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The Australian Mathematical Society

Gazette

David Yost and Sid Morris (Editors)

Gazette of AustMS, Faculty of Science & Technology,
Federation University Australia, PO Box 663,
Ballarat, VIC 3353, Australia

Eileen Dallwitz (Production Editor)

E-mail: gazette@austms.org.au
Web: www.austms.org.au/gazette
Tel: +61 3 5327 9086

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- Reviews of books, particularly by Australian authors, or books of wide interest
- Classroom notes on presenting mathematics in an elegant way
- Items relevant to mathematics education
- Letters on relevant topical issues
- Information on conferences, particularly those held in Australasia and the region
- Information on recent major mathematical achievements
- Reports on the business and activities of the Society
- Staff changes and visitors in mathematics departments
- News of members of the Australian Mathematical Society

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More information can be obtained from the *Gazette* website.

Deadlines for submissions to 43(1), 43(2) and 43(3) of the *Gazette* are 1 February, 1 April and 1 June 2016.

Volume 42 Number 5

2015

- 268 Editorial
Sid Morris
- 270 President's Column
Tim Marchant
- 272 Puzzle Corner 45
Ivan Guo
- 277 Honorary Doctorates
- 278 WIMSIG—two years on
Asha Rao
- 282 The 56th International Mathematical Olympiad
Angelo Di Pasquale
- 290 Higher degrees and honours bachelor degrees in mathematics
and statistics completed in Australia in 2014
Peter Johnston
- 297 4th South Pacific Continuous Optimization Meeting (SPCOM 2015)
*Henri Bonnel, Jonathan M. Borwein, Regina S. Burachik
and C. Yalçın Kaya*
- 303 Meta-Analysis Workshop
Shahjahan Khan
- 305 3rd Heidelberg Laureate Forum Report
Matthew Tam, Ioannis Tsartsafis and Melissa Lee
- 307 Book Reviews
Count Like an Egyptian
by David Reimer
Reviewed by Gordon Clarke
- 313 NCMS News
Nalini Joshi
- 316 AMSI News
Geoff Prince
- 320 News
- 343 AustMS



Editorial

David and I welcome you to the final issue of the *Gazette* for 2015. We began the year with an air of pessimism as regards funding for science and mathematics, research and universities. We end the year with a new Prime Minister and optimism about recognition of the importance of science and mathematics, research and universities to the future of Australia. Quoting from *The Sydney Morning Herald* (<http://www.smh.com.au/federal-politics/political-news/why-malcolm-turnbull-got-a-standing-ovation-from-the-nations-top-scientists-20151022-gkfh3.html#ixzz3pL1xXq3A>): “Australian scientists had been badly bruised, alienated even, by his predecessor Tony Abbott’s deep cuts to research funding, which had brought the country’s investment in research and development to a 30 year low”. Prime Minister Turnbull said “The best accolade I can give Ian Chubb is to assure him that we’re working to put into effect the very ambitious agenda he set us. We have to be and we will be a country that invests in science and puts it right at the centre of our national agenda.” Of course some academics will have concern about an article in the November 16, 2015 edition of *The Age* referring to a possible change to the way research funds will be allocated to universities, which could place a lot less weight on journal publications.

With that in mind it is indeed pleasing in the News section of this issue of the *Gazette* to see the many mathematicians who have had success with their ARC applications. And it is worth noting that these successes were at a large number of universities. Congratulations to all those whose applications were successful.

Congratulations also to Dr Paul Cleary who was elected a Fellow of the Australian Academy of Technological Sciences and Engineering, to Professor Peter Hall who was elected a Fellow of the Academy of Social Sciences in Australia, and to CARMA Director Jonathan Borwein and Professor Trevor McDougall who were elected Fellows of the Royal Society of NSW. Congratulations also to Professor Alan McIntosh who received an Honorary Doctorate from UNE, Professor Hugh Possingham who will receive an Honorary Doctorate from University of British Columbia and Professor Cheryl Praeger who will receive an Honorary Doctorate from The University of St Andrews.

The Australian Mathematical Society Council is pleased at the growing interest in establishing new Divisions and Special Interest Groups of the Society. Members of the Society can express their interest in joining one of these, and paying a small fee, when completing their annual membership payments. Divisions and Special Interest Groups receive significant funding for their activities from the Society. This funding is possible because of the health of the journal publishing activities associated with the Society.

In this issue of the *Gazette* we see the final Puzzle Corner. Sincere thanks to Ivan Guo who has done a fantastic job preparing Puzzle Corner for each issue of the *Gazette*. We acknowledge the considerable amount of work done by Ivan in the

last six years and the extremely high quality of the Puzzle Corner he prepared. Ivan wishes to take a break from this activity now. Hopefully he will be willing to return at some future time. In the meantime, we record that we are still looking for a person or people who wish to prepare Puzzle Corner in the future.

At the Council meeting at the Society's AGM there was a discussion on ways in which the Society can interact more with undergraduates. The Society has established a facebook presence. You can find it on facebook by searching for "The Australian Mathematical Society". Over a period of time this will include material of particular interest to undergraduates. It will also contain links to mathematics texts which can be downloaded legally for free and to the many YouTube videos which are related to university courses.

While mentioning YouTube videos, I note an interesting recently uploaded video: "Hanna Neumann A Mathematician in Difficult Times - Dr Peter Neumann". Hanna was Professor of Mathematics and Head of the Department of Mathematics, School of General Studies, Australian National University.

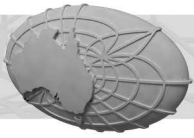
[https://www.youtube.com/watch?v=\\$DLRiY8ZiHzI](https://www.youtube.com/watch?v=$DLRiY8ZiHzI).

As usual this issue has Book Reviews, the Society President's Report, as well as contributions from the Chair of NCMS and the Director of AMSI—all worth reading if you wish to know what is happening in mathematics in Australia and throughout the world. There is also the annual report by Peter Johnston on Higher degrees and honours bachelor degrees in mathematics and statistics completed in Australia in 2014, and reports on conferences, forums and workshops. Finally I mention Ashley Rao's article "WIMSIG—two years on" and Angelo Di Pasquale's report on The 56th International Mathematical Olympiad and as Angelo said "Congratulations to the Australian IMO team on an absolutely spectacular performance this year". This is an appropriately positive note to end this last Editorial for 2015.

Sid Morris, Adjunct Professor, La Trobe University;
Emeritus Professor, Federation University Australia.
Email: morris.sidney@gmail.com



Sid Morris retired after 40 years as an academic. He received BSc (Hons) from UQ in 1969 and PhD from Flinders in 1970. He held positions of Professor, Department Head, Dean, Deputy Vice-Chancellor, CAO and CEO. He was employed by the universities: Adelaide, Ballarat, Flinders, Florida, La Trobe, UNE, UNSW, UQ, UniSA, Tel-Aviv, Tulane, Wales, and Wollongong. He was Editor of *Bull. AustMS* and *J. Research and Practice in IT*, and founding Editor-in-Chief of *AustMS Lecture Series*. He was on the Council of AustMS for 20 years and its Vice-President. He received the Lester R. Ford Award from the Math. Assoc. America. He has published 150 journal papers and 4 books for undergrads, postgrads and researchers, plus an online book, supplemented by YouTube and Youku videos, and translated into 6 languages. The third edition of the 900-page book *The Structure of Compact Groups* by Karl H. Hofmann and Sid was published in 2013 by Water De Gruyter GmbH, Berlin/Boston.



President's Column

Tim Marchant*

The 59th annual meeting of the AustMS has recently been held at Flinders University in South Australia. At the opening ceremony a number of high profile invited guests spoke; the Honourable Christopher Pyne, Federal Minister for Industry, Innovation and Commerce, the Flinders University VC, Professor Colin Stirling, Ms Katrine Hildyard and Mrs Annabel Digance, members for the local SA electorates of Reynell and Elder respectively. All the speakers discussed the importance of mathematics and the other STEM disciplines, in terms of creating Australian jobs in new knowledge based industries and the vital role that technology transfer, between the university and industry sectors, will play in that development. The mathematical sciences community in Australia is already involved with some exciting industry schemes, such as AMSI Intern, The Mathematics in Industry Study Group and the ATN Industry Doctoral Training Centre in Mathematics and Statistics. However, the challenge is set for our members to increase their engagement with industry, in order to help achieve the government's aims.

Some of the Society's most important prizes were announced at the meeting; congratulations to Dr Scott Morrison (ANU) on being awarded the 2015 AustMS medal, for distinguished research in the mathematical sciences by a Society member under 40 and to Professor Andrew Hassell (ANU) on being awarded the 2015 Gavin Brown prize, for the best publication in the previous nine years. The plenary speakers at the conference included some extremely high profile mathematicians such as Professor Terry Tao, Fields medalist (UCLA), Professor Manjul Bhargava, Fields medalist (Princeton) and Professor Dame Frances Kirwan (Oxford). Terry Tao is a South Australian and Flinders graduate so it was especially appropriate that he was invited to present a plenary talk. Congratulations to the Conference Director, Associate Professor Vladimir Ejov, and his team for organizing such a successful conference.

The AustMS meeting also coincides with our annual Society Council meeting. For a few years now the journals of the Society have been generating a significant profit, and Council decided to spend a portion of this on what we believe are worthwhile and important activities for our members. Funding for special interest meetings was increased from \$25,000 to \$35,000 a year, for the next three years. In an important new joint initiative with AMSI, it was decided to provide up to \$25,000 of new funding to support two international meetings, to be held before and after the 2016 annual AustMS conference in Canberra. One of aims of these new satellite

*Email: President@austms.org.au

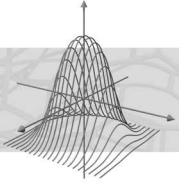
meetings is to provide a block of high profile events for mathematicians and attract additional international delegates to the 2016 AustMS conference.

Also, Society support for female mathematicians was significantly increased with funding for the Cheryl Praeger Travel awards now \$20,000. These awards are for female mathematicians to attend conferences or visit collaborators. Also funding for the Anne Penfold Street Awards was increased to \$3,000. These awards are to support the caring responsibilities of mathematicians, whilst travelling to conferences or visiting collaborators.

I look forward to seeing you all next year at either of our major annual meetings; the 2016 ANZIAM meeting to be held at Canberra in February or at the 2016 AustMS meeting, also being held at Canberra, in December.



Tim Marchant received his Doctorate from Adelaide University in 1989. After graduation he joined Wollongong University where he is currently Dean of Research and Professor of Applied Mathematics. His research areas include nonlinear optics, nonlinear waves and combustion theory. Tim is a Fellow of the Australian Mathematical Society, a Member of the Endeavour Awards selection panel and on the editorial board of *Applied Mathematical Modelling*. His other interests include playing bridge and learning Mandarin.



Puzzle Corner

Ivan Guo*

Welcome to the Australian Mathematical Society *Gazette*'s Puzzle Corner number 45. Each puzzle corner includes a handful of fun, yet intriguing, puzzles for adventurous readers to try. They cover a range of difficulties, come from a variety of topics, and require a minimum of mathematical prerequisites for their solution. Should you happen to be ingenious enough to solve one of them, then you should send your solution to us.

For each puzzle corner, the reader with the best submission will receive a book voucher to the value of \$50, not to mention fame, glory and unlimited bragging rights! Entries are judged on the following criteria, in decreasing order of importance: accuracy, elegance, difficulty, and the number of correct solutions submitted. Please note that the judge's decision — that is, my decision — is absolutely final. Please e-mail solutions to ivanguo1986@gmail.com or send paper entries to: Gazette of the Australian Mathematical Society, Faculty of Science and Technology, Federation University Australia, PO Box 663, Ballarat, Victoria 3353, Australia.

The deadline for submission of solutions for Puzzle Corner 45 is 15 January 2016. The solutions to Puzzle Corner 45 will appear in the March 2016 issue of the *Gazette*. This will also be my last Puzzle Corner, after which the column will be on hiatus. I would like to thank those who have read, solved and contributed puzzles over the last six years, as well as the *Gazette* editors for their continuing efforts.

Folding quadrilaterals

Find all quadrilaterals such that it is possible to fold all the corners neatly into a common point with no gaps or overlaps.

Summing strategy

There are 100 cards arranged in a row on the table. Each card is showing a positive integer. Two players now play a game. On each player's turn it is permitted to take either the rightmost or the leftmost card. This is done until all cards are taken. The winner is the player who has the greatest sum of numbers on his/her cards.

It is known that the sum of all cards equals 2015. Who has a winning strategy?

*School of Mathematics & Applied Statistics, University of Wollongong, NSW 2522, Australia.
Email: ivanguo1986@gmail.com

Train tracks

Terrence is playing with toy train tracks and has constructed a closed circuit which contains no intersections and no linear segments. He used a large number of congruent standard rails, each having the shape of a quarter of a circle. Prove that the total number of tracks used is a multiple of 4.



Photo: Martin Hochhin

Card array

Prove that if you deal out a standard deck of 52 cards into 4 rows of 13, then it is always possible to pick one card from each column to obtain 13 different card values. Note that the 13 cards do not have to have the same suit.

Droid drivers

Larry and Rob are two robots travelling in a car from Arcadia to Zooland. Both robots have control over the steering and steer according to the following algorithm: Larry makes a 90° left turn after every l kilometres; Rob makes a 90° right turn after every r kilometres, where l and r are positive integers. In the event of both turns occurring simultaneously, the car will keep going without changing direction. Given that the robots started from Arcadia facing the correct direction towards Zooland, for which choices of the pair (l, r) , are they guaranteed to reach Zooland, regardless of how far it is?

Solutions to Puzzle Corner 43

Many thanks to everyone who submitted. The \$50 book voucher for the best submission to Puzzle Corner 43 is awarded to Adrian Nelson. Congratulations!

Floating fedora

Sammy dives from a bridge into a river and swims upstream for one hour at constant speed. She then turns around and swims downstream at the same speed. As Sammy passes under the original bridge, a bystander tells her that her hat fell into the river the moment she dived into the water. In order to retrieve her hat, Sammy continues to swim downstream at the same speed. She finally catches up to her hat when she is exactly one kilometre away from the bridge. Assuming it is constant, what is the speed of current?

Solution by Steve Clarke: The answer is 0.5km per hour. Consider the problem from the perspective of the hat. Note that the relative position of Sammy with respect to the hat is not affected by the speed of the current since they are both in the water.

Sammy swam away from the hat for one hour, so it takes another hour for her to swim back to the hat. In total, the hat has moved 1 km from the bridge in two hours. Therefore the speed of the current is 0.5 km per hour.

Social network

There is a group of 300 Twitter users, such that each one is following exactly one other person in the group. Prove that it is possible to find a smaller group of 100 in which no one is following anyone else.

Solution by Dave Johnson: We will solve the following generalisation:

‘Suppose there is a set S of n twitter users, such that each one is following exactly one other person. Prove that it is possible to find a subset of size $n/3$ in which no one is following anyone else.’

We proceed via induction. The claim be easily checked for $n \leq 5$. For $n \geq 6$, there are two cases.

- (i) There exists a person y who is followed by no one. Suppose that y follows x . Consider the set $S \setminus \{x, y\}$. By the inductive hypothesis, there exists a subset T of size $\lceil (n-2)/3 \rceil$ in which no one is following anyone else. Then the set $T \cup \{y\}$ satisfy the required conditions since

$$\left\lceil \frac{n-2}{3} \right\rceil + 1 = \left\lceil \frac{n+1}{3} \right\rceil > \frac{n}{3}.$$

- (ii) Everyone is followed by someone else. In this case the set S can be decomposed into disjoint cycles of followers. Now it suffices to show that we can choose at least $1/3$ of the people from each cycle satisfying the required condition. This can be easily achieved by selecting every second person in the cycle, with the exception of leaving out the final person if the cycle length is odd.

This completes the induction and the solution.

Digit divisibility

A number is said to be elegant if its digit sum is divisible by eleven. How many elegant numbers are there in the set $\{0, 1, 2, \dots, 10^{11} - 1\}$?

Solution by Adrian Nelson: We show there are $\frac{1}{11}(10^{11} - 10)$ elegant numbers in $\{0, 1, 2, \dots, 10^{11} - 1\}$.

By the uniqueness of the decimal expansion, every number in the set can be written as an 11-tuple (a_0, \dots, a_{10}) of digits chosen from $\{0, 1, 2, \dots, 9\}$. The number of such sequences with digit sum n is the coefficient of x^n in the expansion of

$$F(x) = (1 + x + \dots + x^9)^{11}.$$

So it suffices to find the sum of the coefficients of x^n where n is divisible by 11.

Let ζ be a primitive 11th root of unity. In particular, $\zeta^{11} = 1$ and $\zeta \neq 1$. Furthermore,

$$1 + \zeta^n + \zeta^{2n} + \cdots + \zeta^{10n} = \begin{cases} 0, & \text{if } 11 \nmid n, \\ 11, & \text{if } 11 \mid n. \end{cases} \quad (1)$$

Now consider the expansion of

$$G(x) = \frac{1}{11}(F(x) + F(\zeta x) + F(\zeta^2 x) + \cdots + F(\zeta^{10} x)).$$

Denote the coefficient of x^n in $F(x)$ by f_n . Applying (1), the coefficient of x^n in $G(x)$ is given by

$$\frac{1}{11}(f_n + \zeta^n f_n + \zeta^{2n} f_n + \cdots + \zeta^{10n} f_n) = \begin{cases} 0, & \text{if } 11 \nmid n, \\ f_n, & \text{if } 11 \mid n. \end{cases}$$

Thus the required sum is simply the sum of the coefficients in $G(x)$, or

$$G(1) = \frac{1}{11} \sum_{m=0}^{10} F(\zeta^m).$$

The $m = 0$ summand is given by $F(1) = 10^{11}$. For each of $m = 1, 2, \dots, 10$, (1) implies

$$F(\zeta^m) = (1 + \zeta^m + \cdots + \zeta^{9m})^{11} = (-\zeta^{10m})^{11} = -1.$$

Therefore the total number of elegant numbers is $G(1) = \frac{1}{11}(10^{11} - 10)$.

Square solitaire

Four pegs are initially placed on the ground so that they form a square. At each move, you may take an existing peg from some point P and move it to a new point P' , as long as there is another peg at the midpoint of PP' . Is it possible to form a larger square using the four pegs after a finite number of moves?

Solution by John Butcher: The answer is no, it is not possible to form a larger square. First note that the inverse of each possible move is also a valid move. If a finite number of moves can lead to a larger square, then the inverses of these moves carried out in reverse order will lead to a smaller square.

Suppose the four pegs start on the coordinates $(0, 0)$, $(0, 1)$, $(1, 0)$ and $(1, 1)$, it is not possible to form a smaller square since the pegs will always be on integer coordinates. This gives the required contradiction.

Rational coordinates

Does there exist a sphere (i.e. the surface of a ball) in \mathbb{R}^3 , such that exactly one point on it has only rational coordinates?

