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The Australian Mathematical Society

Gazette

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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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Deadlines for submissions to 37(2), 37(3) and 37(4) of the *Gazette* are 1 April 2010, 1 June 2010 and 1 August 2010.

Volume 37 Number 1 **2010**

Editorial

Welcome to the first issue of the *Gazette* for 2010, produced by a (mostly new) editorial team of Amie Albrecht, Kevin White and Eileen Dallwitz. We begin by thanking the previous editors, Birgit Loch and Rachel Thomas, for their excellent work and dedication over the past three years. We are delighted that Eileen is remaining on the team to continue ensuring that each issue is produced on time.

In this issue's President's column, Nalini Joshi discusses research funding for the mathematical sciences under ERA, and suggests that mathematicians take some practical steps to enhance the outcomes.

Geoff Prince covers some of the recent activities of AMSI, and urges us to scrutinise the new national curriculum for schools. The Australian Curriculum, Assessment and Reporting Authority (www.acara.edu.au) will release the draft curriculum (years K–10) for consultation from 1 March 2010 to the end of May 2010. The senior secondary curriculum will follow in April 2010.

Mathematical Minds features David Ellwood, Research Director of the Clay Mathematics Institute (CMI). David describes CMI initiatives in supporting mathematicians at various stages of their career. He reflects on the importance and difficulty of fundamental mathematics and how the Millennium Problems were introduced, in part, to communicate this to the general public.

In the Communications section, Ben Burton provides some insight into the mathematics of the International Olympiad in Informatics. On the theme of puzzling problems, we welcome Ivan Guo's first Puzzle Corner contribution in this issue. Ivan is taking over Norman Do's role of posing interesting, mind-bending puzzles. The winner of the $50 book voucher for Puzzle Corner 14 is Joe Kupka — congratulations! Puzzles also feature in one of the books reviewed in this issue: a tribute to Martin Gardner.

We highlight the accomplishments of mathematicians recently honoured by the Society. Included are the citations for the 2009 AustMS Medal winners, Dr Stephen Lack and Dr Ian Wanless, as well as the citation for the 2010 ANZIAM Medal recipient, Dr Bob Anderssen. Through its new Secretary, Peter Stacey, the Society is now calling for nominations for the 2010 AustMS and George Szekeres Medals.

Although the *Gazette* is no longer accepting contributed technical papers for publication, there are such articles still coming through the review and editorial process. In this issue we present two of them. We expect soon to start publishing invited articles of general interest to our readers.

We hope you enjoy reading this issue of ***your*** *Gazette*.

President's column

Nalini Joshi*

Three months have passed since I wrote my last column for the *Gazette*. In this usually peaceful part of the year, so many events of interest have occurred that I am finding it difficult to fit them all into this report.

Two of these are face-to-face conversations with key people in authority in Australia, an activity which I find extremely important. By saying this, I do not mean to imply that written reports are unnecessary. Reports provide evidence, usually backed up by expert researchers, reference groups or reviewers. They crystallise facts and propose change. But information comes in many forms and communication works in many ways. If you are involved in teaching or training, you would already know that the best kind of communication conveys a passion for your subject, enables an exchange of ideas and tantalises the listener or reader with a dream of great things. Conversations back up reports by conveying passion, ideas and dreams in a very immediate way.

On 16 October 2009, I had a meeting with the Chief Scientist for Australia, Professor Penny Sackett. My meeting with Penny ranged widely over many issues of importance to mathematical sciences in Australia, including primary and secondary education and research funding for mathematical sciences. On 27 January 2010, I had a meeting with the Chief Executive Officer of the ARC, Professor Margaret Sheil[1]. My conversation with Margaret ranged over the ERA and research funding for the mathematical sciences.

To each, I highlighted two pages of a DEST report called 'Australian Science and Innovation System, A Statistical Snapshot 2006'[2] . These two pages show Australian scientific publications as a percentage of world totals by field of research, 2001–2005 (p. 215) and the impact of Australian scientific publications relative to the world by field of research 2001–2005 (p. 216). Let me refer to these plots by the abbreviations 'totals' and 'impact' respectively. On the impact plot, mathematical sciences is ranked third (below Geosciences and Space Science), while it is twentieth or fifth last (above Materials Science, Chemistry, Physics and Law) on the totals plot. In other words, we produce less output relative to mathematical scientists in other countries but the impact of our publications on the global mathematical scene is much higher. We punch well above our weight.

