharp, and David Wall attended the 3-day symposium on the Numerical solution of differential equations organised by Professor J. Butcher to take advantage of the visit to New Zealand of Professor G. Dahlquist from Sweden.

Visitors expected in early 1983 are:

Professor Adam Buraczewski (University of Papua New Guinea), from 14 January to 8 February. His principal field of interest is operator theory.

Dr. G. A. Watson (University of Dundee), March - May; numerical analysis.

Professor K. Hirsch (Queen Mary College, London), March - May; continuum mechanics.

Assistant Professor R. K. Beatson (University of Connecticut), January - December 1983; numerical analysis, approximation theory.

R.S.L.

MASSEY UNIVERSITY

The past few months have been a quiet time. Preparations are well under way for a major change in our first-year offerings. The single mainstream Algebra and Calculus paper is to be replaced by two papers, Introductory Calculus, and Algebra and Geometry. Major changes are also taking place in the second-year statistics offerings, where the Introductory Theoretical Statistics paper is likewise being replaced by two papers, Probability and Statistics, and Statistical Inference. All these changes will be introduced internally in 1983 and extramurally in 1984.

December saw the departure of our two visitors. Graham Read from the Open University and Peter Comer, our visiting teaching fellow. Before he left, Peter crystallized some of his thoughts in a seminar entitled "School and University, and where begins Mathematics?". Graham left behind an enthusiasm for innovations in extramural teaching which will undoubtedly be of benefit to us for a long time to come.

M.R.C.

OTAGO UNIVERSITY

Dr. Marston Conder (former post-doctoral fellow at Otago - and honours graduate from Waikato) visited us during November. He spent most of 1982 at the Mathematical Institute in Tübingen (West Germany) on a research fellowship from the Royal Society under the European Scientific Exchange Programme, and is currently writing up his results on group actions on surfaces. Marston will take up a lectureship at the University of Auckland in January, 1983.

Dr. John Harris attended the Philosophy of Science Association Biennial Meeting in Philadelphia from 29 to 31 October, and presented a paper. He went on to give talks at Vanderbilt University, and the Universities of New Mexico, Oklahoma, Georgia, South Carolina, and Minnesota before returning to New Zealand early in December.

Professor Martin Schwarzschild, Emeritus Professor of Astronomy at Princetown University, visited the Physics and Mathematics Departments (November & December) and gave a lecture on "The Dynamics of Giant Galaxies".

G.O.

WAIKATO UNIVERSITY

Staff changes make the headlines: Peter Braun and Ray Littler both resigned at 31 January. Peter has gone to Sydney, to help found an art boutique (with the franchise from several N.Z. potters and painters). Ray has joined Ruakura, as the A.M.D. correspondent may confirm, hoping to get his hands dirty on more down-to-earth problems.

To compensate for this, the university granted us (statistical) junior lectureship, for two years. Bronwyn Beder - I hope I've got her name right; if not, blame our staffing section - has taken this up, after completing Honours at Vic.

Don Lewis has all but completed his Master's dissertation, and has accepted a mathematics lectureship at the University of Technology, Lae, Papua New Guinea. (Full circle, as he came here from PNG.)

Seminars:

Graham McBride (MWD, Water and Soil Science Centre) "*A Lagrangian numerical scheme for an advection-dispersion problem.*"

R. Radock (Asian Institute of Technology, Bangkok) "*Algorithms for experimental estimates of eddy diffusivities.*"

M.S.

USP APPOINTMENTS

As part of its policy of seeking ways in which to further mathematical education in the South Pacific, the NZMS recently wrote to the New Zealand Vice-Chancellors' Committee to seek an expression of its attitude and policy on the granting of leave to staff to enable them to take up appointments with limited tenure at the University of the South Pacific. The following reply was received, and is printed here for members' information.

Dear Dr. Russell,

I am replying to your letter to the Secretary of the New Zealand Vice-Chancellors' Committee, on behalf of the Committee.

In 1974 there were negotiations between the Committee and the Ministry of Foreign Affairs concerning the basis of secondment and funding of New Zealand university staff to the University of the South Pacific. The terms of the approved scheme at that time were:

1. That New Zealand academic and administrative staff employed by the U.S.P. should receive an equalization allowance to bring their total emolument to equivalent to their net New Zealand salary.
2. That appointment to the U.S.P. of any New Zealand staff should be on the basis of secondment at New Zealand salary rates.
3. That the Ministry of Foreign Affairs was prepared to provide assistance from bilateral aid funds for secondments on the following basis:
 - (a) the number of secondments at any time not to exceed 10;
 - (b) the U.S.P. to explore all reasonable alternatives before approaching New Zealand universities;
 - (c) secondments to be for a term not exceeding two years;
 - (d) in seeking appointees to unfilled vacancies, the U.S.P. to approach individual universities in New Zealand on an informal basis to ascertain if the staff required were available, keeping the Vice-Chancellors' Committee informed. When it was established that suitable staff were available the U.S.P. was to submit a formal request to the Ministry of Foreign Affairs for assistance with the appointment.

A number of detailed provisions were then made for the financial arrangements.

In the event it does not appear that the system has worked in this formal way. The present position is that the Ministry of Foreign Affairs as part of its total aid funding to the U.S.P., provides a specified amount to cover the university's supplementation of local salaries necessary to attract New Zealand staff. This is administered entirely by the University itself which exercises its own discretion in the use of these funds, and makes individual approaches to the staff and universities concerned in New Zealand.

Overall it is my experience that University Councils and Vice-Chancellors have been supportive in terms of releasing staff for the U.S.P. where such approaches have been made, and I think it would be true to say that this attitude still prevails.