Solution by Jensen Lai: The answer is yes. Consider a sphere of radius $\sqrt{2}$ centred at $(0, 0, \sqrt{2})$. The equation of the sphere is given by

$$x^2 + y^2 + (z - \sqrt{2})^2 = 2,$$

which rearranges to

$$x^2 + y^2 + z^2 = 2\sqrt{2}z. \quad (2)$$

Let (x, y, z) be a point on the sphere with rational coordinates, satisfying (2). The left-hand side of (2) is rational, which implies that $2\sqrt{2}z$ is rational. This is only possible if $z = 0$. Substituting back into (2) yields $x^2 + y^2 = 0$, so $x = y = 0$. Therefore $(0, 0, 0)$ is the only point with rational coordinates on the sphere, as required.



Ivan is a Postdoctoral Research Associate in the School of Mathematics and Applied Statistics at The University of Wollongong. His research involves financial modelling and stochastic games. Ivan spends much of his spare time pondering over puzzles of all flavours, as well as Olympiad Mathematics.



Communications

Honorary Doctorates

Our congratulations to three Society members who have recently received or will soon receive honorary degrees.

Alan McIntosh / University of New England

Alan McIntosh, Professor at the Australian National University, received an honorary doctorate from UNE and delivered the occasional speech at the graduation ceremony on 23 October 2015.

Hugh Possingham / University of British Columbia

Hugh Possingham, Vice Chancellor's Senior Research Fellow, Professor of Mathematics and Professor of Ecology at the University of Queensland, will receive an honorary degree from the University of British Columbia on 25 November. He is renowned as a scientist who has helped to establish conservation ecology firmly within the realm of science and for leading the application of the resulting science to the development of sound conservation principles worldwide. His work has underpinned the rezoning of the Great Barrier Reef Marine Park, the largest systematically designed reserve network in the world.

His co-recipients in the Fall Congregation (25–27 November) are Marangu Njogu, the executive director of Windle Trust Kenya; Susan Solomon, the Ellen Swallow Richards Professor of Atmospheric Chemistry and Climate Science at MIT; and Rachel Thibeault, Professor in the School of Rehabilitation Sciences at the University of Ottawa.

Cheryl Praeger / University of Saint Andrews

Professor Cheryl Praeger of the University of Western Australia, is to be awarded an honorary doctorate by The University of Saint Andrews on St Andrew's Day, 30 November.

Two other honorary doctorates will be conferred that day on Professor the Right Honourable Sir David Edward, Professor Emeritus of the University of Edinburgh and former Judge of the Court of Justice of the European Communities; and Vicky Featherstone, Artistic Director of the Royal Court Theatre and former Artistic Director of The National Theatre of Scotland.

WIMSIG — two years on

Asha Rao,* Founding Chair, 2013–2015

The Women in Mathematics Special Interest Group (WIMSIG) of the Australian Mathematical Society was officially founded in December 2012, and the Executive Committee met for the first time in February 2013. Now, two years on, the group has become well established on the mathematics scene in Australia, and with a new Executive Committee taking office in February 2015, it is time to take stock. This report outlines the many achievements of the group in the short period of its existence so far.

The volunteers

The Executive Committee has been fundamental in pushing many of WIMSIG's activities towards their conclusion. There have also been many, many volunteers who have been the force behind converting these activities into achievements. So, firstly, here is a list of people who have been instrumental in making WIMSIG a success (with apologies for any omissions).

The first mention needs to go to the many people who advocated for the start of this organisation, and a bit of history seems relevant at this point. While WIMSIG was formed by a motion at the 2011 AustMS AGM in Wollongong, moved by Julie Clutterbuck and Anne Thomas, there were many actions which preceded this formation. An important precursor was the creation of the AustMS Hanna Neumann Lectureship (led by Nalini Joshi, Cheryl Praeger and others) which was, itself, a response to there being no female plenary speakers at the 2007 AustMS Annual Meeting.

The impetus for the group seems to have been initiated by a meeting of 10 female participants at the 2006 AustMS Annual Meeting at Macquarie (following a suggestion by the then AustMS President Michael Cowling), and continuing with a catered lunch and discussion with 35 women participants at the 2007 AustMS Annual Meeting at La Trobe, both organised by Lesley Ward and Cheryl Praeger. The trend of lunch meetings with panel discussions continued over the next few years, leading finally to the suggestion of the formation of a special interest group at the 2011 Annual Meeting, a move warmly welcomed by the then President of the AustMS, Peter Taylor. Thus the gestation period of many years finally resulted in the drafting of the WIMSIG Rules of Procedure by Barbara Maenhaut, Anne Thomas, Lesley Ward and Julie Clutterbuck, and the election of the first Executive Committee of WIMSIG in late 2012. The Returning Officers to date have been Julie Clutterbuck (2012) and Birgit Loch (2014).

The first Executive Committee (February 2013–January 2015) was composed of Asha Rao (RMIT) as Chair, Giang Nguyen (Adelaide) as Treasurer, Joanne Hall

*Email: asha@rmit.edu.au

(QUT) as Secretary, and Amy Glen (Murdoch) and Lesley Ward (UniSA) as Ordinary Members. As can be seen from the affiliations, the executive members were from far and wide and the monthly meetings via Skype were full of agenda items and enthusiasm. The current Executive of WIMSIG (February 2015–January 2017) is composed of Lesley Ward (UniSA) as Chair, Asha Rao (RMIT) as immediate past Chair, Giang Nguyen (Adelaide) as Treasurer, Joanne Hall (QUT) as Secretary, and Deborah Cromer (UNSW) and Lynn Batten (Deakin) as ordinary members.

In addition to the Executive Committee members, a large number of other members have volunteered their time to contribute in many ways, such as serving on the WIMSIG Travel Awards Selection Committee. Thanks are especially due to Cheryl Praeger, Julie Clutterbuck and Amie Albrecht, the Selection Committee for Round 1 of the Travel Awards, for their patience and help in ironing out all the many snags that became obvious once the process got underway. Other members helped by contributing to WIMSIG's 2013 submission to the Decadal Plan for the Mathematical Sciences; hosting coffee gatherings and lunch meetings at AMSI's Summer and Winter Schools as well as at various national events including the Mathematics in Industry Study Group (MISG), the Australian Mathematical Sciences Student Conference and AustMS and ANZIAM annual meetings; and hosting a total of 16 women-in-mathematics get-togethers in June and November in cities around the country. It should be noted that all of the events mentioned here are open to all genders, as WIMSIG recognises that successfully addressing gender equity as an issue requires the involvement of all in finding solutions. And then there is the constant assistance WIMSIG has received from AustMS Secretary Peter Stacey—the many requests and questions have been answered patiently and clearly.

Special mention must be made of AustMS past-President Nalini Joshi, who has been using part of her ARC Georgina Sweet Australian Laureate Fellowship to fund the Women in Mathematics dinners at the AustMS Annual Meetings and lunches at ANZIAM Annual Meetings. Nalini Joshi hosted the first of these dinners, at her home campus of the University of Sydney in 2013. The second one was hosted by the then Chair of WIMSIG, Asha Rao, at the ANZMC8 meeting, incorporating the AustMS Annual Meeting, at the University of Melbourne in 2014; it attracted over 100 registrations and gave WIMSIG an opportunity to highlight some of the issues it believes to be important with regards to gender equity. While Nalini Joshi's Laureate Fellowship will cover funding of these events until 2017, WIMSIG hopes to continue this new tradition beyond that date with funding from the AustMS or elsewhere.

Mention also needs to be made of the Australian Mathematical Sciences Institute (AMSI) which has enthusiastically welcomed and encouraged WIMSIG participation. The AMSI Summer and Winter Schools now have special events to encourage networking among female mathematicians. AMSI hosts the annual meeting of the Australian Council of Heads of Mathematical Sciences (ACHMS), and WIMSIG has been invited in 2014 and 2015 to address this gathering. Since 2014, AMSI funding of workshops and conferences has required organisers to put measures in place to increase female participation; WIMSIG has developed an advice sheet to

help organisers to develop such measures. In return for increased exposure, WIMSIG promotes AMSI events to its members via its newsletter, as well as mentioning these events on the WIMSIG website. A Memorandum of Understanding between WIMSIG and AMSI is in progress.

The website

The establishment of the WIMSIG website <http://www.austms.org.au/Women+in+Mathematics+group> was one of the first successful endeavours taken on by the Executive Committee. Amy Glen took up the challenge of being the webmaster and continues in that role. All events that support and showcase female participants are advertised, and the website contains an advice sheet for event organisers. The WIMSIG website is also used to collect and disseminate information, scholarly works and other resources about gender equity in the sciences in general, and mathematics in particular, in areas including employment, recruitment, student evaluations, refereeing of articles, conference participation, and country comparisons. It showcases examples of best practice on gender equity, such as the UK's Athena SWAN Charter¹, the Banff International Research Station for Mathematical Innovation and Discovery (BIRS) report on 'Women Mathematicians in the Academic Ranks: A Call to Action'², and the London Mathematical Society's 'Good Practice Scheme'³.

Advocacy

WIMSIG has been actively raising the issue of gender equity in many ways, including addressing the annual meetings of the Heads of Mathematical Sciences. The Executive Committee, with input from many WIMSIG members, prepared an eight-page written submission to the Decadal Plan for the Mathematical Sciences, about the need for gender equity within mathematical research environments, putting into context published research on this topic. The report included possible actions that could be taken to address the eight issues raised in the WIMSIG submission as well as the possible negative consequences that could eventuate from taking these proposed actions. The then Chair, Asha Rao, as well as WIMSIG member Maria Athanassenas, participated in the Decadal Plan Workshop in December 2013.

In late 2014, the Science Australia Gender Equity (SAGE) Forum was set up under the auspices of the Australian Academy of Science. The SAGE Forum is currently convened by Nalini Joshi and Brian Schmidt. Then WIMSIG Chair, Asha Rao, attended the first SAGE Forum workshop, held in November 2014, where ideas such as the set-up of an equivalent program to the UK's Athena SWAN program were discussed. WIMSIG plans to be involved in future developments of the SAGE Forum.

¹<http://www.ecu.ac.uk/equality-charters/athena-swan/>

²www.birs.ca/workshops//2006/06w5504/report06w5504.pdf

³<http://www.lms.ac.uk/women/good-practice-scheme>

WIMSIG travel awards scheme launched

An achievement of the WIMSIG Executive Committee was securing funding from the AustMS, mainly for the establishment of two travel awards. The AustMS WIMSIG Cheryl E. Praeger Awards are designed to support the research careers of female mathematicians by providing travel funding for conferences or research visits. Valued at up to \$2000 for an international trip and up to \$600 for a domestic trip, the Praeger awards are funded for \$6400 in each financial year with funding approved by AustMS Council in September 2013; there is the possibility of increased funding in future years based on demand. The AustMS WIMSIG Anne Penfold Street Awards recognise the fact that mathematicians sometimes need financial support to meet caring needs when travelling. Open to AustMS members of all genders, the Street Awards gained funding of \$1600 per financial year. Each Street award is valued at up to \$400, with the possibility of increased funding in future years based on the increases in the costs of caring.

The efforts of Giang Nguyen and Lesley Ward need to be acknowledged, as they led the development of these Awards by drafting the award documentation, including: the selection criteria and scoring schemes, processes and timelines to be followed by the Selection Committee, the application forms and conflict of interest policy, advice for applicants, and biographies of the Award patrons. The Awards were publicly announced on 1 September 2014, and the first awards were made in late 2014. Details of the awards are available on the WIMSIG website. The application deadlines are 1 April and 1 October each year, and people are encouraged to apply.

Membership

WIMSIG membership is open to all members of the AustMS. In addition, WIMSIG has a number of ‘friends’ — those who wish to be part of WIMSIG, but are not members of the AustMS. Currently there are over 300 members and friends, including 200 AustMS members, on the mailing list. The membership is kept informed of events and opportunities via a monthly newsletter, which is archived on the WIMSIG website. The friends of WIMSIG include visiting foreign mathematicians, staff of AMSI and others.

Conclusion

WIMSIG has had a very successful start and we confidently expect that it will continue to grow from strength to strength. The new Executive Committee took the reins in February 2015, exactly two years after the first meeting of the inaugural Executive Committee. As the Founding Chair, I feel privileged to have been instrumental in giving the conversation on gender equity in mathematics a new footing.

With the new executive and the many volunteers, as well as the continued support of all members of the mathematics community, I am certain that WIMSIG will continue to grow and influence policy, engendering equity in the mathematical sciences at all levels and making mathematics a desired profession for all genders, both in industry as well as academia.

The 56th International Mathematical Olympiad Chiang Mai, Thailand

Angelo Di Pasquale*

The 56th International Mathematical Olympiad (IMO) was held from 4–16 July in Chiang Mai, Thailand.

This was the largest IMO in history with a record number of 577 high school students from 104 countries participating. Of these, 52 were girls.

Each participating country may send a team of up to six students, a Team Leader and a Deputy Team Leader. At the IMO the Team Leaders, as an international collective, form what is called the *Jury*. This Jury was chaired by Soontorn Orain-tara.

The first major task facing the Jury is to set the two competition papers. During this period the Leaders and their observers are trusted to keep all information about the contest problems completely confidential. The local Problem Selection Committee had already shortlisted 29 problems from 155 problem proposals submitted by 53 of the participating countries from around the world. During the Jury meetings one of the shortlisted problems had to be discarded from consideration due to being too similar to material already in the public domain. Eventually, the Jury finalised the exam questions and then made translations into all the more than 50 languages required by the contestants. Unfortunately, due to an accidental security breach, the second day's paper had to be changed on the night before that exam was to be taken. This probably resulted in a harder than intended second day.

The six questions that ultimately appeared on the IMO contest are described as follows.

1. A relatively easy two-part problem in combinatorial geometry proposed by the Netherlands. It concerns finite sets of points in the plane in which the perpendicular bisector of any pair of points in such a set also contains another point of the set.
2. A medium classical number theory problem proposed by Serbia.
3. A difficult classical geometry problem in which it is asked to prove that a certain two circles are mutually tangent. It was proposed by Ukraine.
4. A relatively easy classical geometry problem proposed by Greece.

*IMO Team Leader, Australia. Email: A.Dipasquale@ms.unimelb.edu.au

This article will also appear in 'Mathematics Contests, The Australian Scene 2015' and the journal of the World Federation of National Mathematics Contests.

5. A medium to difficult functional equation proposed by Albania.
6. A difficult problem in which one is asked to prove an inequality about a sequence of integers. Although it does not seem so at first sight, the problem is much more combinatorial than algebraic. It was inspired by a notation used to describe juggling. The problem was proposed by Australia.

These six questions were posed in two exam papers held on Friday 10 July and Saturday 11 July. Each paper had three problems. The contestants worked individually. They were allowed four-and-a-half hours per paper to write their attempted proofs. Each problem was scored out of a maximum of seven points.

For many years now there has been an opening ceremony prior to the first day of competition. HRH Crown Princess Sirindhorn presided over the opening ceremony. Following the formal speeches there was the parade of the teams and the 2015 IMO was declared open.

After the exams the Leaders and their Deputies spent about two days assessing the work of the students from their own countries, guided by marking schemes, which had been discussed earlier. A local team of markers called *Coordinators* also assessed the papers. They too were guided by the marking schemes but are allowed some flexibility if, for example, a Leader brings something to their attention in a contestant's exam script that is not covered by the marking scheme. The Team Leader and Coordinators have to agree on scores for each student of the Leader's country in order to finalise scores. Any disagreements that cannot be resolved in this way are ultimately referred to the Jury.

The IMO paper turned out to be quite difficult. While the easier problems 1 and 4 were quite accessible, the other four problems 2, 3, 5 and 6 were found to be the most difficult combination of medium and difficult problems ever seen at the IMO. There were only around 30 complete solutions to each of problems 2, 3 and 5. Problem 6 was very difficult, averaging just 0.4 points. Only 11 students scored full marks on it.

The medal cuts were set at 26 for gold, 19 for silver and 14 for bronze.¹ Consequently, there were 282 (=48.9%) medals awarded. The medal distributions² were 39 (= 6.8%) gold, 100 (= 17.3%) silver and 143 (= 24.8%) bronze. These awards were presented at the closing ceremony. Of those who did not get a medal, a further 126 contestants received an honourable mention for solving at least one question perfectly.

¹This was the lowest ever cut for gold, and the equal lowest ever cut for silver. (This was indicative of the difficulty of the exam, not the standard of the contestants.)

²The total number of medals must be approved by the Jury and should not normally exceed half the total number of contestants. The numbers of gold, silver and bronze medals must be approximately in the ratio 1 : 2 : 3.

Alex Song of Canada was the sole contestant who achieved the most excellent feat of a perfect score of 42. He now leads the IMO hall of fame, being the most decorated contestant in IMO history. He is the only person to have won five IMO gold medals.³ He was given a standing ovation during the presentation of medals at the closing ceremony.

Congratulations to the Australian IMO team on an absolutely spectacular performance this year. They smashed our record rank⁴ to come 6th, and they also smashed our record medal haul, bringing home two Gold and four Silver medals.⁵ This is the first time that each team member has achieved Silver or better. The team finished ahead of many of the traditionally stronger teams. In particular, they finished ahead of Russia, whom we would have considered as untouchable.

Congratulations to Gold medalist Alexander Gunning, year 12, Glen Waverley Secondary College, Victoria. He is now the most decorated Australian at the IMO, being the only Australian to have won three Gold medals at the IMO. On each of these occasions he also finished in the top 10 in individual rankings.⁶ He is now equal 17th on the IMOs all-time hall of fame.

Congratulations to Gold medalist Seyoon Ragavan, year 11, Knox Grammar School, NSW. Seyoon solved four problems perfectly and was comfortably above the Gold medal cut. He was individually ranked 19th.

And congratulations to our four Silver medalists: Ilia Kucherov, year 11, Westall Secondary College, Victoria; Yang Song, year 12, James Ruse Agricultural High School, NSW; Kevin Xian, year 11, James Ruse Agricultural High School, NSW; and Jeremy Yip, year 12, Trinity Grammar School, Victoria.

Three members of this year's team are eligible for selection to the 2016 IMO team. So while it is unlikely we will be able to repeat this year's stellar performance, the outlook seems promising.

Congratulations also to Ross Atkins and Ivan Guo, who were IMO medalists with the Australian team when they were students.⁷ They were the authors of the juggling-inspired IMO problem number six. In fact Ross is a proficient juggler.

The 2015 IMO was organised by: The Institute for the Promotion of Teaching Science and Technology; Chiang Mai University; The Mathematical Association

³In his six appearances at the IMO, Alex Song won a bronze medal in 2010, and followed up with gold medals in 2011, 2012, 2013, 2014 and 2015.

⁴The ranking of countries is not officially part of the IMO general regulations. However, countries are ranked each year on the IMO's official website according to the sum of the individual student scores from each country.

⁵Australia's best performance prior to this was the dream team of 1997. They came 9th, with a medal tally of two Gold, three Silver and one Bronze.

⁶In his four appearances at the IMO, Alexander won a bronze medal in 2012, and followed up with gold medals in 2013 (8th), 2014 (1st) and 2015 (4th).

⁷Ross and Ivan won Bronze at the 2003 IMO, and Ivan won Gold at the 2004 IMO.

of Thailand under the Patronage of His Majesty the King; and The Promotion of Academic Olympiad and Development of Science Education Foundation.