My message was that, while universities and other bodies have been discounting the quality of mathematical work by valuing numbers of publications, numbers of

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[1]For part of our meeting, we were joined by Andrew Calder from the ERA team at the ARC.
[2]See pages 215 and 216 of http://www.dest.gov.au/NR/rdonlyres/C4822084-87B6-46C2-947B-B55A70FB60A4/17649/AustraliasScienceandInnovationSystemAStatisticalSn.pdf.

PhD completions, and dollars of grant money as the currency of success, we have been quietly producing work within our discipline that is internationally regarded as very high value. Wouldn't it be nice if the ERA rankings reflected this high value?

On the ERA front, there have been three developments of interest to mathematical sciences. First, on 2 November 2009, our Society recommended a ranked list of journals in the mathematical sciences to the ARC, as it was contracted to do. We are told that the final list, incorporating feedback from overlapping disciplines, will be released in February.

Second, we have been told that papers with at least 80% mathematical content that appear in journals classified under other Field of Research codes can be 'clawed back' to the mathematical sciences codes, if the authors of these papers make a case to the ERA submissions group at their individual University. Note that the pathway for making such a case is a local arrangement that may vary from institution to institution. You should be making contact with your University's Research Office to find out how to make this case if any of your output (i.e. refereed papers, book chapters and research monographs) is assigned to FoR codes that lie outside the 01* codes for mathematical sciences.

This mechanism is expected to increase the number of outputs that are captured in each University's submission for mathematical sciences, particularly in the FoR codes 0102, 0103, 0104 and 0105. However, it is not expected to add substantially to the submissions for the pure mathematics FoR code 0101. This led to the third development in the ERA of interest to us. The ARC has determined that peer review will be used for assessing the research output in the pure mathematics FoR code 0101, but citation analysis will be used for the remaining mathematical science FoR codes, despite our submission to the ARC recommending that peer review should be used for all the 01* FoR codes. Once again, this requires action from the authors of outputs that are classified in the 0101 code. Each of you should be nominating what you believe to be the top 20% of your output to your local Research Office to be put forward for peer review.

In addition to the ERA, my continuing message has been that support for mathematical sciences is essential for maintaining a scientifically and technologically proficient, innovative society. So I was pleased to see recently that the guidelines for the next round of Future Fellowships recognise mathematical sciences as an *enabling discipline*. I quote from the guidelines:

> 4.3.3. b. Targeted discipline areas
> There are a range of disciplinary areas where national capacity needs enhancing, especially by mid-career researchers. The targeted discipline areas are enabling disciplines: mathematics; earth sciences; history; English; sociology; education; and economics.

I hope that this is the start of the turn of the tide.

Last, but not least, I joined a panel discussion by regional Heads of Mathematical Societies from Asia at the joint meeting of the Korean and American Mathematical Societies in Seoul in December 2009. There is a momentum building in the region. I expect to see some interesting action at the ICM in Hyderabad in August.

Nalini Joshi holds a PhD and MA from Princeton University in Applied Mathematics and a BSc (Hons) from the University of Sydney. She has held lecturing positions and fellowships at ANU, UNSW, and the University of Adelaide, as well as visiting positions at institutions including Princeton, Kyoto, Manchester and the Isaac Newton Institute of Mathematical Sciences at Cambridge University. In 2002, she returned to the University of Sydney to take up the Chair of Applied Mathematics and became the first female mathematician to hold a Chair there. In 2008, she was elected a Fellow of the Australian Academy of Science. Her research focuses on longstanding problems concerning the asymptotic and analytic structure of solutions to nonlinear integrable equations. She has solved open problems for the classical Painlevé equations (differential equations that are archetypical nonlinear models of modern physics) and discrete systems. Currently, she is obsessed with the analysis of cellular automata.