Yours sincerely,

J. D. Stewart,
CHAIRMAN, NZVCC.

Conferences

*** 1983 ***

- January 10-14
(St. Louis, Missouri)
William H. Roever Lectures in Geometry
Details from William M. Boothby, Department of Mathematics, Washington University, St. Louis, Missouri 63130.
- January 10-14
(College Station, Texas)
Fourth International Symposium on Approximation Theory
Details from C.K. Chin, Department of Mathematics, Texas A & M University College Station, Texas 77843.
- January 17-29
(Dubrovnik, Yugoslavia)
Foundations of Computation Theory
Details from Secretariat, Inter-University Centre of Postgraduate Studies, Frana Bulica 4, YU-50000 Dubrovnik, Yugoslavia.
- February 9-19
(Adelaide)
Third International Mathematical Physics Workshop and NUPP Meeting
Details from C.A. Hurst, Department of Mathematical Physics, University of Adelaide, Adelaide, South Australia 5001.
- February 14-17
(Boca Raton, Florida)
Fourteenth South-Eastern Conference on Combinatorics, Graph Theory and Computing
Details from Frederick Hoffman, Department of Mathematics, Florida Atlantic University, Boca Raton, Florida 33431.
- March 21-25
(Santa Barbara, California)
Conference on Computational Complexity Theory
Details from R.V. Book, Department of Mathematics, University of California, Santa Barbara, California 93106.
- March 21-26
(Birmingham, Alabama)
UAB International Conference on Differential Equations
Details from Ian W. Knowles, Department of Mathematics, University of Alabama in Birmingham, Alabama 35274.
- March 24-26
(Fayetteville, Arkansas)
Numerical Analysis of Parametrized Nonlinear Equations
Details from D.W. Brewer, Department of Mathematics, University of Arkansas, Fayetteville, Arkansas 72701.
- April 5-9
(Aberdeen, Scotland)
Thirty-fifth British Mathematical Colloquium
Details from R.J. Archbold, Department of Mathematics, The Edward Wright Building, Dunbar Street, Aberdeen AB9 2TY, Scotland.
- April 15-16
(Stillwater, Oklahoma)
Seventh Conference on Undergraduate Mathematics
Details from James Choike, Department of Mathematics, Oklahoma State University, Stillwater, Oklahoma 74078.
- April 21-22
(Pittsburgh, Pennsylvania)
Fourteenth Annual Modelling and Simulation Conference
Details from William G. Vogt, Modelling and Simulation Conference, 348 Benedum Engineering Hall, University of Pittsburgh, Pittsburgh, Pennsylvania 15261.
- April 25-27
(Boston, Massachusetts)
Fifteenth ACM Symposium on Theory of Computing
Details from Albert Meyer, MIT Laboratory for Computer Science, NE43-801, 545 Technology Square, Cambridge, Massachusetts 02139.
- April 30 - May 1
(West Lafayette, Indiana)
Conference on Differential Geometry
Details from Harold Donnelly, Department of Mathematics, Purdue University, West Lafayette, Indiana 47907.
- May 11-13
(Montréal)
Optimization Days 1983
Details from Michael P. Polis, Department of Electrical Engineering, Ecole Polytechnique, Campus de l'Université de Montréal, Case postale 6079, Succursale "A", Montréal, Québec H3C 3A7, Canada.
- May 12-14
(Berlin)
Colloquium on the 200th Anniversary of the Death of Leonhard Euler
Details from J. Winkler, Technische Universität Berlin, Fachbereich 3-Mathematik (MA 8-2), Strasse des 17 Juni 135, D-1000 Berlin 12, Federal Republic of Germany.
- May 16-18
(Washington, D.C.)
Fifth Symposium on Mathematical Programming with Data Perturbations
Details from Anthony V. Fiacco, School of Engineering and Applied Science, The George Washington University, Washington, D.C. 20052.

- May 22-29
(Blazejewko,
Poland) *Third International Conference on Functional-Differential Systems and Related Topics*
Details from D. Przeworska-Rolewica, Mathematical Institute, Polish Academy of Sciences, Sniadeckich 8, 00-950 Warszawa, P.O. Box 137, Poland.
- May 23-25
(Palmerston North) *Eighteenth New Zealand Mathematics Colloquium*
Details from Colloquium Secretary, 18th N.Z. Mathematics Colloquium, Department of Mathematics and Statistics, Massey University, Palmerston North, New Zealand.
- May 24 - June 12
(Singapore) *First Southeast Asian Colloquium on Graph Theory*
Details from H.P. Yap, Department of Mathematics, National University of Singapore, Kent Ridge, Singapore 0511, Republic of Singapore.
- May 30 - June 3
(Palaiseau,
France) *International Colloquium in Honour of Laurent Schwartz*
Details from B. Teissier, "Colloque Laurent Schwartz", Centre de Mathematiques, Ecole Polytechnique, F 91128 Palaiseau, Cedex, France.
- June 6-8
(Denver, Colorado) *SIAM 1983 National Meeting*
Details from H.B. Hair, Society for Industrial and Applied Mathematics, 117 South 17th Street, Philadelphia, Pennsylvania 19103.
- June 20-24
(Israel) *International Symposium on the Mathematical Theory of Networks and Systems*
Details from P.A. Fuhrmann, Department of Mathematics, Ben Gurion University of the Negev, Beer Sheva 84120, Israel.
- June 27-29
(Cambridge,
Massachusetts) *SIAM Symposium on the Applications of Discrete Mathematics*
Details from Society for Industrial and Applied Mathematics, 1405 Architects Building, 117 South 17th Street, Philadelphia, Pennsylvania 19103.
- June 28 - July 1
(Dundee,
Scotland) *Dundee Biennial Conference on Numerical Analysis*
Details from Conference Secretary, Department of Mathematics, University of Dundee, DD14HH, Scotland.
- June 30 - July 10
(Durham, England) *Durham Symposium on Modular Forms*
Details from R.A. Rankin, Department of Mathematics, University of Glasgow, Glasgow G12 8QW, Scotland.
- July 4-9
(Venice) *Tenth International Conference on General Relativity and Gravitation*
Details from GR10 Secretariat, Istituto di Fisica "G. Galilei", Via Marzolo 8, I 35100 Padova, Italy.
- July 4-22
(Montréal) *Séminaire de Mathématiques Supérieures - NATO Advanced Study Institute on Topological Methods in Nonlinear Analysis*
Details from SMS-NATO ASI, Département de mathématiques et de statistique, Université de Montréal, C.P. 6128, Montréal H3C 3J7, Canada.
- July 6-9
(Morgantown,
West Virginia) *Conference on Physical Mathematics and Nonlinear Partial Differential Equations*
Details from J. Lightbourne, Mathematics Department, West Virginia University, Morgantown, West Virginia 26506.
- July 10-16
(Noordwijkerhout,
The Netherlands) *Journées Arithmétiques 1983*
Details from Mrs. S.J. Kuipers-Hoekstra, Mathematisch Centrum, Postbus 4079, 1009 AB Amsterdam, The Netherlands.
- July 11-15
(Warsaw) *Symposium on Large Scale Systems Theory and Applications*
Details from Z. Nahorski, ul. Newelska 6, PL01-447 Warsaw, Poland.
- July 11-15
(Southampton) *Ninth British Combinatorial Conference*
Details from E.K. Lloyd, Faculty of Mathematical Studies, The University, Southampton SO9 5NH, England.
- July 11-16
(Salzburg,
Austria) *Seventh International Congress of Logic, Methodology and Philosophy of Science*
Details from Paul Weingartner, Institut fuer Philosophie, Universitaet Salzburg, Franciskanergasse 1/1, A-5020 Salzburg, Austria.
- July 11-22
(Durham, England) *L.M.S./S.E.R.C. Durham Symposium on Potential Theory*
Details from D.A. Brannan (Ref. PT/83), Faculty of Mathematics, The Open University, Walton Hall, Milton Keynes MK7 6AA, United Kingdom.