Venues for future IMOs have been secured up to 2019 as follows:

- 2017, Brazil
- 2018, Romania
- 2019, United Kingdom.

The 2016 IMO is scheduled to be held 6–16 July in Hong Kong.

Much of the statistical information found in this report can also be found at the official website of the IMO: <https://www.imo-official.org>.

IMO Papers

Day 1, Friday 10 July 2015

Problem 1. We say that a finite set \mathcal{S} of points in the plane is *balanced* if, for any two different points A and B in \mathcal{S} , there is a point C in \mathcal{S} such that $AC = BC$. We say that \mathcal{S} is *centre-free* if for any three different points A, B and C in \mathcal{S} , there is no point P in \mathcal{S} such that $PA = PB = PC$.

- (a) Show that for all integers $n \geq 3$, there exists a balanced set consisting of n points.
- (b) Determine all integers $n \geq 3$ for which there exists a balanced centre-free set consisting of n points.

Problem 2. Determine all triples (a, b, c) of positive integers such that each of the numbers

$$ab - c, \quad bc - a, \quad ca - b$$

is a power of 2. (*A power of 2 is an integer of the form 2^n , where n is a non-negative integer.*)

Problem 3. Let ABC be an acute triangle with $AB > AC$. Let Γ be its circumcircle, H its orthocentre, and F the foot of the altitude from A . Let M be the midpoint of BC . Let Q be the point on Γ such that $\angle HQA = 90^\circ$, and let K be the point on Γ such that $\angle HKQ = 90^\circ$. Assume that the points A, B, C, K and Q are all different, and lie on Γ in this order.

Prove that the circumcircles of triangles KQH and FKM are tangent to each other.

Language: English

*Time: 4 hours and 30 minutes
Each problem is worth 7 points*

Day 2, Saturday 11 July 2015

Problem 4. Triangle ABC has circumcircle Ω and circumcentre O . A circle Γ with centre A intersects the segment BC at points D and E , such that B, D, E and C are all different and lie on line BC in this order. Let F and G be the points of intersection of Γ and Ω , such that A, F, B, C and G lie on Ω in this order. Let K be the second point of intersection of the circumcircle of triangle BDF and the segment AB . Let L be the second point of intersection of the circumcircle of triangle CGE and the segment CA .

Suppose that the lines FK and GL are different and intersect at the point X . Prove that X lies on the line AO .

Problem 5. Let \mathbb{R} denote the set of real numbers. Determine all functions $f: \mathbb{R} \rightarrow \mathbb{R}$ satisfying the equation

$$f(x + f(x + y)) + f(xy) = x + f(x + y) + yf(x)$$

for all real numbers x and y .

Problem 6. The sequence a_1, a_2, \dots of integers satisfies the following conditions:

- (i) $1 \leq a_j \leq 2015$ for all $j \geq 1$;
- (ii) $k + a_k \neq \ell + a_\ell$ for all $1 \leq k < \ell$.

Prove that there exist two positive integers b and N such that

$$\left| \sum_{j=m+1}^n (a_j - b) \right| \leq 1007^2$$

for all integers m and n satisfying $n > m \geq N$.

Language: English

*Time: 4 hours and 30 minutes
Each problem is worth 7 points*

Mark distribution by question

Mark	Q1	Q2	Q3	Q4	Q5	Q6
0	93	256	408	91	153	521
1	89	151	122	36	255	11
2	5	77	12	61	34	15
3	21	27	1	18	90	6
4	72	8	3	11	8	3
5	12	13	0	1	4	3
6	20	14	1	8	3	7
7	265	31	30	351	30	11
Total	577	577	577	577	577	577
Mean	4.3	1.4	0.7	4.8	1.5	0.4

Some country totals

Rank	Country	Total	Rank	Country	Score
1	United States of America	185	17	Poland	117
2	China	181	18	Taiwan	115
3	South Korea	161	19	Mexico	114
4	North Korea	156	20	Hungary	113
5	Vietnam	151	20	Turkey	113
6	Australia	148	22	Brazil	109
7	Iran	145	22	Japan	109
8	Russia	141	22	United Kingdom	109
9	Canada	140	25	Kazakhstan	105
10	Singapore	139	26	Armenia	104
11	Ukraine	135	27	Germany	102
12	Thailand	134	28	Hong Kong	101
13	Romania	132	29	Bulgaria	100
14	France	120	29	Indonesia	100
15	Croatia	119	29	Italy	100
16	Peru	118	29	Serbia	100

Australian scores at the 2015 IMO

Name	Q1	Q2	Q3	Q4	Q5	Q6	Score	Award
Alex Gunning	7	6	7	7	2	7	36	Gold
Ilia Kuchеров	7	2	0	7	3	0	19	Silver
Seyoon Ragavan	7	7	1	7	7	0	29	Gold
Yang Song	7	2	1	7	3	0	20	Silver
Kevin Xian	7	3	1	7	3	0	21	Silver
Jeremy Yip	7	6	1	7	2	0	23	Silver
Totals	42	26	11	42	20	7	148	
Australian Average	7.0	4.3	1.8	7.0	3.3	1.2	24.7	
IMO Average	4.3	1.4	0.7	4.8	1.5	0.4	13.0	

The medal cuts were set at 26 for gold, 19 for silver and 14 for bronze.

Distribution of awards at the 2015 IMO

Country	Total	Gold	Silver	Bronze	H.M.
Albania	37	0	0	0	3
Algeria	60	0	1	1	2
Argentina	70	0	0	1	4
Armenia	104	0	1	5	0
Australia	148	2	4	0	0
Austria	63	0	0	3	1
Azerbaijan	73	0	0	2	4
Bangladesh	97	0	1	4	1
Belarus	84	0	0	3	3
Belgium	67	0	1	0	3
Bolivia	5	0	0	0	0

Distribution of awards at the 2015 IMO (continued)

Country	Total	Gold	Silver	Bronze	H.M.
Bosnia and Herzegovina	76	0	0	2	4
Botswana	1	0	0	0	0
Brazil	109	0	3	3	0
Bulgaria	100	0	2	1	2
Cambodia	24	0	0	0	2
Canada	140	2	0	4	0
Chile	12	0	0	0	1
China	181	4	2	0	0
Colombia	72	0	0	4	0
Costa Rica	53	0	0	2	2
Croatia	119	1	3	1	0
Cuba	15	0	0	1	0
Cyprus	58	0	1	0	2
Czech Republic	74	0	0	3	3
Denmark	52	0	0	2	1
Ecuador	27	0	0	0	2
El Salvador	14	0	0	0	0
Estonia	51	0	0	1	3
Finland	26	0	0	0	1
France	120	0	3	3	0
Georgia	80	0	1	3	1
Germany	102	0	2	3	0
Ghana	5	0	0	0	0
Greece	71	0	1	2	2
Hong Kong	101	0	2	3	1
Hungary	113	0	3	3	0
Iceland	41	0	0	0	3
India	86	0	1	2	3
Indonesia	100	0	2	4	0
Iran	145	3	2	1	0
Ireland	37	0	0	0	3
Israel	83	1	0	2	2
Italy	100	1	2	0	0
Japan	109	0	3	3	0
Kazakhstan	105	1	1	2	2
Kosovo	24	0	0	0	1
Kyrgyzstan	17	0	0	0	0
Latvia	36	0	0	0	3
Liechtenstein	18	0	0	1	0
Lithuania	54	0	0	1	1
Luxembourg	12	0	0	0	1
Macau	88	0	1	2	3
Macedonia (FYR)	45	0	0	1	1
Malaysia	66	0	0	3	1
Mexico	114	1	2	3	0
Moldova	85	0	1	2	3
Mongolia	74	0	0	2	4
Montenegro	19	0	0	1	0
Morocco	27	0	0	0	1

Distribution of awards at the 2015 IMO (continued)

Country	Total	Gold	Silver	Bronze	H.M.
Netherlands	76	0	0	3	1
New Zealand	72	0	0	2	4
Nicaragua	26	0	0	0	3
Nigeria	22	0	0	0	2
North Korea	156	3	3	0	0
Norway	54	0	1	0	2
Pakistan	25	0	0	1	0
Panama	9	0	0	0	0
Paraguay	53	0	0	3	0
Peru	118	2	2	1	0
Philippines	87	0	2	2	1
Poland	117	1	1	4	0
Portugal	70	0	0	3	1
Puerto Rico	18	0	0	1	0
Romania	132	1	4	1	0
Russia	141	0	6	0	0
Saudi Arabia	81	0	1	3	2
Serbia	100	1	1	2	2
Singapore	139	1	4	1	0
Slovakia	97	0	2	3	0
Slovenia	46	0	0	1	1
South Africa	68	0	0	1	2
South Korea	161	3	1	2	0
Spain	47	0	0	1	2
Sri Lanka	51	0	0	0	4
Sweden	63	0	0	2	2
Switzerland	74	0	0	3	2
Syria	69	0	1	1	3
Taiwan	115	0	4	1	1
Tajikistan	57	0	1	1	2
Tanzania	0	0	0	0	0
Thailand	134	2	3	1	0
Trinidad and Tobago	26	0	1	0	0
Tunisia	41	0	0	1	2
Turkey	113	0	5	0	0
Turkmenistan	64	0	0	2	2
Uganda	6	0	0	0	0
Ukraine	135	2	3	1	0
United Kingdom	109	0	4	1	1
United States of America	185	5	1	0	0
Uruguay	16	0	0	0	1
Uzbekistan	64	0	0	3	2
Venezuela	13	0	0	0	1
Vietnam	151	2	3	1	0
Total (104 teams, 577 contestants)	39	100	143	126	

NB: Not all countries sent a full team of six students.

Higher degrees and honours bachelor degrees in mathematics and statistics completed in Australia in 2014

Peter Johnston*

This report presents data relating to students who completed Honours or Higher Degrees in Mathematics during 2014. The data are part of an on-going project for the Australian Mathematical Society and should be read in conjunction with previous reports [1]–[15] covering the period 1993–2013.

This year represents the fourth occasion that data has been reported for two-year coursework masters degrees with classifications (similar to existing Honours degrees). The University of Melbourne is the only university to offer such degrees in place of the traditional Honours degree, although some other universities are expected to follow this model. In the discussions that follow, these data have been merged together and will be referred to simply as ‘Honours’, although the completions for the two degrees are presented in separate tables. As time goes on, and more universities offer coursework masters degrees of this type, the two data sets will be differentiated and displayed as separated entities (backdated to 2010).

Appendix 1 presents data for students completing Honours degrees in 2014, at all Universities in Australia. Within each institution, the data are broken down into male and female students and into the three traditional areas of Mathematics: Pure; Applied and Statistics. There is also the general category ‘Mathematics’ for institutions that do not differentiate between the conventional areas. Finally, there is an ‘Other’ category for newer areas of mathematics such as Financial Mathematics. Each category is further broken down into grades of Honours awarded. Appendix 2 presents the coursework masters degrees awarded by the University of Melbourne in 2014. Appendices 1 and 2 combined show that in 2014 there were 186 Honours completions in Australia, with 139 (75%) receiving First Class Honours (compared with 119 out of 173 (69%) in 2013 and 113 out of 176 (64%) in 2012). Over recent years the average fraction of First Class degrees awarded has been about 70%.

Figure 1 presents the total number of students completing Honours degrees in Mathematics, including two-year Coursework Masters degrees (with classifications) over the period 1959–2014. It shows that in 2014 the number of Honours completions continues on an upward trend (with only a slight dip last year). The figure also shows the numbers of male and female students who completed Honours over the same time period. For last year, the number of male students has again increased over the previous years with 141 completions (140 in 2013 and 130 in 2012),

*School of Natural Sciences, Griffith University, Nathan, QLD, 4111.
Email: P.Johnston@griffith.edu.au

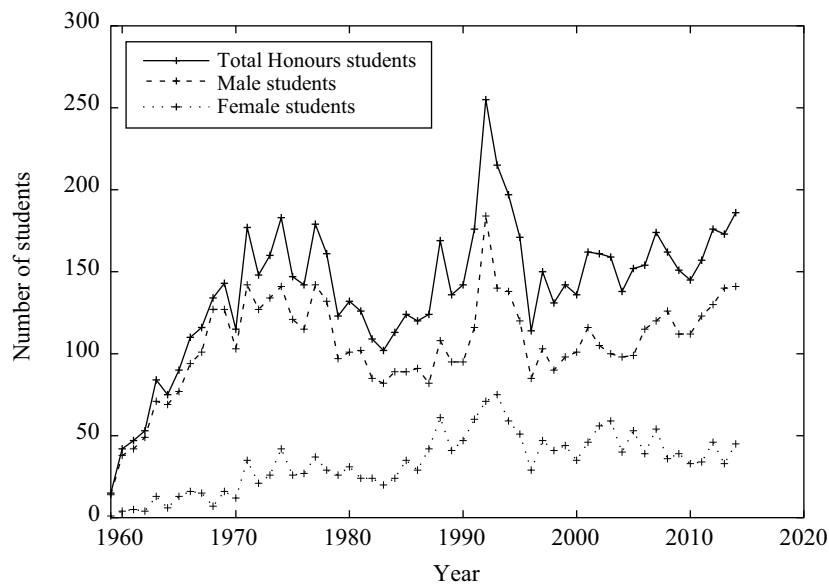


Figure 1. Number of Honours degrees, including two-year coursework masters degrees (with classifications), completed in mathematics and statistics, 1959–2014.

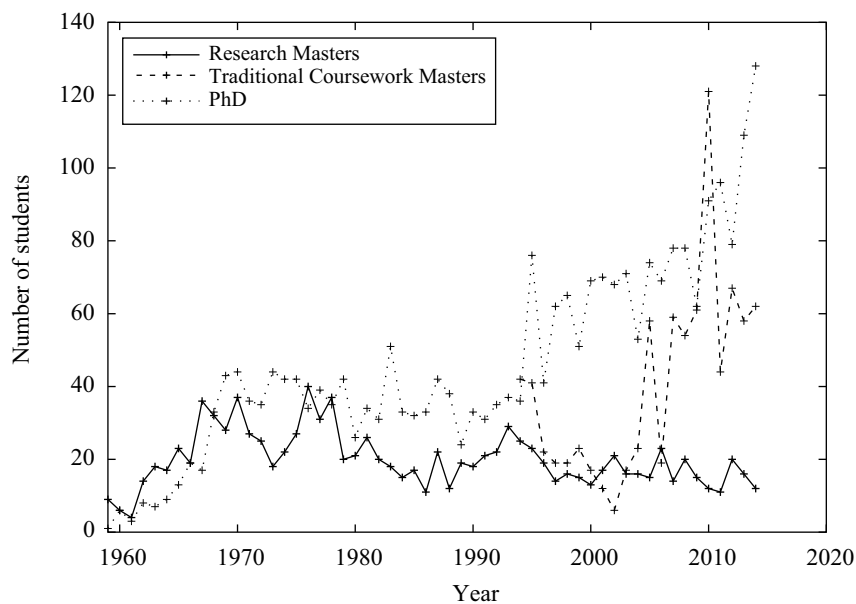


Figure 2. Number of research higher degrees completed in mathematics and statistics, 1959–2014.

while the number of female students increased to 45 (compared to 33 in 2013) back to the level of 2012 (46).

Appendix 3 presents the data for Higher Degree completions in 2014. The data are broken down into traditional Coursework Masters, Research Masters and PhD degrees, with the latter two divided into the three typical areas of Mathematics. These data are also represented in Figure 2, as part of the overall Higher Degree data for the period 1959–2014. The figure shows that:

- (1) There was a considerable increase in the number of PhD completions compared with the previous two years. In 2014, there were 128 PhD completions (up from 109 in 2013 and 79 in 2012), of which 85 were by male students and 43 by female students. This represents a large increase in the number of male students (up from 73 in 2013) while the number of female students showed a reasonable increase (up from 36 in 2013).
- (2) The number of Research Masters completions (12) again decreased slightly, down from 16 in 2013.
- (3) There was a slight increase in coursework masters completions (62) in 2014, up from 58 in 2013, but fewer than in 2012 (67).

For those who are interested in the finer details, the raw data are available directly from me. Simply send me an e-mail. I have an Excel spreadsheet containing the complete data for 2014 as well as spreadsheets containing cumulative data from 1959 for Honours, Research Masters and PhD degrees.

I would like to thank the many people who took the time and effort to collect this data and forward it to me. This year I received 33 out of a possible 38 responses to requests for data, which is a very good response rate. Finally, if having read this report, you would like to contribute missing data for 2014, I would be happy to add it to the spreadsheet.