Puzzle corner

Ivan Guo*

Welcome to the Australian Mathematical Society *Gazette*'s Puzzle Corner No. 16. From this issue onward, I will be taking over Norman's role of bringing you fun, yet intriguing, puzzles. The puzzles cover a range of difficulties, come from a variety of topics, and require a minimum of mathematical prerequisites in order to be solved. And should you happen to be ingenious enough to solve one of them, then the first thing you should do is send your solution to us.

In 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: Kevin White, School of Mathematics and Statistics, University of South Australia, Mawson Lakes SA 5095.

The deadline for submission of solutions for Puzzle Corner 16 is 1 May 2010. The solutions to Puzzle Corner 16 will appear in Puzzle Corner 18 in the July 2010 issue of the *Gazette*.

Chocolate blocks

Photo: Zsuzsanna Kilian

You are given an $m \times n$ block of chocolate which you wish to break into mn unit squares. At each step, you may pick up one piece of chocolate and break it into two pieces along a straight line. What is the minimum number of steps required?

Summing products

Consider nonempty subsets of the set $\{1, 2, \ldots, N\}$. For each such subset we can compute the product of the reciprocals of each member. Find the sum of all such products.

Point in square

Let $ABCD$ be a square, labelled counter-clockwise in that order. Point P is chosen inside the square, such that $PA = 1$, $PB = 2$ and $PC = 3$. Find the size of angle APB.

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Photo: Bernd Klumpp

Sleepy students

During a particularly long lecture, each of five students fell asleep exactly twice. Furthermore, each pair of students was asleep at the same time, at some point. Prove that there was a moment when at least three students were asleep.

Baffling buckets

(1) There are three buckets filled with 50, 100 and 150 pebbles, respectively. Each move, you are allowed to take two pebbles out of one bucket, and place one in each of the others. Can you ever have 100 pebbles in each bucket?
(2) There are 100 distinct buckets, arranged in a circle, each containing some pebbles. Each move, you are allowed to take two pebbles out of one bucket, and place one in each of the neighbouring buckets. Prove that if the initial configuration is achieved again after n moves, then n must be a multiple of 100.
(3) There are three buckets, each containing some pebbles. Each move, you are allowed to transfer pebbles from one bucket to another if the transfer doubles the number of pebbles in the receiving bucket. Is it always possible to empty one of the buckets?

Solutions to Puzzle Corner 14

The $50 book voucher for the best submission to Puzzle Corner 14 is awarded to Joe Kupka. Many thanks to Norman Do for collecting and compiling the following solutions.

Matching shoes

Solution by: Xinzi Qiu

We represent each left shoe with a zero and each right shoe with a one. Obviously, we would like to show that if $a_1, a_2, \ldots, a_{30}$ is a sequence of 15 zeros and 15 ones, then there must exist 10 consecutive numbers whose sum is five. Write $S_k = a_k + a_{k+1} + \cdots + a_{k+9}$ for $1 \leq k \leq 21$ and, in order to obtain a contradiction, let us suppose that $S_k \neq 5$ for all k.

Note that $|S_k - S_{k+1}| \leq 1$ for all k. So if $S_1 > 5$, it follows that $S_2, S_3, \ldots, S_{21} > 5$ and this contradicts the fact that $S_1 + S_{11} + S_{21} = 15$. A similar contradiction is obtained if we suppose that $S_1 < 5$, so we must have $S_k = 5$ for some value of k.

Positive subsets

Solution by: Ross Atkins

Let's pair up each subset — including the empty set and X itself — with its complement. The two subsets in each pair cannot both have a positive sum and they cannot both have a nonpositive sum. This is simply because the two sums are integers which add up to 1. Therefore, exactly one subset from each pair has a positive sum, giving 2^{99} subsets in total.