- July 11-22
(Hamilton, Canada) *Quadratic Forms and Hermitian K-Theory*
Details from C. Riehn, Department of Mathematical Sciences, McMaster University, Hamilton, Ontario, Canada L8S 4K1.
- July 12-15
(Exeter, England) *International Conference on the Teaching of Mathematical Modelling*
Details from Mrs. S. Williams, Conference Secretary, University of Exeter, St. Lukes, Exeter EX1 22U, England.
- July 18-22
(Bari, Italy) *International Conference on Mathematics in Biology and Medicine*
Details from V. Capasso, Istituto di Analisi Matematica, Università di Bari, Palazzo Ateneo, 70121 Bari, Italy.
- July 25-29
(Pittsburgh, Pennsylvania) *Sixth International Symposium on Multivariate Analysis*
Details from P. R. Krishnaiah, Centre for Multivariate Analysis, Ninth Floor, Schenley Hall, University of Pittsburgh, Pennsylvania 15260.
- July 31 - August 6
(Harrisonburg, Virginia) *Seventh International Conference on Near-Rings and Near-Fields*
Details from Carter Lyons, James Madison University, Harrisonburg, Virginia 22807.
- August 1-14
(Saint John's, Newfoundland) *Workshop and Conference in Algebraic Topology*
Details from Renzo Piccini, Department of Mathematics and Statistics, Memorial University of Newfoundland, St. John's, Newfoundland, Canada A1B 3X7.
- August 15-17
(Zurich) *Fourth International Conference on Mathematical Modelling*
Details from X.J.R. Avula, Co-Chairman, Fourth International Conference on Mathematical Modelling, School of Engineering, University of Missouri-Rolla, Rolla, Missouri 65401.
- August 22-26
(Szeged, Hungary) *Universal Algebra*
Details from L. Szabó, Bolyai Institute, Aradi vértanúk tere 1, 6720 Szeged, Hungary.
- August 22-27
(Namur, Belgium) *Tenth International Congress on Cybernetics*
Details from Association Internationale de Cybernetique Palais de Expositions, Place André Ryckmans, B-5000 Namur, Belgium.
- August 26-31
(Pusan, Korea) *Conference on Combinatorial Groups*
Details from A.C. Kim, Department of Mathematics, The Pusan National University, Pusan, Korea.
- September 11-15
(Paris, France) *Fourth Meeting of the International Society for Clinical Biostatistics* (Incorporating a Mini-Symposium on Diabetes). Further information on this meeting and on the Society and how to join may be obtained from: ICSB-4 secretariat, Département de Statistique Médicale (+10), Institut Gustave-Roussy, rue Camille Desmoulins, 94805 Villejuif Cedex, France.
- September 25 - October 2
(Leipzig) *International Conference on Operator Algebras, Ideals and their Applications in Theoretical Physics*
Details from Karl-Marx-Universität, Naturwissenschaftlich-Theoretisches Centrum, International Conference 1983, DDR-7010 Leipzig, Karl-Marx-Platz, PF 920, German Democratic Republic.
- November 28 - December 2
(Newcastle, Australia) *Eighth Australasian Fluid Mechanics Conference*
Details from Professor R.A. Antonia, Department of Mechanical Engineering, University of Newcastle, New South Wales 2308, Australia.

INTERNATIONAL CONGRESS OF MATHEMATICIANS

The National Committee has recently received word from the Executive Committee of the IMU that the next International Congress will be held in Warsaw in August 1983. It will be recalled that the Congress was to have been held there in August 1982, but was postponed after martial law had been declared in Poland. In his letter, the Secretary of the IMU, Professor J.-L. Lions, writes:

"Information and views received did not point in a single direction and the Committee had considerable difficulty in reaching its decision. In the light of all the information, the Executive Committee did not feel justified in taking the drastic step of cancelling the Congress. The tradition of regular congresses is an important one which has only been interrupted during the two world wars."

POINCARÉ'S HOMOLOGY SPHERE

DAVID GAULD

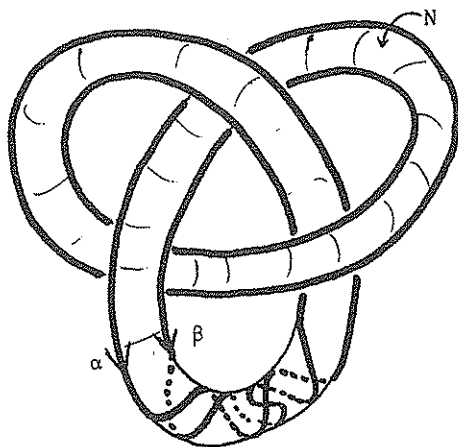
With rumours flying around that a solution of the four-dimensional Poincaré conjecture is about solved and having a lecture to spare in my singular homology course, I decided to find out a bit about Poincaré's original conjecture and, particularly, his counterexample. By coincidence, half an hour before my final lecture I was given a copy of an article, [5], confirming the rumours: the four-dimensional Poincaré conjecture has been solved by Michael Freedman of the University of California at San Diego.

As enunciated in [3], the Poincaré conjecture states that if a closed 3-manifold has the homotopy type of a 3-sphere then it is homeomorphic to the 3-sphere. The generalised conjecture replaces the number 3 by any other number n . When $n \leq 2$ the conjecture is true, for example there is a simple classification of all surfaces. In 1962 Stephen Smale of the University of California at Berkeley verified the conjecture for $n \geq 5$ but until now dimensions 3 and 4 have refused to yield. A common paraphrasing of the situation is: by dimension 3 there is enough room for things to go wrong and by dimension 5 there is enough room to rectify the situation. Smale's proof bears this out, cf [1]. As reported in [5], Freedman's proof manages to make do with the confined room of four-dimensional space to rectify the situation.

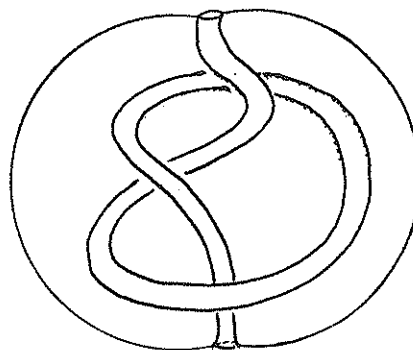
Returning to the goal of this note, originally Poincaré demanded only the homology type of a 3-sphere and his paper [3] includes a construction of a closed 3-manifold whose homology groups are those of the 3-sphere but, because the fundamental group of the manifold is non-trivial, it is not homeomorphic to the 3-sphere.

There are several methods of constructing the Poincaré homology sphere, two of which are described in §9D of [4]. After presenting Poincaré's original construction, including his diagram, Rolfsen describes a surgical construction of Dehn. Dehn's construction readily lends itself to verification and generalisation, and Rolfsen also shows the equivalence of the two examples. We present Dehn's construction.

Let $X_1 = S^1 \times B^2$, a solid torus whose boundary is $T^2 = S^1 \times S^1$. Let K be a smooth trefoil knot in S^3 and N a tubular neighbourhood of K . Let $X_2 = S^3 - \text{int } N$. Then N is a knotted solid torus and $\partial X_2 = \partial N \approx T^2$. The figure below shows two pictures of X_2 : one from within and one from without.



X_2 from the inside



X_2 from the outside

Choose the two curves α and β on the boundary of X as shown. One can verify that α generates $H_1(X_2) \approx \mathbb{Z}$ and that β is homologically trivial in X_2 . Choose a homeomorphism $h: T^2 \rightarrow \partial X_2$ which takes $\{1\} \times S^1$ onto α and $S^1 \times \{1\}$ onto β . The identification space $H = X_1 \cup_h X_2$ is Poincaré's homology sphere. Thus H is obtained from S^3 by removing $\text{int } N$ and sewing in $S^1 \times B^2$ (in a particular way), so is a 3-manifold.