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Appendix 1. Number of Honours degrees completed
in mathematics and statistics, 2014

Uni.	Sex	Maths			Pure			Applied			Statistics			Other			Honours Total
		I	IIA	IIB	III	I	IIA	IIB	III	I	IIA	IIB	III	I	IIA	IIB	
ACU	M																0
	F																0
ADF	M																0
	F							1									1
ANU	M				5			5									10
	F				3			1									4
BOU																	0
																	0
CDU	M																0
	F																0
CQU	M																0
	F																0
CSU	M																0
	F																0
CUT																	0
																	0
DKU	M																0
	F																0
ECU	M																0
	F																0
FDU	M																0
	F																0
GFU	M							1									1
	F																0
JCU	M											1					1
	F	1												1			2
LTU	M				2			1		2	1						6
	F									1							1
MDU	M											1	1				0
	F										1	1					2
MNU	M				1	3		2	1			7					14
	F																0
MQU	M																0
	F																0
QUT	M							4	1		2	1					8
	F							1						1			2
RMT	M							4	2								6
	F							2			1						3

Appendix 1. (continued)

Uni.	Sex	Maths			Pure			Applied			Statistics			Other			Honours Total					
		I	IIA	IIB	III	I	IIA	IIB	III	I	IIA	IIB	III	I	IIA	IIB		III				
SCU	M																0					
	F																0					
SUT	M																0					
	F																0					
UAD	M					1			1	1		1	1				5					
	F					1					1						2					
UCB	M																0					
	F																0					
UNC	M							1				1					2					
	F																0					
UNE	M																0					
	F																0					
UNS	M					2			2	2		1	2		1		10					
	F								1								1					
UQL	M					10			7	3		2	2				24					
	F						1				2	1					4					
USA	M								2								2					
	F																0					
USN	M					8	1		5	1	1	3	1				20					
	F								1			2					3					
USQ	M											1					1					
	F																0					
UTM	M					1			1								2					
	F					2			1								3					
UTS	M								1			1					2					
	F									1			1				2					
UWA	M					2						2		2	1		7					
	F					1						2					3					
UWG	M	1				2			2	1				2	1		6					
	F					1					1						5					
UWS	M	1															1					
	F								1								1					
VUT	M																0					
	F																0					
Totals		2	1	0	0	41	5	1	1	45	14	3	0	31	12	2	0	5	3	1	0	167

Appendix 2. Number of two-year coursework masters degrees (with classifications) completed in mathematics and statistics, 2014

Uni.	Sex	Pure			Applied			Statistics			Other			Total				
		I	IIA	IIB	III	I	IIA	IIB	III	I	IIA	IIB	III					
UMB	M	3				4			3	1		1		1	13			
	F	2							2	1		1			6			
Totals		5	0	0	0	4	0	0	0	5	2	0	1	1	0	0	1	19

Appendix 3. Number of research higher degrees completed
in mathematics and statistics, 2014

Uni.	Sex	Coursework Masters	Research Masters		Research Masters Total	PhD		PhD Total	
			Pure	Applied Statistics		Pure	Applied Statistics Other		
ACU	M				0			0	
	F				0			0	
ADF	M			1	1			0	
	F				0	1		1	
ANU	M	4		1	1	3	1	4	
	F				0	1		1	
BOU					0			0	
					0			0	
CDU	M				0			0	
	F	1			0			0	
CQU	M				0			0	
	F				0			0	
CSU	M				0			0	
	F				0			0	
CUT					0			0	
					0			0	
DKU	M				0	1		1	
	F				0			0	
ECU	M				0			0	
	F				0			0	
FDU	M				0	1		1	
	F				0	1		1	
GFU	M				0	1		1	
	F				0			0	
JCU	M				0			0	
	F				0			0	
LTU	M	1			0	1	1	2	
	F	6			0	1	2	3	
MDU	M				0			0	
	F				0			0	
MNU	M		1		1	2	2	4	
	F				0	3	1	2	6
MQU	M			1	1	1		1	
	F				0			0	
QUT	M				0	1	2	3	
	F				0	4	2	6	
RMT	M	10			0	4	1	5	
	F	12			0	2	1	3	
SCU	M				0			0	
	F				0			0	
SUT	M				0	1		1	
	F				0			0	
UAD	M		2	1	3	4		4	
	F				0	1		1	
UCB					0			0	
					0			0	

Appendix 3. (continued)

Uni.	Sex	Coursework Masters	Research Masters		Research Masters Total	PhD			PhD Total		
			Pure	Applied Statistics		Pure	Applied Statistics	Other			
UMB	M		1		1	7	5	3	15		
	F				0		3		3		
UNC	M				0	1	1		2		
	F				0				0		
UNE	M				0				0		
	F				0				0		
UNS	M		1		1	1	2		3		
	F			1	1	4	3		7		
UQL	M	9			0	2	5	3	10		
	F	6			0	1	1	1	4		
USA	M				0		3		3		
	F				0				0		
USN	M				0	2	5	2	9		
	F				0	1		3	4		
USQ	M				0		2		2		
	F				0				0		
UTM	M				0		1		1		
	F				0				0		
UTS	M	1			0				0		
	F	1			0				0		
UWA	M				0	3	1		4		
	F		1		1		1		1		
UWG	M	7		1	1	2	4	3	9		
	F	4			0		1	1	2		
UWS	M				0				0		
	F				0				0		
VUT	M				0				0		
	F				0				0		
Totals		62	5	7	0	12	36	64	27	1	128

4th South Pacific Continuous Optimization Meeting (SPCOM 2015)

University of South Australia
8–12 February 2015

Henri Bonnel¹, Jonathan M. Borwein², Regina S. Burachik³
and C. Yalçın Kaya⁴

Background

SPCOM brought together 60 researchers, including 11 PhD students and 4 early career researchers. Of these researchers, 39 came from many other parts of the world: Austria, Brazil, Canada, China, Finland, France, Germany, Hong Kong, Italy, Malaysia, New Caledonia, Singapore, Spain, and USA.

This was the fourth edition of the successful South Pacific meetings, South Pacific Conferences in Mathematics (SPCM) in 2005 and 2010 held in Noumea, New Caledonia, and South Pacific Optimization Meeting in 2013 (SPOM 2013) held in Newcastle, Australia. SPCOM 2015 was hosted by the University of South Australia (UniSA) and held at UniSA's City West Campus in Adelaide, between 8 and 12 February 2015. SPCOM 2015 took place soon after another Australian mathematics meeting, ANZIAM 2015.

The meeting was generously sponsored by University of South Australia (UniSA), School of Information Technology and Mathematical Sciences (ITMS) at UniSA, Centre for Industrial and Applied Mathematics (CIAM) at UniSA, Australian Mathematical Sciences Institute (AMSI), Centre for Computer Assisted Research Mathematics (CARMA) at the University of Newcastle, University of New Caledonia, Australian Mathematical Society (AustMS), Australian and New Zealand Industrial and Applied Mathematics (ANZIAM), and ARC Centre of Excellence for Mathematical and Statistical Frontiers (ACEMS).

Program

SPCOM 2015 offered a rich scientific program, addressing a diverse range of researchers, from early career to senior. The topics included variational analysis, optimal control theory, convex analysis, numerical optimization, vector optimization, stochastic optimization, functional analysis, and their applications.

¹University of New Caledonia, Noumea, New Caledonia. Email: henribonnel@gmail.com

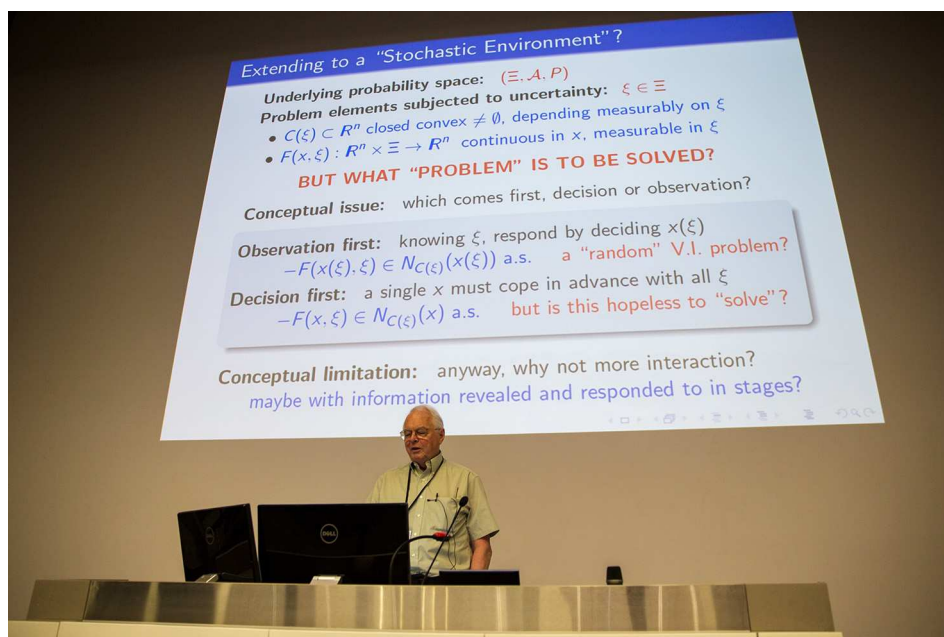
²University of Newcastle. Email: jon.borwein@gmail.com

³University of South Australia. Email: regina.burachik@unisa.edu.au

⁴University of South Australia. Email: Yalcin.Kaya@unisa.edu.au

The activities consisted of general conference talks, the Fitzpatrick Workshop (see below), two half-day tutorials on numerical optimization, and a student poster session. The program at a glance, as well as the detailed program, are still available at the conference website <https://carma.newcastle.edu.au/meetings/spcom/>. Between Monday and Thursday, there were 12 plenary talks, 31 invited talks, and 2 contributed talks.

The meeting started with the two tutorials on Sunday 8 February, one in the morning and one in the afternoon. José Mario Martínez delivered the morning tutorial, which was on numerical smooth optimization. The afternoon tutorial was on numerical non-smooth optimization, delivered by Claudia Sagastizábal. Both tutorials were free of charge for all registered participants, and were indeed very well attended (by 20–25 participants)



Terry Rockafellar gave a stellar opening talk on Monday showing how Stochastic Variational Inequalities can provide the right framework for studying problems of optimization and equilibrium in a stochastic setting. All participants joyfully celebrated his 80th birthday on Tuesday during the meeting banquet, by means of live piano performances, singing and dancing.

Tuesday morning, the Fitzpatrick Workshop celebrated the 25th anniversary of the publication of a seminal paper on maximal monotone operators by the late Australian mathematician Simon Fitzpatrick.

PhD students had the opportunity to showcase their research, and find out more about their peers' research, in a session also held on Tuesday.



SPCOM 2015 further promoted collegiality via a Wineries Tour to McLaren Vale on Wednesday afternoon, which 27 participants joined. The tour featured lunch at a winery, visits to wineries and a stroll at the beach.

SIAM and Springer supported the meeting by sending hard copies of books authored by the SPCOM speakers. These books were displayed on desks during the meeting, and then distributed to the students on the last day of the meeting. SIAM made three of these books available electronically, which were given to students as gifts.

Mathematical significance



Simon Fitzpatrick (b. 1953 Perth, d. 2004 Perth)

Fitzpatrick function and its impact. Simon Fitzpatrick was an outstanding Australian mathematician. His contributions have an increasing impact in Functional Analysis, both in theoretical and applied aspects. The now celebrated Fitzpatrick

function,

$$F_T(x, x^*) = \sup_{y^* \in T(y)} \langle y^* - x^*, x - y \rangle + \langle x, x^* \rangle,$$

where T is a maximally monotone map, has been cited and used extensively in a wide range of applications from PDEs to modern economic theory. It has become a fundamental tool in maximal monotone theory. The Fitzpatrick function was unnoticed for several years until Martínez-Legaz and Théra rediscovered it in 2001. This function provides a bridge between certain monotone phenomena and convex functions. This allows use of powerful variational techniques for studying problems such as (i) first-order monotone flows, (ii) nonlinear evolutionary PDEs and (iii) quasilinear models in continuum mechanics, electromagnetism and heat conduction. In a surprisingly different field, Flam has recently given an economic interpretation of the Fitzpatrick function in terms of a supply curve, which couples prices to quantities in a non-Walrasian market.

In terms of theoretical advances, the Fitzpatrick function has led to considerable simplifications of the proofs of some classical properties involving maximally monotone operators. For example, Simons and Zalinescu used it to obtain a new and short proof of Rockafellar's characterization of maximal monotone operators. Within the theory of maximally monotone maps, Burachik and Svaiter used it to define a one-to-one correspondence between a family of convex functions associated with a maximally monotone operator, and a family of enlargements of these operators. These enlargements, in turn, generated a new way for the efficient approximation and analysis of variational inequality problems. Marques Alves and Svaiter have used it recently to define a new constraint qualification ensuring maximality of the sum of maximally monotone operators in non-reflexive Banach spaces.

Stephen Simons opened the Fitzpatrick Workshop with a plenary talk in which, using concepts emanating from Fitzpatrick's work, he obtained a generalization of Rockafellar's theorem on the maximal monotonicity of subdifferentials, and, among other results, he obtained an extension of Brezis–Browder theorem to non-reflexive Banach spaces (The Brezis–Browder theorem proves that, in a reflexive Banach space, the adjoint of a linear monotone mapping with closed graph is monotone if and only if the original mapping is maximally monotone.) The plenary talk was followed by four 20-minute talks by Jonathan Borwein, Samir Adly, Radu Bot and Regina Burachik. Borwein's talk introduced the strong Fitzpatrick inequality and used it to define a gap function for the monotone inclusion problem and variational inequalities. Bot's talk furnished new duality results for certain convex optimization problems. Adly showed how non-smoothness naturally arises in dynamical systems, such as those induced by electrical circuits, and some problems from mechanics. Burachik presented a new family of enlargements, which is inspired by Fitzpatrick's 1988 paper, in which every member is structurally closer to the epsilon-subdifferential enlargement.

Stochastic variational inequalities and other stochastic problems. Variational inequality modeling, analysis and computations are important for many applications, but most of the subject has been developed in a deterministic setting. In recent years research has proceeded on a track to incorporate stochasticity in one way or another. However, the main focus has been on a rather limited idea of what a stochastic variational inequality might be. Because variational inequalities are especially tuned to capturing conditions for optimality and equilibrium, stochastic variational inequalities ought to provide such service for problems of optimization and equilibrium in a stochastic setting. Therefore they ought to be able to deal with multistage decision processes involving recourse actions, which has so far hardly been the case. Terry Rockafellar showed that this can be accommodated by bringing in the tools of nonanticipativity and its martingale dualization. Roger Wets put these new contributions into a historical perspective in his plenary talk, which described the highlights of Terry Rockafellar's results. To reinforce the stochastic flavor, Claudia Sagastizábal's plenary talk was about a new variant of bundle methods, which has 'on-demand' accuracy, and Jong Shi Pang's plenary talk concerned Nash equilibria for games with stochastic recourse functions.

Theoretical aspects of variational analysis. The plenary talks by Boris Mordukhovich and Asen Dontchev concerned some important theoretical issues of variational analysis. Mordukhovich discussed a new approach of variational analysis and generalized differentiation to characterizations of maximal monotonicity and strong maximal monotonicity properties for set-valued mappings in both global and local frameworks. Dontchev gave an overview of recent advances in the study of Lipschitz properties of solution mappings, which is of paramount importance in the sensitivity study of constrained optimization problems.

Theory and applications of numerical optimization. A common denominator in most talks at SPCOM has been the numerical approaches to several types of optimization problems. Some talks encompassed theory, some applications, and some others both theory and applications. An example of the latter type was Bořů's plenary talk, which showed us how duality can be exploited for solving complexly structured non-smooth optimization problems. Jeya Jeyakumar presented new results in global polynomial optimization. José Mario Martínez presented new results on sequential optimality conditions for differentiable constrained optimization. Helmut Maurer spoke about optimal control problems from biology and biomedicine whose solutions exhibit bang-bang and singular control. Xiaoqi Yang presented first- and second-order necessary conditions for nonlinear programming problems from the viewpoint of exact penalty functions. He also presented an interior point method to solve the L_p relaxed penalty problem, together with promising numerical experiments.



Feedback

We have had good feedback from many people who attended the meeting, both face-to-face and in writing. After the conference, the organizers received numerous emails from participants commending them for organizing a high-quality meeting.

Meta-Analysis Workshop
University of Southern Queensland
16–17 June 2015

Shahjahan Khan*

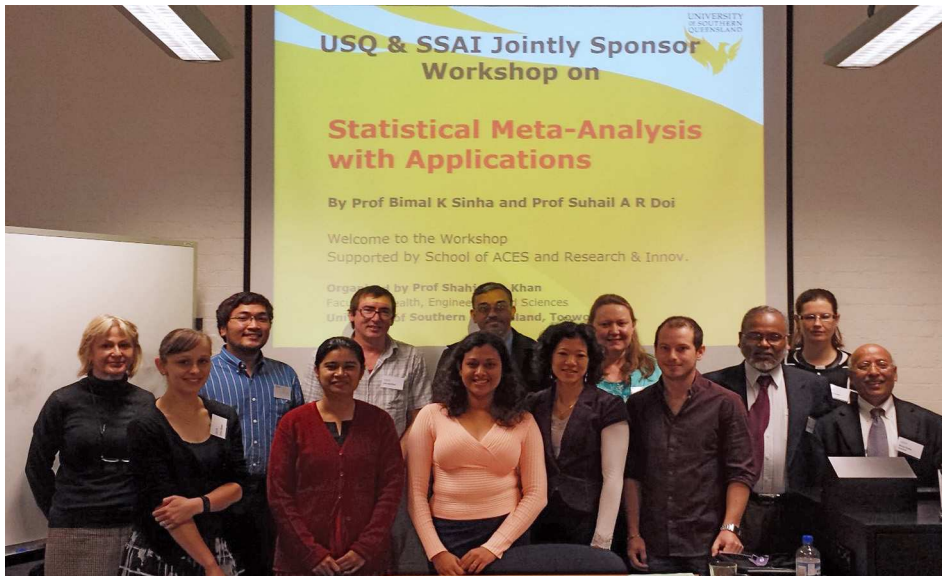
The School of Agricultural, Computational, and Environmental Sciences, and Division of Research and Innovation of the University of Southern Queensland (USQ) hosted a Workshop on ‘Statistical Meta-Analysis with Applications’ in collaboration with the Statistical Society of Australia Inc. The Workshop was held at the newly acquired Ipswich Campus of USQ from 16–17 June 2015. Professor Bimal Sinha, University of Maryland, Baltimore County, USA and Associate Professor Suhail Doi, Australian National University, Canberra, Australia were the two invited presenters.

The organiser of the Workshop, Professor Shahjahan Khan of USQ, opened the inaugural session with a brief introduction of the meta-analysis within the systematic review and evidence-based decision making process and role of statistical methods in synthesising data from independent studies. He also highlighted applications of meta-analysis in many fields of medicine, agriculture, education and business, and discussed some the issues related to methods of allocation of weights under various models in the estimation of the common effect size of meta-analysis.

Professor Bimal K. Sinha started with some motivating real-life examples of data leading to the definition of measures of various effect sizes for continuous and binary outcome variables. He covered all commonly used estimators of common effect size and discussed their variance estimators and confidence intervals. He also discussed inference about the common mean of univariate normal distribution, publication bias, vote counting procedures, and heterogeneity issue along with the random effects (RE) model and meta-regression.

Professor Suhail Doi highlighted the main purpose of meta-analysis and focused on some of the problems inherent with conventional statistical meta-analysis, especially the issue of unfair redistribution of more weights to smaller studies under the random effects model. Under the title of ‘Recent advances in the methodology of statistical meta-analysis’ he presented the inverse variance heterogeneity (IVhet) estimator as an alternative to the RE model estimator, and introduced quality effect (QE) model estimator based on his recent publications. Through extensive simulation examples he demonstrated the advantages and appropriateness of the new estimators.

*University of Southern Queensland, Toowoomba, Queensland.
Email: shahjahan.khan@usq.edu.au



Participants and presenters of the meta-analysis Workshop at USQ, Australia

Twelve participants ranging from government departments, industry and academia from Queensland and other parts of Australia attended the Workshop. They were very happy with the presentations and management of the event and thanked USQ and SSAI for organising the valuable Workshop.

3rd Heidelberg Laureate Forum Report

Matthew Tam¹, Ioannis Tsartsafelis² and Melissa Lee³

The 3rd Heidelberg Laureate Forum (HLF) was held in Heidelberg's picturesque old city in Germany on 23–28 August 2015. Supported by the Klaus-Tschira-Stiftung, since 2013, the Forum has brought young researchers from around the globe together with a handful of laureates — outstanding mathematicians and computer scientists who have been recipients of either the Abel Prize, ACM A.M. Turing Award, Fields Medal, or the Nevanlinna Prize. This year's forum was no different, and included approximately 200 young researchers and 26 laureates including Leonard Adleman (ACM Turing Award recipient and co-inventor of the RSA cryptosystem), Shigefumi Mori (Fields Medalist and president of the International Mathematical Union), and Vinton Gray Cerf (ACM Turing Award recipient and co-inventor of the TCP/IP protocols). The group of young researchers included five young mathematicians working in Australia (see Figure 2).



Figure 1. Fancy souvenirs. (Photo: Matthew Tam.)

It was, of course, an honour to be given the opportunity to meet with the laureates, and to be able to put a face and a personality to their famous names. It was also somewhat humbling that many of them, when asked about how they decided which problems and areas to work on, simply replied ‘I just do what I find interesting’.