Continued calculation

Solution by: Bruce Bates

Let

$$a = \cfrac{1}{3 + \cfrac{1}{4 + \cfrac{1}{\cdots + \cfrac{1}{2009}}}}$$

and note that the desired sum is simply

$$\frac{1}{2+a} + \cfrac{1}{1 + \cfrac{1}{1+a}} = \frac{1}{2+a} + \frac{1+a}{2+a} = 1.$$

The itinerant queen

Solution by: Joe Kupka

We prove the result for all $m \times n$ chessboards by induction on n. First, we note that the case $n = 1$ is trivial while the case $m = n = 8$ corresponds to the problem we are trying to solve. Now suppose that the problem holds true for all boards with n columns and consider a board with $n + 1$ columns. If we denote the rightmost column by C and the remaining board by B, then one of the following three cases must occur.

- Case 1: In B, both the set of red squares and the set of blue squares are accessible.

  In order to obtain a contradiction, suppose that neither the set of blue squares nor the set of red squares in $B \cup C$ is accessible. Denote the squares of C from top to bottom by $C_1, C_2, \ldots, C_m$ and the squares immediately to the left of these by $L_1, L_2, \ldots, L_m$. Without loss of generality, suppose that C_1 is blue — then L_1 must be red which in turn implies that C_2 is blue. By continuing this argument, we can show that all of the squares in C are blue, which contradicts the fact that the set of blue squares in $B \cup C$ is not accessible. Hence, the set of blue squares or the set of red squares in $B \cup C$ is accessible.

- Case 2: In B, the set of red squares is accessible, but the set of blue squares is not accessible.

Then each row of B must contain at least one red square, which means that the set of red squares in $B \cup C$ is also accessible.

- Case 3: In B, the set of blue squares is accessible, but the set of red squares is not accessible.

  Then each row of B must contain at least one blue square, which means that the set of blue squares in $B \cup C$ is also accessible.

By induction, we conclude that the problem holds true for all $m \times n$ chessboards.

Snail trail

Solution by: Ivan Guo

1. We consider the snail on the Cartesian plane, starting at the origin and travelling one unit up, down, left or right every 15 minutes. Suppose that the snail returns to the origin after taking N steps upward. Since the number of steps upward must equal the number of steps downward, it must make a total of $2N$ vertical steps. Furthermore, since the snail alternates between vertical and horizontal steps, it must make a total of $2N$ horizontal steps. It follows that the snail travels $4N$ units and returns to its starting point after N hours.
2. We will show that if there are $n \geq 10$ people watching, then the snail can crawl at most n metres. Certainly, the snail cannot crawl further than this, since each person watches the snail crawl exactly one metre. To show that the snail can in fact crawl n metres, suppose that all n people watch the snail remain stationary during the first $(n-10)/(n-1)$ hours. After that, the n people take turn to watch the snail crawl one metre in $9/(n-1)$ hours. Then each person has watched the snail for $(n-10)/(n-1) + 9/(n-1) = 1$ hour and the snail has crawled for a total of $(n-10)/(n-1) + 9n/(n-1) = 10$ hours, during which it travels n metres.

Ivan is a PhD student in the School of Mathematics and Statistics at The University of Sydney. His current research involves a mixture of multi-person game theory and option pricing. Ivan spends much of his spare time playing with puzzles of all flavours, as well as Olympiad Mathematics.

Mathematical minds

David Ellwood*

David Ellwood is Research Director of the Clay Mathematics Institute. He was interviewed for the Gazette during the 53rd Annual AustMS Meeting at the University of South Australia in Adelaide.

Gazette: Can you tell us about the Clay Mathematics Institute?

Ellwood: The Clay Mathematics Institute (CMI) is different from other mathematics institutes in several respects. First of all, CMI is not part of any graduate school, university system or national research initiative. Rather, CMI is a private philanthropic foundation based in Cambridge Massachusetts, and was founded in 1998 through the vision and generosity of Boston businessman Landon T. Clay. Landon's vision was to create an institute that would further the beauty, power and universality of mathematical thought.

CMI has been extremely active and diverse in its approach to Landon's vision. We offer various types of research appointments, ranging from fellowships to support senior researchers at a thematic program, to our one-month 'Lift-Off' fellowships that are awarded to new PhDs in the summer of their graduation. The Clay Research Fellowship (formally called Clay Long Term Prize Fellowship) is one of our flagship programs, a 'dream' postdoc position lasting from three to five years and tenable at any institution of the Fellow's choice. For example, when Terry Tao was a Long Term Prize Fellow, he used this flexibility to return to Australia and visit UNSW.