$(H; X_1, X_2)$ is an exact triad so, letting $A = X_1 \cap X_2$ (in H), we have a reduced Mayer-Vietoris sequence:

$$\dots \rightarrow H_3(X_1) \oplus H_3(X_2) \rightarrow H_3(H) \rightarrow H_2(A) \rightarrow H_2(X_1) \oplus H_2(X_2) \rightarrow H_2(H) \rightarrow H_1(A) \rightarrow H_1(X_1) \oplus H_1(X_2) \rightarrow H_1(H) \rightarrow \tilde{H}_0(A) \dots$$

As complements of 1-spheres in S^3 , X_1 and X_2 have trivial homology except in dimension 1, and since $A \approx T^2$, $H_2(A) \approx \mathbb{Z}$, $H_1(A) \approx \mathbb{Z} \oplus \mathbb{Z}$ and $\tilde{H}_q(A) = 0$ for other q . Thus the reduced sequence becomes:

$$0 \rightarrow H_3(H) \rightarrow \mathbb{Z} \rightarrow 0 \rightarrow H_2(H) \rightarrow \mathbb{Z} \oplus \mathbb{Z} \rightarrow \mathbb{Z} \oplus \mathbb{Z} \rightarrow H_1(H) \rightarrow 0.$$

One immediately deduces from exactness that $H_3(H) \approx \mathbb{Z}$ and that if $H_1(H) = 0$ then $H_2(H) = 0$. Since H is connected this means that H has the homology of the 3-sphere. $H_1(H) = 0$ because the generator $S^1 \times \{1\}$ of $H_1(X_1)$ is identified in H with β which is homologically trivial in X_2 and hence in H , and the generator α of $H_1(X_2)$ is identified in H with $\{1\} \times S^1$ which is homologically trivial in X_1 and hence in H .

In [4], Rolfsen obtains a presentation of $\pi(H)$ and shows that it is non-trivial: it is the binary icosahedral group which has order 120. To show that $\pi(H)$ is non-trivial, Rolfsen constructs an epimorphism onto the icosahedral group, the subgroup of $SO(3)$ leaving the icosahedron fixed. This leads to another description of H .

Let G' be the subgroup of $SO(3)$ leaving the icosahedron fixed. Pull G' back to $G \subset SU(2)$ via the natural 2:1 cover $SU(2) \rightarrow SO(3)$. Then G is the binary icosahedral group. The group $SU(2)$ acts on S^3 in a natural way. Restricting this action to G , then H is the orbit space S^3/G . This description is related in §9 of [2] to another description in terms of algebraic varieties. For $\epsilon > 0$ small enough,

$$H = \{(z_1, z_2, z_3) \in \mathbb{C}^3 / z_1^2 + z_2^3 + z_3^5 = 0 \text{ and } |z_1|^2 + |z_2|^2 + |z_3|^2 = \epsilon\}.$$

REFERENCES

1. J.W. Milnor, "Lectures on the h-cobordism theorem", Princeton University Press, 1965.
2. J.W. Milnor, "Singular points of complex hypersurfaces", Annals of mathematics studies number 61, Princeton University Press, 1968.
3. H. Poincaré, "Cinquième complément à l'Analyse situs", Rend. Circ. Matem. Palermo, 18(1904), 45-110 = "Oeuvres de Henri Poincaré, Gauthier-Villars, 1953, vol. 6, 435-498.
4. D. Rolfsen, "Knots and links", Publish or Perish, 1976.
5. L.A. Steen, "Twisting and turning in space", Science News 122 (17/7/82), 42-44.

MATHEMATICS PROJECT COMPETITION FOR TEACHERS

1. The competition is open to teachers of mathematics in New Zealand.
2. The project shall be on one of the following:
 - (a) an application of mathematics in the community;
 - (b) an application of mathematics in another discipline;
 - (c) an aspect of the teaching of mathematics (e.g. novel or non-standard classroom techniques); or
 - (d) the motivation and use of games in mathematics.
3. The mathematics involved should be no more advanced than in the Seventh Form Mathematics syllabus.
4. The project should not have been published elsewhere and should preferably have an innovative or original aspect.
5. Projects will be judged on their originality and suitability for use in teaching mathematics.
6. The Society reserves the right to publish an account of any project received.
7. There will be three prizes of \$250, \$150 and \$75.
8. Closing date: 1st June, 1983. Results announced: 15th September, 1983.
9. Entries or enquiries should be directed to: Dr. J. H. Ansell, Mathematics Department, Victoria University of Wellington, Private Bag, Wellington.

INTELLIGENT, AUTOMATED, AND POTENTIALLY COMPREHENSIVE MATHEMATICAL ASSISTANTS

KEVIN BROUGHAN

UNIVERSITY OF WAIKATO

1. INTRODUCTION

Even though computer languages for performing symbolic mathematical operations automatically have been in existence for some time they are only now beginning to become generally available.

In this paper I will review the symbolic language macsyms, with particular reference to the implementation of it on the vax 11/780 computer called vaxima. I will do this from the point of view of the mathematical user.

The paper is organised as follows: first a brief summary of the purpose of a symbol manipulation language, then a potted history of macsyms and vaxima. This is followed by a detailed list of the features of vaxima with examples of its commands and program facilities. Then there is a brief indication of areas in which symbol manipulation languages have found application.

2. PURPOSE

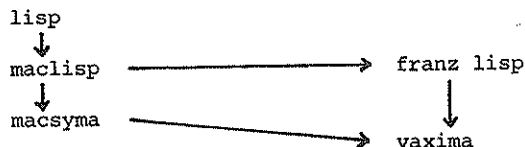
The central purpose of a symbol manipulation language for the mathematician is to assist him or her by doing mathematics, that is performing calculations, derivations, and deductions according to specified rules and procedures in a manner analagous to the way in which a traditional computer language manipulates numbers. Of course, the employment of such a language is unnecessary for short straight-forward pieces of mathematics, and thus it is problems where the expressions involved are large or the structures complex that these languages find their greatest utility.

In order that such a language might achieve this goal it must be able to reproduce many of the skills of pattern recognition, simplification, application of apriori knowledge, and versatility of expression representation that the mathematician applies automatically when dealing with expressions and structures of small and moderate size. It must do this in an easily programmed manner and produce output of traditional format and style using modest amounts of computer time and space. It should be flexible so that new constructions and operations may be grafted onto the existing body of procedures in a coherent manner.

A great deal of this has been achieved and has been embodied in the language macsyms.

3. HISTORY

Vaxima is the vax 11/780 implementation of macsyms. Macsyms is written in maclisp whereas vaxima is written in franz lisp. I will give a brief outline of the history of these languages.



Lisp itself is the most frequently used language for work in artificial intelligence. Its basic structure is lists of lists. It was developed around 1960 by John McCarthy and his students while he was at MIT. One of the principle developers of maclisp on the PDP-10 at MIT was J. Golden. Macsyms itself could be regarded as being principally derived from C. Engleman's matlab 68 system on the PDP-6, again at MIT.

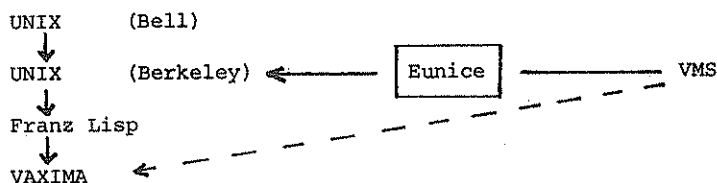
The design work for macsyms began in July 1968 under the sponsorship of project MAC, a deliberately ambiguous title it seems. W. A. Martin, C. Engleman, and J. Moses participated. The programming began in July 1969. Various sections of macsyms were programmed as follows although there was a great degree of interaction and sharing of ideas:

expression evaluation and input/output: W. A. Martin, P. Loewe, and T. Williams; polynomial arithmetic package: W. A. Martin; rational function package and extensions: R. Fateman; simplifier, differentiation, substitution, integration: J. Moses; powerseries expansion routines: E. Tsiang, W. A. Martin; limit programs and secondary storage: P. Wang; semantic pattern matching: R. Fateman.