The Forum's program was full of activities which gave both the young researchers and the laureates a great deal of time to get better acquainted. Each day of the academic program began with a number of engaging talks from the laureates. The afternoon sessions included a number of short workshops given by the more senior young researchers, stimulating ‘hot topic’ discussions, and visits to local institutions including the German Cancer Research Centre and the Max Planck Institute for Mathematics. Highlights of the social program included dinner in a museum

¹CARMA, University of Newcastle, University Drive, Callaghan, NSW 2308.
Email: matthew.tam@uon.edu.au

²La Trobe University, Melbourne, Victoria 3086.

³The University of Western Australia, 35 Stirling Highway, Perth, WA 6009.



Figure 2. 2015 HLF attendees (left to right): Matthew Tam, Melissa Lee, Philipp Bader, Anna Tomskova and Ioannis Tsartsafis. (Photo: ©HLFF// C. Flemming. All rights reserved 2015.)

aside a Russian space shuttle in the nearby town of Speyer, a Bavarian Night with a little *Schuhplattler* (Bavarian dance) just for good measure, and, no visit to Heidelberg would be complete without the renaissance ruins of the spectacular Heidelberg Castle.

In summary, the Heidelberg Laureate Forum was a fantastic opportunity to engage with, learn from, and be inspired by mathematicians and computer scientists who have achieved remarkable things and reached the top of their respective fields, as well as to network with an international cohort of up and coming young researchers.

Further information regarding the Heidelberg Laureate Forum can be found online at <http://www.heidelberg-laureate-forum.org/>.

Book Reviews

Count Like an Egyptian

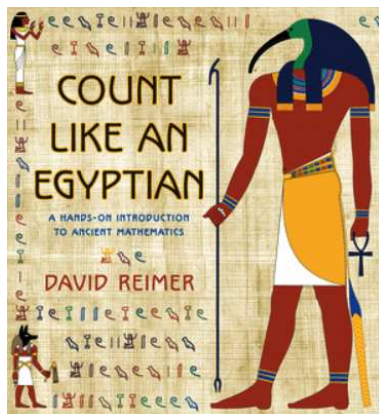
David Reimer

Princeton University Press, 2014, ISBN 978-0-691-16012-2

It was great to see the dedication and work David Reimer put into this book. In the Preface (but who reads that part of a book these days) he mentions he read many books on the history of Egyptian computation, though mainly to no avail. Then he took the radical step of going back to the original source, by obtaining a translation of the Rhind Mathematical papyrus. For those unfamiliar with that text, it dates from around 1,500 BC, or thereabouts, as we can't be exact, but that date puts it at the beginning of the New Kingdom era. Written by a Vizier named Ahmose, who was preserving an earlier document from the Middle Kingdom, perhaps as early as 2,000 BC, it contains most of our knowledge of Egyptian mathematical computation and geometry. Reimer goes through this document not once, but at least three times, coming to grips with how the Egyptians did their maths, working through their examples until he understood how they obtained their results as well as how they used their short cuts and maths tables.

What a great approach and a dedicated effort. So one hopes the book will reflect that persistence and it does. It is a pity that other scientists don't follow suit. Only recently I watched on TV a well known astronomer repeat the perennial myths about Galileo and the Catholic Church on the conflict between science and religion. It is a myth that the trial of Galileo was about his book on heliocentricity, it is a myth it was the church being anti-science, it is a myth that instruments of torture were presented before him, which is probably the result of the myth maker confusing the Catholic Church's Inquisition with the Spanish

Inquisition and he probably didn't mumble under his breath at the end of the very long and protracted trial. Another example of this lack of consulting original documents is that these days social media has a lot to answer for the obsessive scrutiny of Ada Lovelace whose two hundredth anniversary of her birth happens this December. She has been promoted above her station by some mathematicians and computer programmers in this country and overseas. However, going back to original documents her misguided fame is based on excellent mathematical instruction by some big name mathematicians of the day, but for small gain, as her knowledge of maths was only elementary at best. She contributed no mathematical papers and is essentially known for just one thing, her translation of an engineering



book from Italian into English, to which was added some notes. This appendix mentioned an algorithm that today we would call a program. Given her level of maths and close association with Babbage it is suggested in current research that it is more likely the latter suggested the content of the notes and was happy to have another person, high up in society, indirectly arguing his case as he pursued more money from the government. As scientists we need to know our limitations and let the science historians handle the history of science.

So it was refreshing to see Reimer had gone back to basics to write this book and not repeat ‘a few trivial examples followed by abstract discussions filled with equations completely out of context’ that the books he found in his library had done previously. After reading the book one can appreciate that he has managed, as best can be expected from his limited material, to get inside the mind of Egyptians who carried out computations for their country three, or four thousand years ago, possibly even further back. Also after reading it, it makes sense why the Greeks referred back to the Egyptians as the basis of their maths knowledge. One comes away with a respect for their maths and geometry, even though the latter is mainly mentioned in passing, as the book concentrates on mostly numeric computation. Reimer succeeds in imbuing one with the simplicity of the Egyptian computation, even comparing it to the complex Babylonian system in a chapter titled Base-Based Mathematics. The book is not without its faults, but looking at the forest and not the trees this book does achieve its goals.

Throughout the book Reimer gives some history to put the computations that follow into context. We are quickly taken through addition then into how the Egyptian carried out their multiplication by doubling. Like the rest of the book there are several examples followed by some practice exercises. None of this calculation is difficult, but the simplicity of their algorithm is impressive. One ends up considering if this method could be used for primary school students who just struggle with their rote learning of multiplication tables, in those schools that still use this learning method. A nice touch is that all the examples are presented as an image on a papyrus scroll. Division, essentially the reverse of multiplication, is very ably illustrated by the simplicity of the Egyptian algorithm which is the same as the one for multiplication with a very minor twist. In fact, it highlighted for me how complex our division is (well at least what I was taught) when say we want to divide 133 into 2261 for argument’s sake. We work it out as follows,

$$\begin{array}{r} 17 \\ 133 \overline{) 2261} \\ \underline{133} \\ 931 \\ \underline{931} \\ 0 \end{array}$$

Not that easy when it is all said and done. After all how does a primary school student work out that 133 divides into 931 seven times? Well, not easily. The

Egyptian student only has to double and either add or subtract. In the examples I did, I think it is faster and certainly easier for division with 3-, 4- and 5-digit numbers.

Another interesting aspect of their maths is fractions, where their numerator was always 1, with the exception of the fraction two-thirds. There is always an exception! Reimer writes their fractions without the numerator, so one-tenth is $\overline{10}$. So our Egyptian student or Vizier would write two-fifths as $\overline{3} \overline{15}$. Reimer then shows how this system is very similar to our decimal system, using the example of pi, 3.141, which would be written by them as $3 \overline{10} \overline{25} \overline{1000}$. The beauty of this system, like our decimal system, is that it allows us to assess that a good approximation to Pi would be $3 \overline{10} \overline{25}$ due to the small value of the third term. So while the reader isn't presented with any complicated mathematics we are presented with an elegant methodology and a system that is simplicity itself, that in some areas mirrors our own decimal system.

Reimer also seeks to put the practical examples into the context of the Egyptian system, which is appreciated. So he gives examples like the area of a triangle, which they knew to be half of the area of the rectangle, so the halving and doubling arises yet again. Other practical examples are working out shares of physical items like wheat, wages, or area of land. This involved some complex work with fractions and it was fascinating to see how the Egyptian calculated multiples of a fraction or divided that fraction into yet smaller fractions, like what is two-thirds of $39\frac{1}{2}$. The Rhind papyrus also gives us an insight into the tables they used to help in the simplification of their everyday computation. Not unlike our logarithm tables or Chambers Shorter Six Figure Mathematical Tables that went to 389 pages, which I'm sure some readers remember. A table introduced in the Rhind document is two times the odd fractions, so 2 times an eleventh is $\overline{6} \overline{66}$ and so on to a limit of two times $\overline{101}$. Why no table of two times the even fractions you ask? Because they knew that all they needed to do was halve the denominator. Halving and doubling was second nature to them, so no table was needed.

He considers how the Egyptians drew of human figures and how those Egyptians of equal status had to have equal heights, as measured to their foreheads. Consequently it was important not only to carve the figures correctly but to the right height. This meant that measuring was important along with marking out the grids in which to carve the figure. This in turn led to the need for rulers, as in marking or measuring devices, which were very different to our uniform 300 mm rulers of today.

As with all good mathematicians the Viziers had their short cuts or simplified workings to speed up their computations, as well as why did they choose a particular value in their tables from a list of multiples. So Reimer takes us through a series of such simplifications and choices. In fact, he devotes a full chapter to it. As an example from the book, he illustrates how the Egyptians selected a particular set of fractions for the two times the odd fractions table from a list of options. The odd

fraction he chose was $\overline{15}$, so two times that can be expressed in four different ways:

- $\overline{8} \overline{120}$
- $\overline{9} \overline{45}$
- $\overline{10} \overline{30}$
- $\overline{12} \overline{20}$

So trying to reverse engineer the Egyptian decision he suggests the following methodology as to how Ahmose's predecessor selected one of the above, over the other three. Firstly, the Egyptians thought of multiple fractions as approximations that are refined with each term. So $\overline{8} \overline{120}$ is close to an eighth, differing by only $\overline{120}$ so it is a good approximation for an eighth, but $\overline{12} \overline{20}$ is a poor approximation because one twentieth is larger than half of one twelfth. So that option was dropped from contention. The Egyptians were doubling fractions and numbers all the time. If they chose the option $\overline{9} \overline{45}$ and needed to double that, then it meant consulting the tables twice, once for $\overline{9}$ and again for $\overline{45}$ giving $\overline{6} \overline{18} \overline{30} \overline{90}$, which would of course would have to be simplified. So much extra work! For even fractions it is so much easier. Need to double $\overline{8} \overline{120}$, easy, as mentioned above just halve the denominator, so it is $\overline{4} \overline{60}$ which is still a good approximation. Need to double $\overline{10} \overline{30}$, easy $\overline{5} \overline{15}$. Also a corollary from this means that $\overline{6} \overline{18} \overline{30} \overline{90}$ can be simplified to either $\overline{4} \overline{60}$ or $\overline{5} \overline{15}$. This would probably not have been lost on the experienced scribe either. So that option of odd fractions from the list is dropped from contention leaving us with just two options. Now a good many fractions and hence their use came about in the Egyptian system as a means of dividing up some quantities. Would you prefer to divide up a loaf or a bushel of wheat into thirtieths or one hundred and twentieths? Hmmm thought so. Reimer's guess is that the Egyptians were just like us in that too. So it doesn't come as a surprise then that the scribe chose $\overline{10} \overline{30}$ as the doubling of $\overline{15}$, which is exactly as it appears in the Rhind papyrus.

Another aspect that comes through in this book is not only their accuracy in calculation but also in measurement, with the prime example being the pyramids. Not only were the pyramids spot on with their location and height, the Viziers knew that the slope couldn't be too steep or it would slide away. The measurement of the slope of the Great Pyramid of Kufu was 51 degrees, 50 minutes and 34 seconds, while some others were 51 degrees and 50 minutes. Amazing accuracy that had to be reflected in their computation. However, although we aren't sure of what the Egyptian knew about the volume of a pyramid, we do know that they knew something even more complex—the volume of a truncated pyramid, which of course suggests they knew the former too. Reimer gives an interesting possibility of how it might have been worked out, but at the end of the day the scraps of information that we do have does hint at greatness. It is a pity that we don't have more. As mentioned previously they were greatly respected by the Greeks, so that might just have to be enough.

This book isn't perfect, there are some errors. Some of them are inconsequential like missing $//3$ symbol in a sentence where the omission is pretty obvious and didn't really affect the maths. Though this particular error was repeated a few times which was a bit disturbing. Then there were some mix-up of words in a sentence, like in Chapter 6, 'We base all we that know about Egyptian mathematics ...'

and so on. Consequently, these errors are pretty harmless, but there are some that are just wrong. As an example, again in Chapter 6, there are a sequence of fractions ' $\overline{5}$, $\overline{15}$, $\overline{19}$, $\overline{15}$ and $\overline{285}$ ' that should be $\overline{5}$, $\overline{15}$, $\overline{19}$, $\overline{95}$ and $\overline{285}$. Fortunately, I didn't find any errors in the answers to the exercises in the book, but then, I didn't check the Practical Solutions at the end of the book. Finally in some places Reimer does labour the point where it appeared to me not needed. The maths wasn't complicated and his first explanation was clear enough.

The maths in this book isn't taxing by any stretch of the imagination. An upper primary school student would be able to deal with most of it, while a high school student should have little difficulty. It would be interesting to see if teaching this Egyptian computation would be of help or hindrance to the high school student. I think it would be of help. At the end of the day the purpose of the book is to get into the mind of the Egyptian Vizier to try and understand how they carried out their computations to run everything in their empire for over 2,500 years. This is a book that comes recommended, for anyone who wants to know where our current basis of mathematics comes from through to those with an interest in maths and history.

Finally, I like that his book's title is playfully based on the Bangles song 'Walk Like An Egyptian'. It is good to see he likes to have some fun as well as have a bit of a play!

Gordon Clarke

Email address: gordonc53@gmail.com





Bio INFO Summer 15

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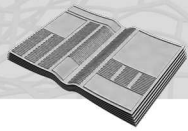


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AMSI RESEARCH



Nalini Joshi*

Science Policy and the needs of Mathematical Sciences

If you have initiated an ARC Linkage project and seen it grow to fruition in the mathematical sciences, then you are very lucky. In the 2015 round, one single Linkage project out of 252 was funded in this field of research code [2, Table 6]. In this context, it is useful to reflect on industry connections in the mathematical sciences and where our needs lie in the context of science policy and advocacy. I welcome your reflections on this nexus.

Since the National Committee for Mathematical Sciences is a committee of the Australian Academy of Science (AAS), I will limit my column to issues of advocacy on which the AAS has been active. This is captured by submissions that are available on the AAS website www.science.org.au under 'Science Policy'.

The latest submission concerns the government review of research policy and funding arrangements [1]. This was made in response to the Australian Government's review of university research funding and policy (announced on 07 July 2015) as part of its *Boosting the Commercial Returns from Research* strategy [3]. The submission addresses a number of issues. Let me focus on the following:

[1, p. 2]: There are a number of systemic barriers to greater collaboration between university researchers and industry and to subsequent commercialisation of Australia's research discoveries.

[1, p. 8]: The most important of these is that Australian businesses collaborate far less with other organisations on innovation (whether with universities or other businesses) than in other countries in the Organisation for Economic Co-operation and Development (OECD).

The submission also points out that (i) relatively few Australian businesses are engaged in innovation; (ii) business innovation in Australia lacks novelty; and, (iii) Australian businesses collaborate mainly with value-chain partners (i.e. with clients, customers, buyers and suppliers).

This is a systemic problem. Those companies that do engage in innovation tend to do so within the areas of production, marketing, or provision of after-sales service. No agricultural company pays for the development of a better numerical algorithm

*Chair, National Committee for Mathematical Sciences, School of Mathematics and Statistics F07, The University of Sydney, NSW 2006, Australia. Email: nalini.joshi@sydney.edu.au

in Australia even though they may rely on the accuracy of the Bureau of Meteorology's forecasting model when they decide whether they will borrow money to plant seed.

A recent article on start-up companies in Australia [4] adds to this view. The author states

[T]here is no actual need in our economy for a tech sector to exist. The commodities sectors do not need one; they have their own R&D channels. The oligarchies in the services sector don't need one; they buy their technology from overseas vendors. The educational exporters don't need one; they only innovate to reduce costs and improve their marketing.

The author goes on to suggest that Australian companies in the services sector have the capital but neither the management nor the culture to 'morph from being domestic oligarchies that use third-party off-the-shelf technology platforms' to vendors of new, useful technology platforms in their own sector.

The lack of appetite for a 'vibrant' tech sector in Australia also reflects a lack of appetite for a mathematical approach to novel commercial developments. Most Australian companies do not see the need to improve mathematical sciences, but sometimes see the need to use what is already out there.

What does this mean for mathematical collaborations with Australian industry? How can we increase the number and throughput of ARC Linkage projects in mathematical sciences? Is it purely up to us, the mathematical scientists, or is there a need for government to consider a systemic problem in Australian industry? What do you think?

References

- [1] 'Submission by the Australian Academy of Science to the Review of Research Policy and Funding Arrangements,' <https://www.science.org.au/sites/default/files/user-content/australian-academy-of-science-review-of-research-policy-and-funding-arrangements.pdf>, accessed 18 October 2015.
- [2] 'ARC Linkage projects: selection report for funding commencing in 2015,' http://www.arc.gov.au/sites/default/files/filedepot/Public/NCGP/LP15/LP15_Selection_Report_and_Outcome_Statistics.pdf, accessed 18 October 2015.
- [3] 'Review of Research Policy and Funding Arrangements,' <https://education.gov.au/review-research-policy-and-funding-arrangements>, accessed 18 October 2015.
- [4] I. Maxwell, "There can only be one Silicon Valley, so let's try something else," <https://theconversation.com/there-can-only-be-one-silicon-valley-so-lets-try-something-else-48752>, accessed 18 October 2015.



Nalini Joshi is an ARC Georgina Sweet Laureate Fellow and the Chair of Applied Mathematics at The University of Sydney. She was the President of the Australian Mathematical Society during 2008–2010, elected a Fellow of the Australian Academy of Science in 2008, became the Chair of the National Committee of Mathematical Sciences in 2011, and is a member of the Commonwealth Science Council of Australia.

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AMSI News

Geoff Prince*

Go8 CEO says research training places should be linked to ERA. We say NO!

In the three months from August to October AMSI has made submissions to three Commonwealth reviews all of which will have a major impact on Australian mathematical sciences.

The first of these is quite remarkable. The government has responded positively to Ian Chubb's call for a national STEM plan and issued a discussion paper 'Vision for a Science Nation' on how this might be achieved. This is a triumph for the Chief Scientist who has, without blinking, maintained a firm position on STEM policy. In the main the government's paper was well-considered although rather self-congratulatory of its own programs. However, the education section tip-toed around both the out-of-field teaching and the pre-requisites issues. We have been part of the consultation briefings and our submission was put together with AMSI members including the AustMS Steering Committee and Council. You can find our comprehensive submission at <http://amsi.org.au/publications/vision-for-a-science-nation-response/>.

The second review has been commissioned by the Minister for Education and Training on Australia's Research Training Programs. The main thrust of this review, by the Australian Council of Learned Academies, is concerned with broadening research training to directly address the overall low take-up of research trained staff by the Australian private sector and the low rates of engagement between the companies and the universities. This might sound scary but the consultation paper is sensible, unlike the response from the Group of Eight (Go8) Executive which goes like this: universities with disciplines which don't score three or more at the two-digit FOR code level should be denied Commonwealth funded PhD and research masters (RTS) places in those disciplines. The press pounced and announced, for example, that La Trobe and Macquarie would lose their postgraduate programs in the mathematical sciences.