We also organise a great variety of conferences, workshops and summer schools, sometimes independently, but often in partnership with other institutions. A personal passion of mine has been to develop CMI's potential as a global research vehicle. I like to think of CMI as an institute 'without walls' since we organise the majority of our programs off-site. This means that we have the potential to operate 'without borders' like no other more localised entity. We seek out opportunities at the highest level, and work to implement them wherever it makes most sense mathematically, with an emphasis on both quality and impact. Although CMI has a physical base in Cambridge, Massachusetts, all our researchers are hosted elsewhere, and typically more than 50% of our programs are conducted abroad. For example, another of our flagship programs is the CMI Summer School. This is a high-level four-week school for 100+ graduate students and young mathematicians. In its 10 years of operation, we have held schools on different subjects every year, ranging from Mirror Symmetry to Galois Representations, and conducted these schools at a great variety of international venues: Boston, Berkeley, Cambridge (UK), Toronto, Budapest, Göttingen, Pisa, Zürich and Manoa (Hawaii). We are

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currently gearing up for our 2010 school in Brazil, which will be on ‘Probability and Statistical Physics in two or more dimensions’.

Gazette: When will there be a school in Australia?

Ellwood: That depends on the enthusiasm and suggestions that come out of the Australian mathematical community, but it’s interesting to note how prominently Australian mathematicians have featured in CMI’s activities to date. For example, Terry Tao and Akshay Venkatesh have been Clay Research Fellows, and Terry won the Clay Research Award in 2003. Danny Calegari was a Clay Lift Off Fellow in 2000, won our Clay Research Award in 2009 and is of course a Clay–Mahler Lecturer at this meeting! Proportionally, Australia has been very strongly represented in CMI programs. This shows the excellence that has been cultivated in Australian mathematics. The Clay–Mahler Lectures is the first major event in Australia and I hope our visit will open doors to future collaborations. It’s been a tremendous pleasure for me to visit and talk to Australian mathematicians about what’s going on here. CMI is always looking for new opportunities and I expect some exciting ones will come out of this tour.

Gazette: What are the origins of the CMI?

Ellwood: CMI was founded in 1998 by Landon T. Clay, a prominent businessman who served for many years as the chief executive officer and chairman of the mutual fund company Eaton Vance. Landon studied the Classics at Harvard and was moved by the achievements of ancient Greece in the arts and sciences. He told me that he was struck by ‘the enduring power of mathematics’. Seeing the potential in starting a mathematics institute, he followed up his ideas with Arthur Jaffe, Landon T. Clay Professor of Theoretical Science at Harvard University and first president of CMI. Talking to Landon you quickly appreciate his deep understanding of the relevance and cultural significance of our discipline.

Let me put it this way, as a philanthropist you might build a building, and if you build it well it can last a long time, but in funding mathematics you create something that is eternal. After all, Euclid’s Elements served as a text book until the early 20th century, that is, for more than two millennia! I think the impact of ones activities in time, rather than space, is often poorly anticipated.

In 2000 we launched the Millennium Prize Competition in Paris. That really helped put us on the map. The idea was not only to promote excellence, but also to draw attention to the fact that mathematics is, in a certain sense, inspired and driven by these extremely hard problems, even if they’re not the problems that we are working on most of the time. If you like, these problems let us know how to orientate ourselves and where the future wealth of the subject can be found.

Gazette: Were you surprised that the Poincaré Conjecture was the first of the Millennium Problems to be solved?

Ellwood: There was a lot of discussion in 2000 as to what might happen. At the time some people thought that it was possible none of these problems would be solved in our lifetime, and so it was really surprising that so much progress was made on the Poincaré Conjecture so quickly. I don't think anyone expected that. It was a remarkable turn of events for mathematics and great for CMI because it was one of the problems we had selected for the competition.