Franz Lisp has its roots in the PDP-11 lisp system at Harvard. It has incorporated features from maclisp and Lisp Machine Lisp. It is written in list and the language "C" and is implemented at Berkeley on the vax 11/780 processor under the Unix operating system. Its designers claim that it is capable of running large lisp programs in a time-sharing environment, has facilities for user defined structures, and can interact directly with "C", fortran and pascal code.

The language has been developed at Berkeley under the general direction of Richard Fateman. The initial system was developed by Mike Curry, John Breedlove and Jeff Lavinsky. Major contributors to the language included the following - compiler: John Foderaro; garbage collector and array package: Bill Rowan; early compiler and system design: Tom London; bignum package and efficiency coding: Keith Sklower. Other contributors included Kipp Hickman, Charles Koester, Mitch Marcus, and Don Cohen.

The coding and development of the Franz Lisp version of macsyms is being done at Berkeley by Richard Fateman, John Foderara, and Keith Sklower.



There is, at present, one remaining piece for this jigsaw of languages and implementations. Franz Lisp and vaxima will run on the vax 11/780 with the vms operating system using the Unix emulator EUNICE developed by David Kashtan of SRI International.

4. FEATURES

In this section a rough summary of the main features will be listed: Integers of arbitrarily large size, rational numbers, floating point numbers with user assigned precision, complex numbers in cartesian and polar forms. Names of arbitrary length. Mathematical operators: factorial, exponentiation, arithmetic operations, non-commutative multiplication. User defined functions, symbolic arrays, arrays with symbolic indices, dynamic arrays. Lists of symbols and expressions, lists of lists, operations on lists. Matrices with symbolic elements, matrix arithmetic including symbolic inversion and exponentiation, determinant and characteristic polynomial calculations. Relational and logical operators. Compound commands, command composition, program blocks, recursion to arbitrary depth. Loop control using terminator values, while conditions, unless conditions, and looping through lists. A variety of special internal representations for expressions: rational, taylor series, power series, and poisson series. Predefined functions and constants including %e, %pi, inf, minf, infinity, true, false, abs(x), [x], sign(x), min{x1, ..., xn}, sqrt(x), exp(x), log(x), binomial coefficients, fibonacci numbers, zeta(n), sin, cos, tan, and their inverses. An extensive range of evaluation and simplification routines, trigonometric simplification, factorization of polynomials over algebraic extensions of the rationals, greatest common divisor calculations for polynomials. Finite sums of symbolic series, infinite sums, limits. Symbolic partial differentiation, indefinite integration, automatic chain rule applications, residue calculations. Commands for extracting parts of expressions and altering parts of expressions locally. An extensive range of pattern matching and substitution commands. Solution to polynomial equations. Laplace transforms and inverse laplace transforms. Continued fractions. Facilities for declaring and assuming apriori mathematical information and contexts. Terminal plotting facilities. Automatic generation of fortran subroutines.

The language is primarily interactive but there are procedures in vaxima for running batch mode programmes, incorporating prewritten code into an interactive session, reviewing previous results during an interactive session, saving the session for later recommencement, and obtaining a disk file copy of the session. Storage is allocated automatically but there are commands to override the default relative sizes of the different types of internal storage used.

5. EXAMPLES

An example of a vaxima session illustrating some of these features.

whole numbers:

```
(c6) 51!;
Time= 83 msec.
(d6) 155111875328738228022424301646930321106325972001698611
2000000000000
```

```
(c7) factor(%);
Time= 383 msec.
      47 23 12 8 4 3 3 2 2
(d7) 2 3 5 7 11 13 17 19 23 29 31 37 41 43 47
```

a short program to generate primes:

```
(c9) (s:2, for n:3 step 2 thru 10^2 do (
      if length(factor(n))=0 then (prime_array[s]:n,s:s+1)))s
Time= 7933 msec.
```

```
(c10) prime_array[12];
Time= 33 msec.
(d10)                                     37
```

fibonacci numbers:

```
(c12) fib[n]:= if n=1 or n=2 then 1 else fib[n-1]+fib[n-2]s
Time= 83 msec.
```

```
(c13) fib[30];
Time= 1566 msec.
(d13)                                     832040
```

rational arithmetic:

```
(c15) 345/621432 + 54678/97;
Time= 100 msec.
(d15)                                     11326230787
      -----
      20092968
```

```
(c16) float(%);
Time= 116 msec.
(d16)                                     563.69127681883531
```

equations:

```
(c25) eqn1: x=2*y + 1s
Time= 100 msec.
```

```
(c26) eqn2: y=2*x + 3s
Time= 16 msec.
```

```
(c27) eqn1/x;
Time= 66 msec.
```

```
(d27)                                     2 y + 1
      1 = -----
      x
```

```
(c28) eqn1 + eqn2;
Time= 50 msec.
```

```
(d28)                                     y + x = 2 y + 2 x + 4
```

matrices:

(c30) m1: matrix([a,b], [-b,a]);
Time= 66 msec.

(d30)
$$\begin{bmatrix} a & b \\ -b & a \end{bmatrix}$$

(c32) m1^(-1);
Time= 116 msec.

(d32)
$$\begin{bmatrix} 1 & 1 \\ - & - \\ a & b \\ 1 & 1 \\ - & - \\ b & a \end{bmatrix}$$

(c34) determinant(m1);
Time= 100 msec.

(d34)
$$b^2 + a^2$$

polynomials:

(c36) factor(x^4-1);
Time= 316 msec.

(d36)
$$(x - 1) (x + 1) (x^2 + 1)$$

(c37) factor(x^4+3*x^2+4, a^2+a+2);
Time= 1533 msec.

(d37)
$$(x - a - 1) (x - a) (x + a) (x + a + 1)$$

taylor series:

(c43) taylor(sin(x+y^2), x, 0, 4, y, 0, 4);
Time= 650 msec.

(d43)/T/
$$y^2 + x + \dots$$

(c44) x*%;

Time= 116 msec.

(d44)/T/
$$y^2 x + x^2 + \dots$$

(c45) product((1+x^(2*n)), n, 1, inf);
Time= 866 msec.

(d45)
$$\prod_{n=1}^{\infty} (x^{2n} + 1)$$

(c46) taylor(%, x, 0, 4);
Time= 316 msec.

(d46)/T/
$$1 + x^2 + x^4 + \dots$$

indefinite integration:

(c63) integrate(exp(-x)*(1+x+x^2), x);

Time= 4366 msec.

(d63)
$$-x^2 e^{-x} - 3x e^{-x} - 4 e^{-x}$$

(c66) integrate(exp(-x^2)*(a + b*x), x, 0, 1);

Time= 45133 msec.