All of this happened around the time of the AustMS Annual Meeting at Flinders. There was universal opposition including from colleagues at Go8 universities and, on the Steering Committee's instruction, Tim Marchant and I wrote to Vicki Thompson, the Go8 CEO. I can't reproduce the letter here but I can tell you some of our objections.

*Australian Mathematical Sciences Institute, Building 161, c/- The University of Melbourne, VIC 3010, Australia. Email: director@amsi.org.au

1. The ERA is not designed to evaluate the quality of graduate programs which generally rely on a variety of attributes which it does not measure. La Trobe is a case in point, this can be illustrated with two examples. A La Trobe PhD student won the prize for the best student talk at the Flinders meeting. Also this year Australia had 5 postgraduates (of a total of 200 internationally) selected on merit by the Heidelberg Laureate Forum organisers to attend the annual meeting with Fields medallists and other eminent prize winners. Two of the five were from La Trobe.
2. Although the Go8 proposal is based upon the two-digit FOR codes this measure would decimate programs in statistics. Statisticians publish across a range of discipline areas and so rarely reach the output threshold for assessment within the mathematical sciences. Hence the absence of a two-digit result or a score of 2 at this level would remove RTS places from the sub-discipline without the application of any effective measure of the research quality let alone of the graduate programs. Australia cannot afford this.
3. Australian graduate programs in the mathematical sciences are significantly supported by AMSI, often in conjunction with the learned societies. AMSI provides a four week residential summer school, a two-week residential winter school, a bioinformatics symposium, shared coursework subjects across our national ACE (videoconference) network and around 20 research workshops annually which attract many postgraduates and ECRs. And AMSI Intern is a national program placing PhD students into industry research internships. These programs support all mathematical sciences departments and they are most heavily patronised by the Go8. In this environment, groups too small to reach the ERA outputs threshold can successfully sustain postgraduate supervision. So there is a strong case to be made that the quality of graduate programs in the mathematical sciences should not be measured locally.
4. Even if a broader set of measures were to be applied to limit RTS places we are concerned that such a proposal will limit the agility of universities in pursuing opportunity. For example, there is currently very significant unfilled national demand in data science. Deputy Vice-Chancellors Research and deans need to be able to move quickly to build areas of strength through new appointments and allocations of RTS places and scholarships. This proposal would effectively lock disciplines out of these initiatives and any improvement in their ERA rankings.

Part of my reason for detailing these arguments is the need for advocacy by all of us in our own universities and especially in the Go8.

AMSI had already made a comprehensive and very well received submission to the review <http://amsi.org.au/publications/acola-research-training-system-review-submission/> and at the time of writing I have been invited to both private and public consultation sessions with the panel.

The last of the three reviews was again commissioned by the Minister for Education and Training, this time into the Commonwealth's research funding arrangements for the universities. This review is driven by the government's policy position on increasing the commercial returns on publicly funded research. The need to broaden

measures of impact in order to encourage industry engagement appears throughout the consultation paper. Of course the danger for the mathematical sciences is not that the ERA metrics be broadened but that ALL the new metrics be applied indiscriminately. In our submission <http://amsi.org.au/publications/research-policy-and-funding-review/> we emphasised the need to customise the basket of metrics according to the sub-discipline, for example, biostatistics through cryptography to low dimensional topology should each use applicable metrics identified by the discipline.

I have no doubt that we will see movement away from publication-based measures of impact, and the introduction of industry-engagement grant schemes for individual researchers. We should welcome these so long as the pendulum does not swing to the other extreme.

A positive wind of change is blowing at the moment. Let's hope we aren't becalmed after Ian Chubb leaves office in December.



I was a Monash undergraduate and took out a La Trobe PhD in 1981 in geometric mechanics and Lie groups. This was followed by a postdoc at the Institute for Advanced Study in Dublin. I've enjoyed teaching at RMIT, UNE and La Trobe. My research interests lie mainly in differential equations, differential geometry and the calculus of variations. I'm a proud Fellow of the Society, currently a Council and Steering Committee Member. I became AMSI director in September 2009.

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AMSI RESEARCH



News

General News

Choose Maths Travel Grants for Women

Building professional networks and research collaborations are vital for an academic career. AMSI and the BHP Billiton Foundation are pleased to announce the Choose Maths Grants, which are designed to provide full or partial support for Australian female mathematical sciences students and early career researchers to participate in the AMSI Flagship programs. The grants support women to build and extend their skills and professional networks by providing financial support for:

- Participation in AMSI Summer School, Winter School, BioInfoSummer and Vacation Research Scholarships (including support for second time attendees) Partner and child travel and/or accommodation support Caring responsibility support (for example childcare or temporary respite)
- Funding of up to \$3,000 is available per application, in addition to the costs of participating in the program. The Awards are funded by BHP Billiton Foundation and are an initiative of the Choose Maths Project.

<http://research.amsi.org.au/choose-maths-grants/>

Choose Maths will work with students, parents and teachers over five years through a program of professional development, awareness and reward to turn around community attitude to participation in mathematics, especially for girls and young women.

Mathematics by Inquiry Initiative

Senator The Honourable Simon Birmingham, Minister for Education and Training, announced on 20 October that the Australian Government will provide \$6.4 million from the Mathematics by Inquiry initiative to support the Australian Academy of Science and the Australian Association of Mathematics Teachers to develop and promote new maths resources for Foundation to Year 10 students, teachers and school leaders.

For details see <http://www.senatorbirmingham.com.au/Media-Centre/Media-Releases/ID/2860/Bringing-maths-into-the-real-world-for-students>.

Applied Probability Special Interest Group

The AustMS Council has recently approved the formation of an Applied Probability Special Interest Group (APSIG). Members of the AustMS with a research interest in Applied Probability, are invited to join a Google Groups page, which has been created to facilitate interaction amongst members, by visiting <https://groups.google.com/forum/#!forum/appliedprobability>.

To become a member of the APSIG, you will need to choose this option when you next renew your AustMS membership. A fee (<\$14) is associated with this, of 10% of the AustMS membership fee, but this money will be available for the APSIG to support its objectives. At this stage, APSIG is looking to use the funds to support a biennial Applied Probability Workshop and, depending upon membership numbers, might be able to support other initiatives, in which case we look forward to your suggestions.

If you have any questions, please email Josh Ross (joshua.ross@adelaide.edu.au).

Number Theory Special Interest Group

In recent years there have been conferences, workshops, seminars, and visitors brought to Australia, so number-theoretic (and related fields) research is demonstrably alive and kicking. Recently, the AustMS recognised these efforts by declaring ‘Number Theory Down Under’ as a special interest group. Dr Mumtaz Hussain, as general secretary of this group, is planning to compile a database of Australian researchers who have an interest, either directly or indirectly, in number-theoretic research. Please send an email to mumtaz.hussain@newcastle.edu.au if you would like to be kept informed of upcoming activities and news items.

AF Pillow Applied Mathematics Trust annual ‘top-up’ scholarship

The AF Pillow Applied Mathematics Trust offers an annual ‘top-up’ scholarship to a student holding either an Australian Postgraduate Award (APA) or equivalent award for full-time research in Applied Mathematics leading to the award of a PhD. The aim of the AF Pillow Applied Mathematics Top-up Scholarship is to increase the quantity and quality of postgraduate students in the field of applied mathematics in Australia. The scholarship top-up is awarded for up to three years and consists of up to a \$10 000 annual stipend for a full time applicant, to supplement a basic postgraduate scholarship (e.g. an APA or equivalent award). As a full-time scholarship top-up award, it is non-taxable. An allowance of up to \$1500 per annum (maximum \$4500) will be available and payable to the student on production of receipts for reasonable expenses associated incurred for economy airfares and registration fees to attend the ANZIAM national annual conference. In each year, one top-up scholarship will be awarded.

Closing date: 4 December 2015.

Guidelines, application form and a historical lecture can be obtained by from the ANZIAM website: <http://www.anziam.org.au/The+A+F+Pillow+Applied+Mathematics+Top-up+Scholarship>.

Completed PhDs

ANU

- Dr Yao (Pauline) Ding, *Analysis of longitudinal data with multiple levels of variation*, supervisor: Alan Welsh.

- Dr Matthias Wong, *Theory of the sparse grid combination technique*, supervisor: Markus Hegland.

Macquarie University

- Dr Mitchell A. Buckley, *Three studies in higher category theory: fibrations, skew monoidal structures and excision of extremals*, supervisors: Dominic Verity and Dr Richard Garner.
- Dr Joshua Grahame Peate, *Riesz transform estimates in the absence of a preservation condition and applications to the Dirichlet Laplacian*, supervisor: Xuan Duong.

RMIT University

- Dr Pritheega Magalingam, *Complex network tools to enable identification of a criminal community*, supervisors: Asha Rao and Stephen Davis.

University of Melbourne

- Dr Rami Tabbara, *Generalised directed walker models of adsorption and gelation*, supervisor: Aleks Owczarek.
- Dr Chu Wu, *Studying deformable systems through experimental and theoretical approaches*, supervisor: Derek Chan.
- Dr Peter Hickey, *The statistical analysis of high-throughput assays for studying DNA methylation*, supervisors: Terry Speed and Peter Hall.

University of Newcastle

- Dr Michael Rose, *Expectations over deterministic fractal sets*, supervisors: Jonathan Borwein and Brailey Sims.

University of New South Wales

- Dr Nguyen Hong Le, *Four-fold symmetry in universal triangle geometry*, supervisor: Norman Wildberger.
- Dr Randell Heyman, *Topics in divisibility; pairwise coprimality, the GCD of shifted sets and polynomial irreducibility*, supervisor: Igor Shparlinski.
- Dr Yu-Heng Ting, *Diagnosing ocean transport using a maximum-entropy method*, supervisor: Mark Holzer.

University of Wollongong

- Dr Mitch Hawkins, *Applications of compact topological graph C^* -algebras to noncommutative solenoids*, supervisors: Aidan Sims and Nathan Brownlowe.
-

Awards and other achievements

Australian National University

- Dr Boris Buchmann, Professor Ross Maller and Professor Dr Alexander Szimayer have been awarded an ARC Discovery grant worth \$228 703 to continue an ongoing theoretical study into continuous-time stochastic processes.
- Dr Pierre Portal, Professor Andrew Hassell, Dr Adam Sikora, Professor Dr Johannes van Neerven and Associate Professor Colin Guillarmou have been awarded an ARC Discovery grant worth \$445 118 to explore new perspectives in harmonic analysis.
- Dr Scott Morrison has been awarded an ARC Discovery grant worth \$455 992 to study fundamental examples of higher categories in dimensions 2, 3, and 4, with the goal of understanding their essential features and building appropriate tools and theoretical frameworks for working with them.
- Dr David Ridout, Dr Simon Wood, Professor Peter Bouwknegt and Associate Professor Thomas Creutzig have been awarded an ARC Discovery grant worth \$444 516 to expand our knowledge of logarithmic theories. Conformal field theory provides powerful methods for attacking problems in theoretical physics and furnishes beautiful connections between seemingly disparate branches of pure mathematics. Advancing these theories is crucial to progress in statistical mechanics, string theory and various mathematical disciplines.
- Dr Timothy Trudgian and Dr David Platt have been awarded an ARC Discovery grant worth \$343 101 to verify the Riemann hypothesis to a record height and apply this verification to the distribution of prime numbers.

CSIRO

- Dr Paul Cleary has recently been made a Fellow of the Australian Academy of Technological Sciences and Engineering. His citation states
 Dr Cleary is an outstanding talent in computational modelling and has delivered major impact through novel modelling methodologies, software tools and application to numerous industrial applications. His research standing has been built through novel developments in particle-based computational modelling and in using these to create fundamental insights into the flow of particles, fluids, solids and bubbles in complex multiphase systems. His research has had a significant impact on the development and worldwide adoption of particle-based methods for modelling fluid and particles flows.

Curtin University of Technology

- Dr Lorenzo Ntogramatzidis has been awarded an ARC Discovery grant worth \$275 000 to develop and test new mathematical techniques for the improvement of transient performance in tracking control systems.
- Professor Jie Sun, Dr Honglei Xu and Emeritus Professor R.T. Rockafellar have been awarded an ARC Discovery grant worth \$396 765 to develop

theory and methodology in optimisation which take advantage of recent progress in understanding and treating risk in decision making.

Federation University Australia

- Associate Professor Alexander Kruger, Professor Jiri Outrata, Professor Michel Théra, Professor Dr Marco López Cerdá, Professor Assen Dontchev and Dr Rene Henrion have been awarded an ARC Discovery grant worth \$199 215 to advance a new mathematical theory of variational analysis. The emphasis will be on extensions of regularity concepts appropriate for studying stability of solutions to optimisation problems.

La Trobe University

- Professor Philip Broadbridge, Dr Andriy Olenko, Adjunct Professor Vo Anh and Professor Nikolai Leonenko have been awarded an ARC Discovery grant worth \$324 686 to investigate and model spherical random fields which are described as solutions of stochastic differential equations on a sphere or a ball.

Macquarie University

- Professor Xuan Tinh Duong, Associate Professor Lesley Ward, Dr Ji Li, Professor Michael Lacey and Professor Jill Pipher have been awarded an ARC Discovery grant worth \$363 100 to study advanced harmonic analysis concerning multiparameter theory and related topics.
- Emeritus Professor Ross Street, Professor Dominic Verity, Associate Professor Stephen Lack and Dr Richard Garner have been awarded an ARC Discovery grant worth \$580 900 to develop a theory of generalised monoidal structures with applications to combinatorics, representation theory, algebraic geometry, topology, theoretical physics and computer science.

Monash University

- Associate Professor Jessica Purcell and Dr Daniel Mathews have been awarded an ARC Discovery grant worth \$448 294 to broaden our understanding of three-dimensional spaces, including spaces that arise in engineering, microbiology and physics. The project aims to find new relationships between hyperbolic geometry and quantum invariants, advancing our understanding of both areas.
- Professor Nicholas Wormald and Dr Pu Gao have been awarded an ARC Discovery grant worth \$403 694 to create new methods to generate networks.

University of Melbourne

- PhD student Angus McAndrew was recently awarded the Best Student Poster Prize at ‘Number Theory Down Under’, the annual international number theory workshop.
- Professor Peter Hall, was recently elected to be a Fellow of the Academy of Social Sciences in Australia. Peter must be only one of a small number

who has been elected to be a Fellow of both the Academies of Science and Social Sciences.

- Professor Doreen Thomas, Associate Professor Marcus Brazil, Dr Charl Ras and Professor Dr Martin Zachariasen have been awarded an ARC Discovery grant worth \$350 557 to construct a mathematical framework for the design of minimum-cost networks that are robust and avoid obstacles. This project aims to develop geometric design methods using variable ‘Steiner points’, leading to fast algorithms for optimally solving these problems.
- Dr Nora Ganter and Professor Matthew Ando have been awarded an ARC Discovery grant worth \$225 000 to develop a new conceptual framework for the representations and characters of categorical groups.
- Professor Aleksander Owczarek has been awarded an ARC Discovery grant worth \$334 000 to develop new understanding of key topologically driven behaviour in complex polymers such as DNA. The project aims to explain how topological constraints and changes disturb key polymer behaviour.
- Professor Joachim Rubinstein, Associate Professor Craig Hodgson and Dr Stephan Tillmann have been awarded an ARC Discovery grant worth \$334 000 to develop practical methods for finding geometric and discrete structures on manifolds in both low and high dimensions and advancing our understanding of the information that physics is providing about these spaces.

The University of Newcastle

- PhD student Matt Tam was a winner of the 2015 Bernhard Neumann Prize, given for the best student talk at the annual meeting of the Australian Mathematical Society, and was awarded on Wednesday 30 September. There were 48 talks in the competition.
- CARMA Director, Jonathan Borwein, has been elected a Fellow of the Royal Society of New South Wales. ‘The Society is the oldest learned society in the Southern Hemisphere, tracing its origin to the Philosophical Society of Australasia, founded in Sydney in 1821.’ It initiated a Fellows Program in 2013.
- Professor Jonathan Borwein, Dr Jeffrey Hogan and Professor Dr Russell Luke have been awarded an ARC Discovery grant worth \$564 979 to further develop the non-linear convergence theory, and to provide problem-specific implementations. The project also plans to provide heuristics to help explain why an algorithm performs well on one class of applications but fails on another.
- Dr Murray Elder, Dr Laura Ciobanu and Professor Volker Diekert have been awarded an ARC Discovery grant worth \$417 773 to focus on a major problem at the intersection of algebra, logic and computer science, concerning equations over free groups and free monoids.

University of New South Wales

- Professor Trevor McDougall has been elected as a Fellow of the Royal Society of NSW. His accolades and awards have been steadily building over

the course of his career, and this year alone has also seen him collect an Australian Academy of Science Jaeger Medal for Research in Earth Sciences, his election as Vice President of the International Association for the Physical Sciences of the Oceans, and his selection as one of only 15 recipients of a prestigious Australian Laureate Fellowship. A world-leading oceanographer who was appointed a Fellow of the Royal Society of London in 2012, he was awarded the Royal Society of Tasmania Medal last year. His appointment as Fellow of the Royal Society of NSW has been described by Head of School Bruce Henry as a ‘wonderful honour’, and we warmly congratulate Trevor for his latest achievement.

- Josef Dick has been appointed a Senior Editor of the *Journal of Complexity*. He joins Ian Sloan in that role. With Frances Kuo also on the editorial board, UNSW has a substantial footprint in that journal.
- Associate Professor Scott Sisson and Dr David Nott have been awarded an ARC Discovery grant worth \$404 000 to develop new statistical methods for the analysis of computationally intractable models.
- Associate Professor Thanh Tran, Professor Benjamin Goldys, Professor Zdzislaw Brzezniak, Professor Dr Andreas Prohl, Professor Dr Ernst Stephan and Associate Professor Salim Meddahi have been awarded an ARC Discovery grant worth \$329 377 to develop novel mathematical theories and numerical methods for problems affected by uncertainty in input data.

University of Queensland

- Dr Jorgen Rasmussen and Professor Mark Gould have been awarded an ARC Discovery grant worth \$305 500 to develop a systematic approach to the study and application of indecomposable representations in pure mathematics and mathematical physics. Examples of important contexts considered are diagram algebras and finite and infinite-dimensional Lie algebras including the Virasoro algebra underlying conformal field theory.
- Professor You-Gan Wang has been awarded an ARC Discovery grant worth \$305 500 to develop novel statistical tools for more accurate prediction by taking account of model complexity and uncertainties associated with the fitting procedure. The project also plans to develop a novel shrinkage approach via new penalty functions to avoid over-fitting and asymptotic properties.

University of South Australia

- Emeritus Professor Philip Howlett, Dr Amie Albrecht, Professor Jerzy Filar and Dr Konstantin Avrachenkov have been awarded an ARC Discovery grant worth \$388 294 to deepen understanding of how complex systems may be significantly changed by incremental changes to ambient conditions. It plans to use these algorithms to solve systems of equations, calculate generalised inverse operators, examine perturbed Markov processes, and estimate exit times from meta-stable states in stochastic population dynamics.