When we launched the Millennium Problems, one of the goals was to draw attention to the fact that mathematical problems are intrinsically valuable, independently of their applications. The reward itself honours both the importance and difficulty of these problems. But the competition spoke to the general public in a compelling way, communicating first of all that there are unsolved problems in mathematics (which is something that needs to be better appreciated!) and that mathematicians are not technicians, but more akin to explorers, primarily focused on the frontiers of their field. This is something that's hard to communicate, so highlighting these problems and then actually solving one of them in 'real time' exhibits the functioning of our establishment at its highest level. It a phenomenal event that benefits every mathematician, not only because of the specific advances that enrich our discipline, but also because of the opportunity it provides to put our vocation in the spotlight and for people to pay attention.

Gazette: What is the process now to award the prize?

Ellwood: CMI must follow through the rules that were set out when the Millennium Prizes were announced. After the solution to one of the problems is published, there is two-year waiting period, as there has to be a consensus within the mathematical community that it is valid. Then a special board is set up to evaluate the solution. They report to our scientific advisory board, who then make recommendations to the board of directors. Once all the steps are completed, there will be official recognition and an award ceremony. This process will culminate for the Poincaré Conjecture sometime in 2010. It will be exciting when the award is finally announced.

Gazette: So do you have a sense of which problem might be solved next and when that might be?

Ellwood: I think Terry answered that question well in one of his talks here at the AustMS meeting. All of these problems are certainly extremely difficult and appear to be beyond the reach of current technology. It seems that something unknown, some critical advance, is required for the solution of each problem. People get excited about various new results, but I believe the general consensus is that something really big is necessary in each case. For me, the knowledge that a critical new development will have to happen before any of these problems can be solved makes them all the more exciting.

When Hilbert launched his list of problems in 1900, he set them out as signposts for 20th century mathematics — milestones both to measure our progress as well as chart out a road map for his vision of future progress. I think the scientific advisory board of CMI was much more humble in its perspective. It just wanted to highlight some very important unsolved problems and draw attention to the fact that mathematics is concerned with such very deep questions.

Gazette: Can you tell us a bit more about how the lecture tour in Australia has gone?

Ellwood: Attendance at the talks and public lectures has been excellent. Terry Tao's public lectures often filled the auditoriums to capacity! I think the tour has been a great success, and we are extremely grateful to all the people who worked so hard to coordinate events between six cities and 14 institutions across Australia (special mention should be given to Alan Carey and Andrew Hassell at ANU, as well as all the local organisers and the efforts of AMSI and AustMS). Previous Clay Lectures have been organised in the UK, India and Japan, but this is the first time we've attempted a multi-city tour. It has added enormous value in terms of the amount of exposure and dissemination, and it's a format we should consider adopting for future events.

Gazette: What is your background? What exactly is your role?

Ellwood: I'm the Research Director of CMI, and as such I'm responsible for most of CMI's programs and events. I grew up in New York City, and at age 11 I went to school in England. As a teenager I became fascinated with quantum mechanics, especially Heisenberg's uncertainty principle. I started my PhD at Imperial College (London) under Chris Isham, but while studying there I was invited to IHES (Paris) by the celebrated Operator Algebraist and Fields Medalist Alain Connes. I spent three years working closely with Alain, a period that greatly influenced my taste and development as a professional mathematician. After completing my PhD, I held positions at the University of Paris VI (Pierre and Marie Curie), ETH Zürich, Strasbourg, Boston and Harvard Universities.

Arthur Jaffe was just starting CMI when I arrived at Harvard. I found his ideas completely new, exciting and fresh. In particular, the idea that an institute should have a very small administrative structure and be able to move quickly and decisively in response to new developments in mathematics. I've been working for CMI for 10 years, which is essentially since the beginning of our operations in 1999.

My field of research is operator algebras, in particular noncommutative geometry, but more recently I've become interested in homotopy theory and operads. Non-commutative geometry provides a new paradigm that is as rich conceptually as it is in its applications to mathematics and physics. Most of my time now is dedicated to CMI's activities, and I enormously enjoy being involved with so many mathematicians across so many fields of research. Besides the Clay Lectures, I'm in charge of the CMI Summer Schools, our onsite 'Bow Street' Workshop program, all external conferences, the Lift-Off Program, and I ran a special program for gifted high school students called the Clay Research Academy from 2003–2005. I continue to supervise CMI's involvement in programs for gifted students (CMI-PROMYS and CMI-Ross) and I'm editor of CMI's proceedings series.