(d66)
$$-\frac{e^{-1}}{2} + \frac{b}{2} + \frac{\sqrt{\pi} \operatorname{erf}(1) a}{2}$$

6. ALGORITHMS

The development of the data structures to build these routines is more properly the work of the computer scientist. On the other hand the algorithms employed have frequently been and are being developed by pure mathematicians. Enormous improvements in efficiency can sometimes be obtained through using a clever mathematical device. Sometimes an algorithm which one would never dream of using for pencil and paper calculations gives more efficient code than the 'natural' competitor. For example p-adic numbers have been found to be extremely useful for polynomial factorization, and differential algebra a powerful setting for symbolic integration. Many of the algorithms have inherent limitations as to their scope and it is here that the interaction with mathematical logic has proved to be fruitful. Indeed the effectiveness of at least one of the coded simplification algorithms is dependent on an unsolved conjecture in number theory.

There is often a gap between the mathematical proof being discovered that a particular theory is decidable and the realization of this in the form of a coded efficient algorithm. For example there is a mathematical algorithm to determine whether or not an integral of a function built up using elementary functions is itself elementary. This was worked out in the late 1960's and early 1970's. However this has not yet been completely coded and forms an active research field, using techniques from algebraic geometry.

Macsyma itself is regarded as an experimental system and improvements to the algorithms have been steadily incorporated. The system has been expanded through, at MIT the development of a so called 'share directory' of routines developed by users of general interest. For example there are commands for operating with the exterior calculus of differential forms, symbolic vector and tensor analysis, variational optimization, and generalized hypergeometric functions, to name but a few.

One of the most active areas at present under development is related to working with special functions, using the information derived from the equations they satisfy rather than power series representations.

Published applications are too numerous even to list, and range from celestial mechanics through to algebraic geometry. Because of the very general language and facilities for user defined syntaxes and operations, possible applications include the whole of mathematics (at least!) including mathematics education.

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Secretarial

MINUTES OF THE MEETING OF THE TWELFTH COUNCIL

HELD AT VICTORIA UNIVERSITY OF WELLINGTON ON 7TH DECEMBER, 1982.

PRESENT: J.H. Ansell (President, in the Chair), D.B. Gauld, W. Davidson (Vice-Presidents), J.L. Schiff (Treasurer), K.G. Russell (Secretary), M.R. Carter, P.D. Hill, A. McNabb, D.J. Smith, B. Werry (NZAMT representative).
In attendance: I.L. Reilly (Convenor, Publications Committee).

1. APOLOGIES: J.L. Schiff (for lateness), I.D. Coope. The apologies were sustained.
7. PUBLICATIONS:

(a) The subject of Publications was taken out of the sequence listed in the Agenda. Dr. Reilly reported that an invited group had met the previous day to discuss the Calculus project. They had decided to focus specifically on the production of a Calculus textbook for the mainstream First Year courses.

Due to circumstances rather than policy, there were no people from the South Island on the writing team, but considerable input had been received from members in the South Island. The writing team will be Mike Carter, Thora Blithe, Kevin Broughan, Joel Schiff and Ivan Reilly.

It is hoped to have the book ready for the 1984 academic year. It will be produced in a similar format to the current Seventh Form books produced by the Society. About 1000 books would need to be sold per year for the project to break even. It was hoped to have a first draft available for comment and examination at the 1983 Colloquium.

(b) A letter had been received from S. Papps, President of the NZAMT, expressing the hope that the NZMS and the NZAMT might cooperate in further publishing ventures aimed at the new Form 6 and Form 7 syllabi.

It was moved (JHA/MRC) that the Council agrees in principle with the suggestion that the NZMS and the NZAMT should cooperate in publishing ventures aimed at the new Form 6 and Form 7 syllabi, with work and profits to be shared equally between the two organisations. CARRIED.

W. Davidson felt that this would require a greater rationalisation of publications, and cited examples where this did not seem to be occurring at present. I. Reilly said that there would have to be an official agreement that there would be no competing publications by local associations. It was agreed that Dr. Reilly should liaise with Mr. Papps on the overall question.

(c) A letter had been received from G.J. Tee concerning the A.C. Aitken Trust. It had outlined plans for the future, and had mentioned some incurred expenditure which Mr. Tee had hoped would be met by an Auckland University research grant. Dr. Reilly advised that he had written to Mr. Tee to inform him that the research grant had elapsed. Further discussion took place on the contents of the letter.

It was moved (MRC/DJS) that the NZMS should pay the costs mentioned in the letter, without committing the Society to any further expenses. CARRIED.

It was agreed that Dr. Schiff should discuss the matter with Mr. Tee when he returns from overseas in February.

(At this point, Dr. Reilly left the meeting, and the Council reverted to the usual order of business.)

2. MINUTES OF PREVIOUS MEETINGS:

It was moved from the Chair that the Minutes of the meeting of the Eleventh Council held on 16/5/82, the Minutes of the Annual General Meeting held on 18/5/82, and the brief Council meeting held on 19/5/82, be taken as read. CARRIED.

It was noted that, in the Minutes of the Eleventh Council, section (h), a reference to Dr. G. Joynstone should be to D. G. Johnstone. The Minutes were amended.

It was moved (DJS/DBG) that the Minutes of the meeting of the Eleventh Council held on 16/5/82, as amended, be adopted as a true and correct record of that meeting.

With reference to the Minutes of the Eighth Annual General Meeting, the last two paragraphs of Section 5 were felt to be unclear. The Council's interpretation was that the Council has the power to spend up to \$2,000 from publication profits for special projects. It was decided to have these paragraphs clarified at the next A.G.M.

The Minutes of the brief meeting of 19/5/82 were considered.

It was moved (WD/DBG) that the Minutes of the Brief Council Meeting held on 19/5/82 be adopted as a true and correct record of that meeting. CARRIED.

3 MATTERS ARISING FROM THE MINUTES:

(a) COMMON SEAL: The modified Common Seal of the Society was displayed.

It was moved (DJS/DBG) that the Common Seal, as presented, be adopted. CARRIED.

The Council agreed with a suggestion made by the Newsletter Editor that the "NZMS Kiwi" symbol should be incorporated in the Newsletter heading.

(b) SUPPORT FOR POSTGRADUATE MATHEMATICS EDUCATION IN THE SOUTH PACIFIC: JHA had written to Donald Joyce at U.S.P., seeking suggestions as to how the NZMS might best support this activity. Dr. Joyce had rung him the previous day. He had said that, at USP, the graduate programme dealt mainly with staff members at present. There were one or two students per year who could go on to Honours or Masters studies.

Dr. Joyce suggested that the NZMS could (i) try to organise support for a Masters student coming to NZ, (ii) look at individuals and organise assistance on an ad hoc basis, or (iii) support a specific student doing a Masters course at USP.

Discussion took place, but a decision was deferred until later in the meeting.

The NZ Vice-Chancellors Committee had been asked to provide a statement of its attitude towards assistance to NZ academic staff taking up limited tenure positions at USP. A reply had been received.

It was moved from the Chair that the reply from the NZVCC be published in the "Newsletter" for the information of members. CARRIED.

(c) TEACHING FELLOWSHIPS: JHA had written to the Minister of Education supporting, and seeking expansion of, the granting of University Teaching Fellowships to practising mathematics teachers. A reply had been received, and was noted.

(d) INSTITUTIONAL MEMBERS: JHA would write to appropriate organisations early in 1983. Council members were asked to advise him of any organisations they wished to have included.