University of Sydney

- Associate Professor Mary Myerscough, Associate Professor Charles Macaskill and Dr Christina Bursill have been awarded an ARC Discovery grant worth \$342 200 to use systems of ordinary differential equations, partial differential equations with non-standard boundary conditions, and bifurcation theory to find how nonlinear processes shape plaque growth. The expected results may demonstrate the importance of bifurcations, dynamics and nonlinear systems in plaque growth and provide new models to interpret biological data.
- Professor John Cannon and Professor Derek Holt have been awarded an ARC Discovery grant worth \$305 500 to develop new algorithms for analysing large matrix groups.
- Professor Nalini Joshi and Professor Kenji Kajiwara have been awarded an ARC Discovery grant worth \$495 700 to solve long-standing problems in discrete dynamical systems that are of particular interest to physics, by using reflection groups.
- Professor Gustav Lehrer, Associate Professor Anthony Henderson and Dr Geordie Williamson have been awarded an ARC Discovery grant worth \$519 300 to generalise the recent work of Elias and Williamson to complex unitary reflection groups, with potentially dramatic consequences in number theory, representation theory and topology.

The University of Western Australia

- Associate Professor Michael Giudici and Professor Cheryl Praeger have been awarded an ARC Discovery grant worth \$334 000 to improve our understanding of the structure of groups by studying their factorisations and the structure of certain subgroups and elements.

University of Western Sydney

- Dr Roozbeh Hazrat, Professor Dr Pere Ara and Professor Gene Abrams have been awarded an ARC Discovery grant worth \$377 600 to focus on Leavitt path algebras, which are structures that naturally arise from movements on directed graphs.

University of Wollongong

- Professor Brian Cullis is a recipient of the 2015 IBS-AR ALF [E A (Alf) Cornish] award, which was initiated in 2011 to recognise Australasian Region members who have made substantial and sustained contributions to both Biometrics and the International Biometric Society. In his congratulatory email, the President of the Australasian Region Biometrics Society, Dr Ross Darnell, acknowledged that Brian's 'contribution to delivering impact to industry with respect to the use of biometry and service to the Society has been outstanding'.
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Appointments, departures and promotions

Australian National University

Staff departures:

- Dr Dennis The departed on 10 August 2015.
- Dr Hoel Queffelec departed on 1 September 2015.
- Dr Feida Jiang departed on 7 August 2015.
- Dr Paul Bryan departed on 6 October 2015.
- Mr Lance Gurney departed on 28 August 2015.

Staff arrivals:

- Mr Christopher Bourne, Postdoctoral Fellow, arrived on 20 August 2015.
- Dr Jesse Burke, Research Fellow, arrived on 21 September 2015.
- Dr Bregje Pauwels, Postdoctoral Fellow, arrived on 21 September 2015.
- Dr Paul Bryan, Research Fellow, arrived on 7 August 2015 Research Fellow
- Mr Jan Vysoky, Postdoctoral Fellow, arrived on 2 September 2015.
- Mr Thomas Harding, Postdoctoral Fellow, arrived on 1 August 2015.
- Dr Stephen Morgan, Research Fellow, arrived on 1 September 2015.

Charles Sturt University

- Dr Azizur Rahman has been promoted to Senior Lecturer.

Federation University

- Dr Musa Mammadov has returned to Ballarat, as a Research Fellow with the Capital Markets Cooperative Research Centre.

Macquarie University

New staff

- Professor Jim Denier arrived as Head of Department at the beginning of October 2015.

Monash University

New staff

- Professor Andreas Ernst
- Associate Professor Gregoire Leoper
- Dr Eren Elci
- Dr Kevin Leckey
- Dr Anita Liebenau
- Dr Ozge Ozcakir

RMIT University

- Dr Vera Roshchina joined the School of Mathematical and Geospatial Sciences at RMIT University, in June 2015, as a Research Fellow (DECRA) for three years, and will be continuing as Lecturer from June 2018. Her

research interests include structure and geometry of finite dimensional optimisation problems.

Vera received her PhD in Mathematics in 2009 at City University of Hong Kong. She subsequently worked as a Ciência Researcher at the Research Centre for Mathematics and Applications, University of Évora, Portugal (June 2009 to March 2012); a Research Fellow in Collaborative Research Network at Federation University Australia, formerly University of Ballarat, (April 2012 to August 2014); and then a Research Fellow in Department of Electrical and Electronic Engineering, The University of Melbourne (August 2014 to June 2015).

Dr Fabricio Oliveira joined the School of Mathematics and Geospatial Sciences in October as a Research Fellow. He is a part of the team working on an ARC project DP140100985 led by Professor Andrew Eberhard, entitled ‘Decomposition and Duality: New Approaches to Integer and Stochastic Integer Programming’.

Fabricio holds a PhD Degree in Production Engineering (2012) and a Bachelor Degree in Industrial Engineering (2008), both from PUC-Rio. During his PhD, he worked as a Visiting Researcher at the Center of Advanced Process Decision-making (CAPD) at Carnegie Mellon University. He also worked in the Optimisation and Supply Chain Management group in Tecgraf Research Institute, where he acted as project coordinator (2009–2013). More recently, he has worked as an Assistant Professor in the Department of Industrial Engineering (DEI) at PUC-Rio (2013–2015), where he supervised a number of postgraduate students and published results in several high-quality journals. He has experience in production planning and logistics, with an emphasis on optimisation under uncertainty using mathematical programming techniques for oil and gas production and power distribution.

University of Adelaide

- Dr Pedram Hekmati (DECRA and Lecturer in Pure Mathematics) left in August 2015 for a ‘Postdoc of Excellence’ position at the National Institute of Pure and Applied Mathematics (IMPA), Rio de Janeiro, Brazil.

University of Melbourne

New staff:

- Dr Rhys Bowden (Research Fellow).
- Dr Anthony Mays (Tutor).

University of Southern Queensland

- Dr Ravinesh Deo has been promoted from Level B to C.

University of Western Australia

- Michael Small has been appointed as the ERO Chair in Complex Engineering Systems.

University of Wollongong*New staff:*

- Zahra Afsar, Postdoctoral fellow, working in operator algebras.
- Joan Bosa, Postdoctoral fellow, working in operator algebras.

Conferences and Courses

Conferences and courses are listed in order of the first day.

ANZIAM, NSW branch meeting

Dates: 25–26th November 2015

Venue: 55 Elizabeth Street, Sydney

Website: <https://www.carma.newcastle.edu.au/meetings/anzi-am-nsw-act-2015/>

The NSW branch of ANZIAM will be holding a two-day meeting on 25 and 26 November 2015 in Sydney, NSW. The venue is the Newcastle University Sydney Campus, 55 Elizabeth Street, centrally located near public transport hubs, Martin Place and the retail heart of Sydney. All details can be found on the website.

Please note that registration will be free and support may be provided for students who have to travel from outside Sydney. There will also be a dinner on Wednesday 25 November which will be subsidised.

The 21st International Congress on Modelling and Simulation (MODSIM2015)

Date: Sunday 29 November to Friday 4 December 2015

Venue: Gold Coast Convention and Exhibition Centre, Broadbeach, Queensland

Web: <http://www.mssanz.org.au/modsim2015/index.html>

For further details see the website or *Gazette* 42(1), p. 56.

 SM^2 Statistical Mechanics of Soft Matter

Dates: 30 November to 1 December 2015

Venue: Swinburne University of Technology

Web: <http://smsq.github.io/>

SM^2 is a recently established series of local discussion meetings on the theme of Statistical Mechanics of Soft Matter. Our aim is to fill a gap in the Australian scientific calendar by providing an informal workshop on the fundamentals and applications of equilibrium and non-equilibrium statistical mechanics relating to simple and complex liquids, polymers, biological materials and other forms of soft matter.

Please contact Dr Federico Frascoli (ffrascoli@swin.edu.au) if you have any queries about the scientific programme.

For other queries please contact Mr Ed Phelps, the administrative officer for this workshop (ephelps@swin.edu.au).

Australian Mathematical Sciences Student Conference

Dates: 30 November to 2 December 2015

Venue: University of Tasmania

Web: <http://www.amssc.org/2015/>

The Australian Mathematical Sciences Student Conference is an annual conference for Australian postgraduate and honours students of mathematical sciences. The conference aims to bring students together, enabling them to communicate their work, facilitating dialogue, and encouraging collaboration, within a friendly and informal atmosphere.

The deadline for registration and abstract submission is 15 November 2015.

Confirmed Invited Speakers include Associate Professor Ben Burton (University of Queensland) and Dr Jaci Brown (CSIRO).

Further speakers to be announced.

Victorian Algebra Conference

Dates: Monday 30 November to Wednesday 2 December 2015

Venue: Western Sydney University

Web: <http://vac2015.ltumathstats.com/>

This is only the second time the conference has been held outside Victoria, in its history spanning over 30 years. We would especially like to encourage researchers based in Sydney and surrounding cities to attend.

More detailed information (including a list of invited speakers) is available at the conference website, where you may register and submit an abstract.

There has always been a strong student presence at the conference, and the Gordon Preston Prize of \$200 is awarded for the best student talk. Students from interstate may apply for a small payment towards their travel costs (the exact amount depends on numbers).

Important notice

We can now confirm that registration is free for all participants.

Important dates

- Friday 13 November: abstract submission closes
- Friday 20 November: abstract editing closes
- Friday 27 November: registration closes

Engineering Mathematics and Applications Conference (EMAC)

Date: 6–9 December 2015

Venue: UniSA, City West Campus Adelaide

Web: <https://emac2015.unisa.edu.au/>

Note that refereed proceedings will be published after the conference in the Electronic Supplement of the ANZIAM Journal.

The William Finlay Blyth Prize will be awarded to the best student presentation. Also, ASES (Maple) will offer a prize for the best student talk that uses Maple.

A Maple workshop will be held on Wednesday afternoon following the conclusion of the conference.

For additional information, see the website or *Gazette* 42(4) p. 256.

KOZWaves 2015

Date: 6–9 December 2015

Venue: The University of Adelaide

Web: <http://www.maths.adelaide.edu.au/kozwaves2015/index.html>

The second international Australasian conference on wave science: see *Gazette* 42(1) p. 56 or the website for further details.

Guttman 2015: 70 and Counting

Dates: 7–8 December 2015

Venue: Noahs on the Beach, Newcastle

Web: <http://www.guttman2015.org/>

This conference is a celebration of Professor Tony Guttman's 70th birthday, an acknowledgment of his enormous contribution to Mathematics in Australia and of his field of research: Critical Phenomena in Statistical Mechanics. Amongst Professor Guttman's many contributions to Australian Mathematics was his initial contribution to the founding of AMSI. Attending this conference are several international and national leaders in the field of Critical Phenomena, Enumerative Combinatorics, Algebraic Combinatorics and Computational Algorithms. These are fields of mathematics that all play a significant part in the mathematical understanding of Critical Phenomena.

This is immediately prior to the Fourth Annual ANZAMP meeting, and at the same venue. See below.

For further details please see the website, which contains a link to the registration page, and further information such as the list of confirmed speakers.

We also make a general call for submissions to a special issue of *Journal of Physics A* entitled 'Combinatorics of lattice models: a special issue in honour of Tony Guttman's 70th birthday'. This special issue is completely independent of participation in the conference, and articles submitted for publication in this special issue

will undergo the usual review process of *J. Phys. A*. Please contact Nathan Clisby (nclisby@unimelb.edu.au) if you are interested in contributing to this special issue.

Seventh China-Australia Workshop on Optimization: Theory, Methods and Applications and The Second International Conference on Optimization and Control

Date: 7–10 December 2015

Venue: Chongqing Normal University, the University Town, Chongqing 401331

Website: <http://icoco2015.csp.escience.cn>

The Second International Conference on Optimization and Control (ICOCO 2015) will be held in Chongqing, China, 7–9 December 2015. The Seventh China-Australia Workshop on Optimization: Theory, Methods and Applications (CAWO 2015) will be held at the same venue immediately following the ICOCO2015 on 10 December 2015.

The First International Conference on Optimization and Control was held in Guiyang, China during 18–23 July 2010. The previous six China-Australia Workshops on Optimization: Theory, Methods and Applications were held in Shanghai University, Shanghai, China and Federation University Australia, Ballarat, Australia alternatively in 2003, 2004, 2007, 2009, 2011 and 2013.

As the continuations of the ICOCO and the CAWO, the ICOCO2015 and CAWO-2015 aim to bring researchers and practitioners around the world on optimization and optimal control together to exchange ideas and approaches, to present research findings and state-of-the-art solutions, to share experience and future research development on theory, methods and applications for optimization and optimal control.

The topics of the conference and the workshop include all areas of optimization, optimal control and their applications.

39th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing

Date: Monday 7 December to Friday 11 December 2015

Venue: University of Queensland

Web: <http://39accmcc.smp.uq.edu.au/>

For further information, see the website or *Gazette* 42(4) p. 257.

BioInfoSummer 2015

Date: 7–11 December 2015

Venue: The University of Sydney

Website: <http://bis15.amsi.org.au/>

The BIS symposium introduces bioinformatics as well as mathematical and computational biology to students, researchers and professionals. If you work in mathematics or statistics, information technology or complex systems analysis, any computer science field, or you're biological, chemical or medical sciences engineer, stay ahead with BIS.

The 2015 program features:

- Introduction to biology and bioinformatics
- Epigenomics
- Translational genomics
- Proteomics and metabolomics
- Systems biology, networks and data integration.

Registration closes on 27 November 2015.

Fourth ANZAMP Meeting

Dates: 9–11 December 2015

Venue: Noahs on the Beach, Newcastle

Web: <http://www.anzamp.austms.org.au/meetings/current/>

This is the Fourth Annual Meeting of the Australian and New Zealand Association of Mathematical Physics (ANZAMP), and the first since ANZAMP became a Division of AustMS.

Please register ASAP as we cannot guarantee speaking slots, and it will be a case of first in, best dressed. This year's ANZAMP meeting will have a particularly full program, due in part to the proximity of the satellite conference in honour of Tony Guttman's 70th birthday which is being held at the same venue from 7–8 December.

For further details please see the website or *Gazette* 42(4) pp. 258–259.

Conference on Geometric and Categorical Representation Theory

Dates: 14–18 December 2015

Venue: Mantra Hotel, Mooloolaba, Queensland

Web: <https://sites.google.com/site/masoudkomi/mooloolaba>

The registration deadline is 27 November.

Confirmed speakers include Pramod Achar (LSU), Tsao-Hsien Chen (Northwestern), Emily Cliff (Oxford), Ben Elias (MIT), Peter Fiebig (Erlangen), Nora Ganter (Melbourne), Sam Gunningham (Austin), Anthony Henderson (Sydney), Michael Hopkins (Harvard), Martina Lanini, Chul-hee Lee (Queensland), Elizabeth Milicevic (Haverford College), Ivan Mirkovic (Amherst), Justin Noel (Regensburg), You Qi (Yale), Arun Ram (Melbourne), Daniel Sage (Louisiana), Peng Shan (Orsay), Pablo Solis (CalTech), Monica Vazirani (UC Davis), and Geordie Williamson (Bonn).

2016 AMSI Summer School

Dates: 4–29 January 2016

Venue: RMIT University

Web: <http://ss16.amsi.org.au/>

A reminder that final registration closes on 25 November 2015. For further details please see the website or *Gazette* 42(4) pp. 259.

Gromov–Witten Theory, Gauge Theory and Dualities

Date: 6–15 January 2016

Venue: ANU/Kioloa

Web: <http://maths.anu.edu.au/events/gromov-witten-theory-gauge-theory-and-dualities>

For further details please see the website or *Gazette* 42(4) pp. 260-261.

Mathematics in Industry Study Group (MISG) 2016

Dates: 1–5 February 2016

Venue: University of South Australia, City West campus

Web: <http://mathsinindustry.com>

Registration (free) is now open for one of the worlds longest running mathematics think-tanks: the five-day intensive Mathematics-In-Industry Study Group. As usual, we expect four to six exciting industry projects for participants to work on; details will be progressively added to the website. The workshop is an ideal opportunity to make contact and forge partnerships with Australian and New Zealand industries, and to collaborate with other mathematicians, scientists and engineers.

Early Career Workshop

Dates: 6–7 February 2016

Venue: QT Hotel, Canberra

Web: <http://goo.gl/forms/eoQQVijnRU>

An early career workshop will be held on Saturday 6 (from 1 pm) and Sunday 7 (until 2 pm) February, in conjunction with the ANZIAM conference (see next item).

The workshop is open to research student and early career mathematicians who are members of ANZIAM. Early career is defined as being within five years of conferral of your PhD.

Thanks to funding from ANZIAM, AMSI and AustMS there is no fee to register for the conference, with afternoon tea and dinner provided on Saturday, and morning tea and lunch provided on the Sunday. Participants are responsible for transport and accommodation costs of attending.

The number of places are limited, and preference will be given to early registration. Please register via the form at the website above.

ANZIAM 2016

Date: Sunday 7 February 2016 to Thursday 11 February 2016

Venue: QT Canberra Hotel, Canberra

Web: <http://anziam2016.com/>

Registration for the 2016 Australian and New Zealand Industrial and Applied Mathematics (ANZIAM) Conference is now open. Abstract submission and early-bird registration both close on 8 January 2016.

To register, submit an abstract, or to find out further details, please visit the website.

An early career workshop will be held in conjunction with the ANZIAM conference, at the same venue: see previous item.

Monash Workshop on Numerical PDEs

Dates: 15–19 February 2016

Venue: Monash University

Web: <http://monashpde.eventbrite.com.au>

This workshop is an event in the Monash Summer Visitor Program, and most of the speakers in this and the following workshop have been invited for several weeks at Monash in February.

The deadline for registration is 15 December.

A broad selection of topics will be covered, including, among others: multilevel methods, CFD, finite elements, mimetic schemes, virtual finite elements, numerical relativity, and HPC.

Registration for this workshop is free, and limited financial support will be available for students. Early registration is strongly recommended as the total number of participants is limited.

Workshop on Analysis, Geometry and Mathematical Relativity

Dates: 22–26 February 2016

Venue: Monash University

Web: <http://agmr.eventbrite.com.au>

The deadline for registration is 22 December 2015.

This workshop is not only an event in the Monash Summer Visitor Program but also an occasion to celebrate Robert Bartnik's 60th birthday. In line with Robert's research interests, the focus will be on topics in analysis, geometry, and mathematical relativity. The workshop is open to anyone with an interest in analysis, geometry or general relativity.

Registration for this workshop is also free, and limited financial support will be available for students. Early registration is strongly recommended as the total number of participants is limited.

Capital Number Theory

Dates: 8–9 April 2016

Venue: The Australian National University

Web: <http://amsi.org.au/events/event/capital-number-theory-2/>

This conference, which has a heavy emphasis on student talks, will be an autumn meeting for the Australian number theory community. Building on the success of other conferences (Number Theory Down Under in September, and the Special

Sessions at the AustMS in December), Capital Number Theory will bring together number theorists in Australia and attract international experts.

The focus of this conference is the intersection of number theory with computation. Many results are often known ‘for all sufficiently large integers’: we aim, at this conference, to address issues concerning the remaining cases — relatively small integers. This often requires pushing theoretical arguments, and computations, to their limits.