Gazette: What are your impressions about mathematics in Australia and where it might to go in the future?

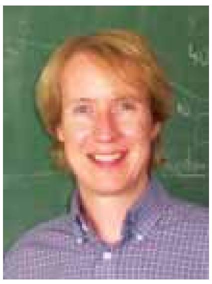
Ellwood: If we think about the last 2500 years, the evolution of mathematics and its achievements has been one of the great successes of human civilisation. Maybe that's not been appreciated by our culture at large as much as it should be, but Australia continues to do an outstanding job in both mathematics research and education. The record breaking participation of this meeting, and high international profile of its speakers, all speak of the hard work and dedication of the Australian mathematical community.

I think any scientific endeavor is best driven by the science itself, and that's what mathematicians do best. It's the most exact of all sciences and impervious to manipulation of any kind. When we find a superior way of doing things, we quickly adopt it — if something is right, we do it; when something is flawed, we drop it. It's a science that's immune to dogma because it's completely self-correcting, and sets the standards by which all others are judged.

As the frontiers of mathematical knowledge advance, we have to adapt to them and take on new challenges. I think mathematicians have to stay close to the pulse of what's happening, where the advances are, where the deep problems lie, and interact with each other as a community to exchange knowledge. These are things that we are getting ever better at. Australian mathematicians are doing all these things, and doing them well. In my opinion a meeting such as this perfectly exhibits the type of activity that keeps our research healthy, advancing and aligned with developments elsewhere. However, mathematicians must stay focused and remind politicians of their achievements at every opportunity. Mathematics is in some ways an art, but it's not a visual art, it's not an art that can be appreciated without getting involved. I think that we mustn't be content with the image that we're doing something difficult that's hard to communicate, but rather seek out ever new ways to explain and relate our achievements to others.

You can listen to a concert and derive something from it, you can go to an art gallery and find something appealing, but with mathematics it really depends on human interaction and communication. If mathematics is to receive the full recognition it deserves we must take every opportunity to communicate with all who express an interest.

Gazette: Thank you very much for talking with us.



David Ellwood has been Research Director of CMI since 2003, and was previously Resident Mathematician at CMI from 1999 to 2003. He obtained his PhD from Imperial College (London), and has held positions in France, Switzerland and the USA. In his work for CMI he has served on the organising committee of hundreds of conferences and workshops around world.

A mathematician reflecting on the International Olympiad in Informatics

Benjamin A. Burton*

Abstract

In July 2013, students from 80–90 countries will descend upon Australia to take part in the International Olympiad in Informatics (IOI). On the surface the IOI is a computer programming competition, but in fact it involves a great deal of both mathematical technique and mathematical creativity. In this short article we introduce the readers to the IOI and the mathematics within.

1. Introducing the IOI

The International Olympiad in Informatics (IOI) is one of the five broad-brush Science Olympiads for high-school students, which also cover biology, chemistry, physics, and of course mathematics. Founded under the auspices of UNESCO in 1989, the IOI is one of the youngest Science Olympiads, but it has grown quickly to now include over 80 countries, making it the second-largest (behind only mathematics).

Despite informatics being roughly synonymous with computer science, the IOI has always had strong associations with mathematicians. Locally, the Australian team is trained by the Australian Mathematics Trust, and all of Australia's team leaders over the past decade have been trained mathematicians[1]. Internationally, the first IOI was organised by Petar Kenderov, a highly-respected Bulgarian mathematician, and it is common to find fellow mathematicians amongst the myriad of team leaders and deputies.

It was recently announced that Australia will host IOI 2013, with the event to be held at The University of Queensland in partnership with the Australian Mathematics Trust. This is a great honour for both the mathematics and computer science communities in Australia, and readers will doubtless hear more about the event as it draws nearer. In the meantime, this short article aims to (i) introduce the IOI to readers with whom it is unfamiliar, and (ii) illustrate the mathematics that runs throughout the competition.