(e) COORDINATING SERVICE FOR MATHEMATICAL VISITORS: W.D. Halford had written to several overseas organisations seeking the free insertion of a notice concerning this facility. Several had replied that they were prepared to publish the notice at no cost; the remainder had indicated what was the applicable fee. Council decided that the free offers should be accepted, and that the other organisations should be sent a further notice and asked to insert it for the benefit of their members.

It was moved (KGR/JLS) that Council expresses its appreciation of the efforts of Dr. Halford in originating the Coordinating Service. CARRIED.

(f) ROYAL SOCIETY OF NEW ZEALAND AWARD SCHEME: Nothing has happened yet.

(g) AMS SUMMER RESEARCH INSTITUTE IN N.Z.: It was hoped to hold a Summer Research Institute in NZ in the future. It was decided to take no action at present, but to invite ideas at the May meeting of Council. The University of Auckland was interested in holding the SRI. Anyone interested in holding it elsewhere should notify DBG.

(h) GRADUATE INFORMATION: JHA had tried to establish a Graduate Information file, but had found this very difficult. He felt that it would be exceptionally difficult to do so on a national basis. WD suggested that the Universities' Careers Advisers be asked to provide information.

Following discussion, MRC was asked to draw up a list of the information wanted from graduates. This would be sent to local coordinators (EJS, PDH, MRC, KGR, IDC, WD), who would contact Mathematics "majors" and "minors" seeking the desired information.

(i) THIRD AND FOURTH AUSTRALASIAN MATHEMATICS CONVENTIONS: The AMS had offered to conduct the 1985 Convention at The University of N.S.W. and the 1988 Convention at The Australian National University. Because the 1988 Convention will be held as part of Australia's Bicentennial celebrations, accommodation is likely to be hard to find, and a booking has already been made. The AMS sought an estimate of the likely NZ attendance in 1988.

It was moved (KGR/DBC) that Council accept the AMS's offer to conduct the Third and Fourth Australasian Mathematics Conventions in 1985 and 1988, and advise the AMS that it thinks the attendance from NZ in 1988 will be at least 40. CARRIED.

Council decided that it should be suggested to the AMS that the Fifth Australasian Mathematics Convention should be held in NZ.

(j) SELECTOR OF VISITING LECTURER: It was decided that DBG should select the 1983 Visiting Lecturer, and it was hoped that a host would organise travel arrangements.

On the top of page 3 of the Minutes of the meeting of the Eleventh Council on 16/5/82, the incoming Council had been asked to consider establishing a Visiting Lecturer Reserve Fund.

It was moved from the Chair that the Treasurer establish in the accounts a Visiting Lecturer Reserve fund of \$500. CARRIED.

(k) OTHER MATTERS: (a) Members of the Council had not been able to find any institutions which might want an accumulation of old mathematics books in MRC's office. It was decided that MRC should dispose of them.

(a) It was noted from Item 3(q) of the Minutes of the Eleventh Council Meeting that R.S. Long and I.D. Coope were to confer on preparing a Newsletter article providing guidelines for members communicating with the Press concerning newsworthy mathematical events with the purpose of increasing public awareness of our activities and achievements.

(Meeting adjourned for lunch 12.30 - 1.15 p.m.)

As Mr. Werry had to leave at 2.30, he was invited to speak about NZAMT's activities, and then Item 11 was brought forward.

11. PROPOSED TEACHERS' COMPETITION: JHA said that he had referred the proposal to Mr. T. Boyle, who had made several suggestions. He had also discussed it with Mr. S. Papps. Mr. Papps had suggested several matters, and had mentioned an international competition with a similar aim. However, the two seemed unlikely to come into conflict.

Mr. Werry said that an upper limit of Bursary level was envisaged, and that it was intended as a "once-off" event. JLS said that this latter fact should be stated explicitly.

It was moved from the Chair that the Council agree in principle to sponsor a Mathematics Teachers' Competition in 1983. CARRIED.

It was moved from the Chair that the NZMS invite the NZAMT to join in running the competition. CARRIED.

Discussion followed on the detailed rules. The rule "Projects will be judged on their originality and suitability for use in teaching mathematics" was to be inserted. The existing rule 2(d) was to be deleted. The words "Bursary and Scholarship" were to be replaced by "Seventh Form Mathematics". In relation to prizes, the words "in books or calculators" were to be deleted. The condition "The Society reserves the right to publish an account of any project received" was to be added. The closing date for entries was to be Wednesday, 1/6/83, and the results were to be published on Thursday, 15/9/83. The year 1983 would be removed from the heading.

It was moved (MRC/PDH) that the judges for the Mathematics Teachers' Competition consist of two nominated by the NZAMT and one nominated by the NZMS. CARRIED.

Members of Council were asked to submit nominations for the NZMS judge before the next Council meeting.

Mr. Werry asked to have a copy of the Competition rules for publication in the "Gazette". JHA thanked Mr. Werry for his contribution on behalf of the NZAMT.

4. CORRESPONDENCE:

It was moved (DJS/PDH) that the Inward Correspondence be received and the Secretary's action with regard to Outward Correspondence be endorsed. CARRIED.

5. BUSINESS ARISING FROM THE CORRESPONDENCE: Arising from a letter on the "memory" of the Society, DJS suggested that the President ought to be able to serve for more than one year. After discussion, DJS was asked to raise this matter for the AGM.

The Society receives copies of several journals, and it was decided to ask the Royal Society if it would care to be given them.

The Council discussed a letter from the NZ Futures Trust.

It was moved from the Chair that information on the New Zealand Future Trust be circulated in the Newsletter. CARRIED.

(At this point, Mr. Werry left the meeting.)

6. TREASURER'S REPORT: JLS reported as follows:

"Since the establishment of the publications account, the treasurer's job has become much more manageable, and I completely support the present set-up. Our major assets are as follows:

(a) Term Deposit @ 13.5% - Matures 31/5/83	\$2,000
(b) Term Deposit @ 13.5% - Matures 18/7/83	\$1,265
(c) Term Deposit @ 13.5% - Matures 30/6/83	\$3,000
(d) Current Account	\$1,978
TOTAL	\$8,243

These figures are *exclusive* of the publications account, although much of these assets are former publications profits.

Concerning membership, there are now 221 members (up from 205), of which 135 are financial (down from 145). Early in '83, a subscription reminder will be sent to all members, together with a statement of arrears where necessary."

Discussion took place concerning members in arrears financially. It was decided that members badly in arrears would be advised that if payment had not been received by 31/3/83, they would be considered to have resigned.

JHA and KGR were asked to prepare a statement of the Publications Account as soon as possible after 31/12/82.

It was moved (JLS/DBG) that the Treasurer's Report be well received. CARRIED.

The Council discussed the unsecured debentures being offered by the RSNZ.

It was moved (MRC/WD) that the NZMS invest \$2,000 from the Publications Account for one year in the RSNZ's unsecured debentures. CARRIED.

8. RSNZ NOMINATIONS AND HONOURS AWARDS: The RSNZ had suggested that more scientists should be nominated for awards in the New Year and Queen's Birthday Honours lists. Members of Council had been previously circularised concerning possible nominees, and their suggestions were discussed.

The Council was asked to think actively about potential nominees for the National Committee of the RSNZ.