Mathematical Methods for Applications

Date: 11–14 November 2016

Venue: Hangzhou, China

Further information: Phil Broadbridge (P.Broadbridge@latrobe.edu.au)

This is a joint meeting of ANZIAM and ZAPA, the Zhejiang Applied Mathematics Association.

Vale

University of Canberra

We regret to announce that Dr Ian Geoffrey Lisle of the University of Canberra passed away on 27 September after a long battle with cancer.

Visiting mathematicians

Visitors are listed in alphabetical order and details of each visitor are presented in the following format: name of visitor; home institution; dates of visit; principal field of interest; principal host institution; contact for enquiries.

A/Prof Pramod Achar; Louisiana State University; 8–11 December 2015; pure; USN; Anthony Henderson

Prof Dmitri Alekseevsky; Russian Academy of Sciences; 4–14 October 2015; homogeneous Riemannian geometry, Lie groups and algebras; LTU; Yuri Nikolayevsky

Prof David Allen; Edith Cowan; 1 August 2015 to 31 July 2016; stats; USN; Shelton Peiris

Dr Joel Andersson; Stockholm University; 1–31 October 2015; pure; USN; Leo Tzou

Dr Alhaji Akbar Bachtiar; 15–30 November 2015; applied; USN; David Ivers Paul Baird; Laboratoire de Mathématiques, De Bretagne Atlantique; September to December 2015; UWA; Lyle Noakes

Dr Elizabeth Beazley; Haverford College, USA; 1 August 2015 to 31 January 2016; UMB; Arun Ram

- Prof Lynne Billard; University of Georgia, Athens, USA; 4–20 December 2015; UMB; Aurore Delaigle
- Dr Raphael Boll; Technische Universität Berlin; 25 November to 8 December 2015; applied; USN; Nalini Joshi
- A/Prof Barbara Brandolini; University of Naples Federico II; 15 November to 5 December 2015; pure maths; USN; Florica Cirstea
- Dr Huy Qui Bui; University of Canterbury, Christchurch, NZ; 9–22 November 2015; harmonic analysis; Macquarie University; Xuan Duong
- A/Prof Yixiong Cao; University of Science and Technology of China; 1 November 2015 to 30 April 2016; UMB; Guoqi Qian
- Dr Emma Carberry; University of Sydney; 23 November 2015 to 29 February 2016; UMB; Paul Norbury
- Prof Jon Carlson; University of Georgia; 10–28 November 15; MAGMA; USN; John Cannon
- Mr Emre Cimen; Anadolu University, Eskisehir, Turkey; 6 October 2015 to 20 February 2015; optimisation; FDU; Adil Bagirov
- Prof Louis Chen; National University of Singapore; 10–19 September 2015; UMB; Aihua Xia
- Dr Lisa Orloff Clark; University of Otago; 15–21 November 2015; UOW
- Prof Stephane Crepey; 15–25 December 2015; fin maths; USN; Marek Rutkowski
- Dr Yohan Davit; Institute of Fluid Mechanics of Toulouse, France; 9–28 November 2015; UMB; James Osborne
- Mr Sayed Ahmadreza Raeisi Dehkordi; University of Isfahan, Iran; 16 January to 15 July 2016; optimisation; FDU; Adil Bagirov
- Dr Wei Deng; Shanghai Maritime University, China; 15–14 December 2016; optimisation; FDU; David Gao
- Ms Soodabeh Asada Dezaki; Shahrekord University, Iran; 20 January to 20 July 2016; optimisation; FDU; Adil Bagirov
- Prof Persi Diaconis; Stanford University, USA; 3–15 December 2015; UMB; Arun Ram
- Mr Adnane Ez-Zizi; University of Bristol, UK; 1 September to 1 December 2015; UWA; Ed Cripps
- Dr Dane Flannery; National University of Ireland, Galway; 4 November to about 16 December 2015; algebraic design theory and linear groups; RMIT; Kathy Horadam
- Prof Stephen Garrett; University of Leicester; 4–22 January 2016; pure; Sharon Stephen
- Dr Claire Gilson; University of Glasgow; 22 November to 6 December 2015; applied; Nalini Joshi
- Mr Jochen Glueck; Ulm University; 8–22 November 2015; pure; USN; Daniel Daners
- Louis Guillot; Ecole Normale Supérieure; 1–16 September 2015; UMB; Richard Huggins and James McCaw
- A/Prof Jianyu Han; Anhui University, PRC; 1 August 2015 to 31 July 2016; UMB; Dr Guoqi Qian
- Mr Cheng Hu; Shandong University; 20 November 2015 to 19 May 2016; statistics; Qiying Wang

- Dr Genggeng Huang; Shanghai Jiao Tong University; 10 October 2015 to 9 October 2016; ANU; Xu-Jia Wang
- Mr He Huang; Peking University; 1 September 2015 to 31 August 2016; UMB; Sanming Zhou
- Prof Anatoli Ivanov; Pennsylvania State University; 10 December 2015 to 9 January 2016; optimisation; FDU; Zari Dzalilov
- Prof Monique Jeanblanc; Universite d'Evry; 1–23 December 2015; financial maths; USN; Marek Rutkowski
- Dr Bernt Jensen; Gjøvik University College, Norway; 24 July 2015 to 9 January 2016; representations of algebras; UNS; Jie Du
- Dr Napsu Karmita; Turku University, Finland; 2 January to 24 December 2016; optimisation; FDU; Adil Bagirov
- Prof Johannes Kellendonk; Universite Claude-Bernard (Lyon); 8–21 November; mathematical physics; UOW
- Prof Satoshi Koike; 7 October to 7 November 2015; pure; USN; Laurentiu Paunescu
- Dr Roald Koudenburg; University of Sheffield; 15 September to 11 November; category theory; MQU; Richard Garner
- Dr Ryszard Kozera; Warsaw University of Life Sciences; 6 December 2015 to 16 January 2016; UWA; Lyle Noakes
- Prof Tony Krzesinski; University of Stellenbosch, South Africa; 20 November to 22 December 2015; UMB; Peter Taylor
- Prof Shrawan Kumar; University of North Carolina; 16 July to 15 December 2015; pure; USN; Gus Lehrer
- Dr Martina Lanini; University of Erlangen-Nuremberg, Germany; 18 December 2015 to 7 January 2016; UMB; Arun Ram
- Dr Vittorio Latorre; Sapienza University, Rome; 20 October 2015 to 17 January 2016; optimisation; FDU; David Gao
- Prof Yuri Latushkin; 8–20 December 2015; applied; USN; Robert Marangell
- Prof Tony Lawrance; University of Warwick, UK; 6–20 October 2015; UWA; Michael Small
- A/Prof Jingjian Li; Guangxi University P.R. China; September 2015 to September 2017; UWA; Cai Heng Li
- Zhe Liu; Zhejiang University; 1 April 2015 to 31 March 2016; UWA; Cai Heng
- Dr Davide Masoero; University of Lisboa; 16 November to 5 December 15; applied; USN; Nalini Joshi
- Ms Lilith Mattei; École Polytechnique Fédérale de Lausanne, France; 15 September 2015 to 15 January 2016; topos theory; MQU; Richard Garner
- A/Prof Mengbo Hou; Shandong University of China; February 2015 to February 2016; cryptography; USA; Raymond Choo
- Dr Djordje Milicevic; Bryn Mawr College, Pennsylvania; 1 August 2015 to 31 January 2016; UMB; Arun Ram
- Prof Pierre Milman; University of Toronto; 15 October to 15 November 2015; pure; USN; Laurentiu Paunescu
- Dr Samuel Muller; University of Sydney; 22–27 November 2015; UWA; Centre for Applied Statistics

- Reza Naserasr; Universite Paris-Sud; 13–21 November 2015; UWA; Gordon Royle and Irene Pivotto
- Dr Simona Paoli; University of Leicester, UK; 1 August to 31 December 2015; higher category theory; MQU; Ross Street
- Dr Gareth Peters; 15 December 2015 to 1 January 2016; stats; Jennifer Chan
- Mr Sven Pistre; Zurich; 19 September to 19 November 2015; ANU; Ben Andrews
- Federico Poloni; University of Pisa; 22 September to 22 November 2015; numerical linear algebra; UAD; Giang Nguyen
- Prof Nicolas Privault; Nanyang Technological University; 10–20 December 2015; fin maths; USN; Marek Rutkowski
- Dr Jiangyan Peng; University of Electronic Sc and Tech China; 15 October 2015 to 14 October 2016; stats; Qiying Wang
- Mr James Reoch; Adelaide; 3 August 2015 to 31 December 2017; applied; USN; Peter Sehoon Kim
- Prof Louis-Paul Rivest; Université Laval, Canada; 28 September to 25 November 2015; UWA; Berwin Turlach
- Prof Steve Rosenberg; Boston University; August 2015 to June 2016; differential geometry in finite and infinite dimensions, particularly with applications to/from mathematical physics; UAD; srmathbu@gmail.com
- Prof Ildar Sadeqi; Sahand University of Technology, Iran; 1 January to 1 September 2016 tbc; optimisation; FDU; Alex Kruger
- Dr Hemanth Saratchandran; 14 April to 31 December 2015; pure; USN; Stephan Tillmann
- A/Prof Alistair Savage; University of Ottawa, Canada; 22 November to 2 December 2015; UMB; Arun Ram
- Mr Landir Saviniec; University of Sao Paulo, Brazil; 1 November 2015 to 31 October 2016; UMB; Alysson Costa
- Mr Muhamad Shoaib; Higher Education Commission, Pakistan; 1 May to 30 November 2015; statistics; USN; Shelton Peiris
- Alexander Stolin; University of Gothenburg, Sweden; 7–18 August 2015; quantum groups, quantum Lie algebras, Lie bialgebras; LTU; Yuri Nikolayevsky
- A/Prof Lianta Su; Quanzhou Normal University, PRC; 1 August 2015 to 31 January 2016; UMB; Guoqi Qian
- Dr Xiuping Su; University of Bath; 24 July 2015 to 9 January 2016; representations of Algebras; UNS; Jie Du
- A/Prof Kaibiao Sun; Dalian University of Technology, P.R. China; August 2015 to August 2016; biological system modeling, biological cybernetics, optimization theory; SUT; Tonghua Zhang
- Ms Ying-Ying Sun; Shanghai University; 9 September 2015 to 1 September 2016; applied; Nalini Joshi
- Prof Anatoliy Swishchuk; University of Calgary; 9–13 December 2015; probability theory and financial mathematics; LTU; Andriy Olenko
- Prof Yoshitsugu Takei; Kyoto University; 9–21 November 2015; applied; USN; Nalini Joshi
- Dr Garth Tarr; 1 March 2015 to 31 December 2015; ANU; Alan Welsh
- Dr Dennis The; Universität Wien; 10 August to 31 December 2015; ANU; Peter Bouwknegt

- A/Prof Yuan Tian; Dalian University of Technology, P.R. China; August 2015 to August 2016; mathematical biology; SUT; Tonghua Zhang
- Prof Claude Viallet; U Pierre et Marie Curie; 1–14 December 2015; applied; USN; Nalini Joshi
- Ms Jun Wang; University of Science and Technology of China; 1 October 2015 to 1 March 2017; ANU; Ben Andrews
- Mr Marcus Webb; Cambridge; 11 January to 9 April 2016; applied; USN; Sheehan Olver
- Prof Ruth Williams; Univeristy of California, San Diego; 9–27 September 2015; statistics; UMB; Peter Hall
- Dr Jeroen Wouters; 25 February 2015 to 24 February 2017; applied; USN; Georg Gottwald
- Mr Wei Wu; UNSW; 30 July 2012 to 31 May 2016; financial maths; USN; Ben Goldys
- Dr Binzhou Xia; Beijing International Center for Mathematical Research, P.R. China; 1–30 November 2015; UWA; Cai Heng Li
- Dr Ying Xu; Hefei University of Technology; 1 September 2015 to 31 August 2017; pure; USN; Ruibin Zhang
- Dr Dongyong Yang; University of Xiamen, Xiamen, China; July 2015 to June 2016; harmonic analysis; MQU; Xuan Duong
- A/Prof Hengyun Yang; Shanghai Maritime University; 16 January 2016 to 15 January 2017; pure; USN; Ruibin Zhang
- Prof Da-jun Zhang; Shanghai University; 23 November to 5 December 2015; applied; USN; Nalini Joshi
- Dr Junyong Zhang; Beijing Institute of Technology; 1 September 2015 to 31 August 2016; ANU; Andrew Hassell
- Mr Yang Zhang; Uni of Science and Technology, China; 1 October 2015 to 30 September 2017; pure; USN; Ruibin Zhang
- Hui Zhou; Peking University, PRC; September 2015 to March 2017; UWA; Cheryl Praeger, Alice Devillers and Michael Giudici
- Dr Jacek Zienkiewicz; Wroclaw University, Poland; 15 October to 25 November 2015; quantum tunnelling and quantum barriers for Schrodinger propagator; MQU; Adam Sikora
-

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Steven G. Krantz



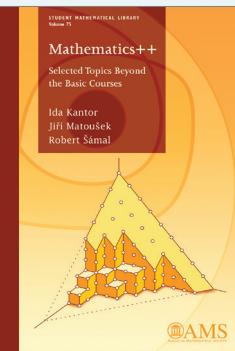
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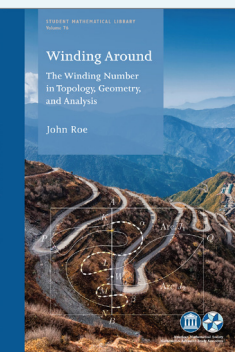


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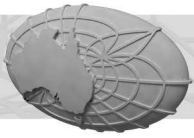
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Special Interest Meetings

Applications for Special Interest Meetings are now considered twice a year, at approximately the start of June and the start of December. The next closing date is 26 November 2015. Applications are required at least three months in advance of the meeting.

Council has approved an increase in the Society's total budget for support of Special Interest Meetings, from \$25,000 to \$35,000 annually, starting for meetings in the 2016–2017 financial year. The normal limit of AustMS support for an individual meeting will remain at \$6,000. Council has also made some minor amendments to the rules governing this support, mostly to harmonize them with AMSI's rules, since most applications are made jointly to AustMS and AMSI. In particular, it is now explicitly stated that the Society's funding is not to be used for catering, administrative expenses and venue hire, and that a registration fee of at least \$25 per day (before applicable discounts) should normally be charged.

If funding is being sought from both AustMS and AMSI, a single application should be made at <http://research.amsi.org.au/workshop-funding/>.

If funding is not being sought from AMSI, please use the application form available at <http://www.austms.org.au/Special+Interest+Meetings> and send it to the secretary at Secretary@austms.org.au.

News from the annual conference

The Society's 59th Annual Meeting was held recently at Flinders University. The Director, Associate Professor Vladimir Ejov, his team of local organisers and the Program Committee, led by the Vice-President (Annual Conferences), were responsible for a very successful conference, which included a public lecture by Terry Tao and a plenary lecture by the Mahler Lecturer, Manjul Bhargava.

The following matters from the meeting are provided here for the information of those who could not attend.

- (1) The Australian Mathematical Society Medal for 2015 was awarded to Dr Scott Morrison of the Australian National University.
- (2) The Gavin Brown Prize for 2015 was awarded to Professor Andrew Hassell of the Australian National University for his paper 'Ergodic billiards that are not quantum unique ergodic', *Annals of Mathematics*, 171:2 (2010), 605–619.
- (3) The 2015 B.H. Neumann Prize was awarded jointly to Murray Neuzerling (La Trobe) for his talk 'Using algebra to avoid robots' and Matthew Tam (Newcastle) for his talk 'Reconstruction algorithms for blind psychographic imaging'.

Honourable mentions were given to Joshua Howie (University of Melbourne), Adrienne Jenner (University of Sydney), Brendan Patch (University of Queensland) and Danya Rose (University of Sydney).

- (4) There was a short Early Career Workshop, organised by Michael Coons, Norman Do and Dale Ward, on the Sunday before the conference. Next year there will be full workshops before both the ANZIAM annual conference in February and the Society's annual conference in December.
- (5) There was a successful *Women in Mathematics Dinner* on the Sunday preceding the conference.
- (6) At the AGM, it was confirmed that the sixtieth Annual Meeting of the Society will be held at the Australian National University from Monday 5 December to Thursday 8 December 2016 with Professor J. Urbas as Director.

It was provisionally determined that the sixty-first Annual Meeting of the Society will be held at Macquarie University from Monday 11 December to Thursday 14 December 2017 with Professor P.D. Smith and Professor X.T. Duong as Co-Directors.

- (7) On behalf of the Society, the President will ask the QS World University Rankings company to include all mathematical scientists based at Australian universities in the list of people to whom they send the reputational survey on which their rankings are partly based. A high response rate from Australian mathematicians will benefit the discipline rankings of Australian universities. Only publicly available contact information will be shared with QS.
- (8) **Cheryl E. Praeger Travel Awards and Anne Penfold Street Awards**
Council has approved an increase in the total budget for these awards, administered by the Women in Mathematics Special Interest Group. In the 2016–2017 financial year, the total available through the Cheryl E. Praeger Travel awards scheme, for conference travel or research visits by female members of the Society, will be \$20,000 (up from \$6,400). The total available through the Anne Penfold Street awards scheme, for support of caring responsibilities during conference travel or research visits by members of the Society, will be \$3,000 (up from \$1,600). In addition, Council has increased the operating budget of the Women in Mathematics Special Interest Group to \$3,200 (up from \$1,000).
- (9) **Major workshops in December 2016**
Council has agreed to a proposal from AMSI to jointly fund two major workshops in Canberra in December 2016, in the weeks immediately preceding and following the Society's Annual Meeting at ANU. These workshops are intended to attract prominent international keynote speakers and to tie in with at least one of the international plenary speakers of the Annual Meeting, so as to encourage international participants who will also register for the Annual Meeting.

(10) **Renewed agreement with AMSI**

Council has approved a new agreement between AustMS and AMSI, covering the years 2016–18. Our joint commitments include continued funding for the Australian Mathematical Sciences Student Conference, the AMSI/ANZIAM and Mahler Lecture Tours, the Early Career Workshops, and the AMSI Summer School, among others.

(11) **New Special Interest Groups**

Council has approved the establishment of two new Special Interest Groups, on Applied Probability and on the Mathematics of Computation and Optimisation.

Peter Stacey

AustMS Secretary

Email: P.Stacey@latrobe.edu.au



Peter Stacey joined La Trobe as a lecturer in 1975 and retired as an associate professor at the end of 2008. Retirement has enabled him to spend more time with his family while continuing with some research and some work on secondary school education. He took over as secretary of the Society at the start of 2010.

The Australian Mathematical Society

President:	Professor Tim Marchant, FAustMS	Dean of Research University of Wollongong NSW 2522, Australia. tim_marchant@uow.edu.au
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Membership and Correspondence

Applications for membership, notices of change of address or title or position, members' subscriptions, correspondence related to accounts, correspondence about the distribution of the Society's publications, and orders for back numbers, should be sent to the Treasurer. All other correspondence should be sent to the Secretary. Membership rates and other details can be found at the Society web site: www.austms.org.au.

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