9. IMU MEETING: JHA reported that he had been nominated to attend this meeting but that ultimately he had declined to do so as the associated International Congress of Mathematicians had been cancelled. He considered that the costs of travel from N.Z. were only justified if the delegate was also an active participant in the Congress.

10. HUMAN RIGHTS: No report was received.

12. GOPI JAIN APPEAL. Council discussed this appeal, in memory of the late Dr. G.C. Jain of Otago University.

It was moved (MRC/JLS) that the NZMS donate \$200 to the Gopi Jain appeal. CARRIED.

13. COUNCIL MEETING AND 1983 A.G.M.: A preference was expressed that the 1983 AGM should be held on the Monday (23/5/83) of the Mathematica Colloquium.

JHA expressed the hope that the date of the mid-term meeting of the Thirteenth Council could be fixed in May so as to avoid the problems of scheduling which had occurred with the current meeting.

14. NEWSLETTER: The Council discussed the letter from I.D. Coope, in which he stated his intention not to continue as Editor after 31/5/83, suggested that the NZMS discontinue registration of the Newsletter with the Post Office, and further suggested that the decision as to whether there should be 3 or 4 issues annually should be left to the current Editor.

It was moved from the Chair that the Council expresses its sincere appreciation of the work done so far by Dr. Coope as Editor of the "Newsletter".

CARRIED BY ACCLAMATION.

The Council decided to discontinue the registration of the Newsletter with the Post Office. It felt that it was not essential that every Newsletter should have a "centrefold", and it decided to defer until the AGM the question of whether to have three or four issues per year.

15. PROFILE OF MATHEMATICS IN THE COMMUNITY: PDH spoke of vague worries which he had concerning this matter, and also of his strong belief that Mathematics should work with Computing Science to their mutual benefit. He was supported by other speakers. It was decided to ask the writers in the "Calculus team" to try to involve computing (and particularly aspects of making use of computers) in the book.

PDH was asked to write an essay outlining the problem, as he saw it, for the April Newsletter.

16. GENERAL BUSINESS:

(a) The desirability that the Society's Secretary should have some previous experience of the Council was discussed (the previous and current Secretaries have each held the position in their first year on Council).

It was moved (JHA/DBG) that the Council co-opt Dr. John Shanks of the University of Otago to the Council of the NZMS to act in the role of incoming Secretary until the 1983 AGM. CARRIED.

(b) The Council discussed the question of the 1983 NZMS Colloquium Lecturer.

It was moved (DBG/KGR) that the Council recommend to the Colloquium organisers that Dr. J.H. Ansell, President of the NZMS, be invited to be the 1983 NZMS Colloquium Lecturer. CARRIED.

(c) The Council returned to the question of assistance to graduate students in the South Pacific.

It was moved from the Chair that the Officers of the NZMS institute a fund to provide, and to seek, support for students from the University of the South Pacific undertaking graduate studies in mathematics in New Zealand, that the initial allocation to this fund be \$500, that other organisations be approached to provide further financial assistance, and that this fund should be available for application by students. CARRIED.

The meeting was declared closed at 4.25 p.m.

Problems

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

Comments on Problem 6, *polygon regions* (Newsletter 21).

This problem is considered in part by R. Honsberger in *Mathematical Gems* published by the Mathematical Association of America (1973). For the case when no regions are lost through multiple intersections the total number of regions, R , is given by the formula

$$R = \binom{n}{4} + \binom{n-1}{2}$$

This formula requires modification when the polygon is regular with an even number of sides (≥ 6), since regions are always lost at the centre where the longest diagonals intersect. In this case the number of regions lost at the centre is easily found to be

$$\frac{1}{8} (n-4)(n-2).$$

However, these are not the only regions lost, since there are extra concurrencies of diagonals away from the centre when n (even) exceeds 6. These are easily counted when $n = 8, 10, 12$ but we leave it as an exercise to determine the general formula.

I. D. Coope
J. C. Spain

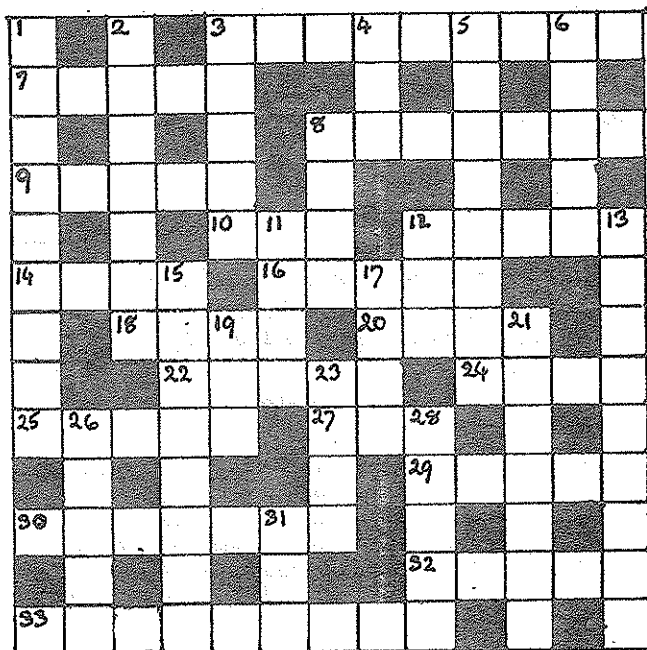
PROBLEM 9.

An aircraft flies with constant airspeed V around a circle (relative to the ground). Find the time of flight in terms of the presumed constant wind speed U . Does it take longer as U increases?

G. C. Wake,
Victoria University of Wellington.

Crossword

N^o 9 BRASSY GREEKS by Matt Varnish



CROSSWORD N^o 8 SOLUTION

Across:

1. Saltire, 5. Fugue, 8. Circa,
9. Largest, 10. Elevens, 11. Oaken,
12. Fusion, 14. Aghast, 17. Nomad,
19. Neutral, 22. Sarcasm, 23. Inapt,
23. Evens, 25. Nonplus.

Down:

1. Socle, 2. Largess, 3. Irate,
4. Enlist, 5. Furlong, 6. Gleek,
7. Extinct, 12. Finesse, 13. Ogdoads,
15. Airmail, 16. Gnomon, 18. Morse,
20. Union, 21. Latus.

21d(7) - 12d(3) 33a(9) led the big parade with a 30a(7) 19d(3) 10a(3) 2d(7) close behind (not to mention 3a(1,8) reeds), as that 18a(4) with the big 31d(3) said to the 25a(5) folk of Iowa - a happening about as likely as finding a 15d(8) on an 7a(5); think of the 6d(5)! However he finished living on the hog's back (or 29a(5)) with not an 22a(5) in town, so my 23d(4) 11d(4) says.

Now 21d(7) - 12d(3) 32a(5) reminds me of 1d(9) who was 3d(5) to the error of the 8a(7) 9a(5) cycle which uses 13d(9). What he 5d(6,2) that a 26d(5) result comes from using 21d(7) - 12d(3) years less 4d(3) day. This 14a(4) him in the same class as Aristarchus of 28d(5) who saw the sun as a 16a(5) on the 20a(4) of the universe. May they be crowned "with ivy never 24a(4)".

The 27a(3) who wrote this 8d(4)logue now 17d(4) his pens of which he has 12a(5).

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