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[1] Robbie Gates (leader from 1999–2000) holds a PhD in category theory, the author (leader from 2001–2008) holds a PhD in geometry and topology, and Bernard Blackham (leader since 2009) holds a BCM with a major in pure mathematics.

2. The structure of the IOI

At its core, the IOI is about algorithm design and computer programming. To solve an IOI task, students must design an algorithm that is both *correct* and *efficient*. They must then code this algorithm into a computer program, which they submit at the end of the contest for judging.

Algorithm design has a long history in mathematics — consider, for instance, Euclid's algorithm to find the greatest common divisor, a clever and extremely fast algorithm designed thousands of years ago and still in common use today. For a more modern example, the author, Rubinstein and Tillman have recently resolved an old topological conjecture [3]; although this is a theoretical result, it would not have been possible without significant work on efficient algorithms to support the underlying computations.

Although entry-level competitions in this field might focus more on computer programming (particularly where high-school students have little algorithmic training), the focus of the IOI lies squarely on algorithms — tasks are chosen to avoid excessive amounts of coding, and a good student will typically spend much of the contest designing algorithms using pen and paper. During training, students will often deem a task solved once they find a suitable algorithm, without having touched the computer at all. In a sense, computer programming acts as the means of communicating a solution in the IOI, much as a written proof does in the International Mathematical Olympiad. This has both benefits and drawbacks, as discussed further in [1].

The format of the IOI is as follows. Students sit two five-hour exams in front of a computer, each with 3–4 tasks to solve. A sample task is illustrated in Figure 1, taken from the inaugural Asia-Pacific Informatics Olympiad. Here we see the typical components of an IOI task: a description of a mathematical problem with some surrounding story, descriptions of the input and output requirements for the student's computer program, bounds on the size of the input, and limits on the program's running time and/or memory usage. Figure 1 is merely a brief summary of the full task description, which can be downloaded from http://apio.olympiad.org/.

Evaluation of IOI solutions is also done by computer. The judges prepare an *official data set*, consisting of input files ranging from small to large, and from simple to pathological. For each input file, a student scores points if their program gives the correct output within the given time and memory limits. In this way, students with optimal algorithms will score 100%, and students with correct but slow algorithms will score partial marks according to which input files their programs can solve within the time limit.

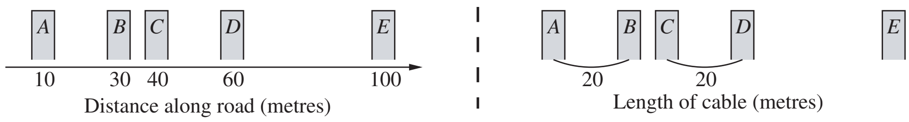
It is essential that the official data set be constructed carefully, and contest organisers typically put a great deal of time into ensuring that the spread of cases is fair, thorough and discriminates well. Computer evaluation also has benefits and drawbacks [1], [5], [7], and the IOI community is continually seeking ways to improve the experience.

Task: 'Backup'

Asia-Pacific Informatics Olympiad 2007 (by Mathias Hiron)

You are given the locations of n office buildings along a single road, and you wish to join these buildings in pairs with network cables so that the offices can back up each other's data. You are only able to lay k cables (thereby pairing off $2k$ buildings in total, with the remaining $n - 2k$ buildings left isolated).

Your task is to decide which buildings to join so that you use the *smallest possible total length of cable*. You must join $2k$ distinct buildings (i.e. you cannot have more than one cable running out of a single building).



For instance, consider the $n = 5$ buildings on the road above, and suppose you are able to lay $k = 2$ cables. The best option is to join A–B and C–D, giving a total length of $20 + 20 = 40$ m of cable as illustrated on the right hand side.

Input and output: The input to your program will be the integers n and k, followed by the locations of each of the n buildings along the road. Your output should be the smallest possible total length of cable that you can use.

Limits: The input will satisfy $2 \leq n \leq 100\,000$ and $1 \leq k \leq \frac{n}{2}$. Your program must run within 1 second, and may use up to 32 Mb of memory.

Figure 1. A task from the Asia-Pacific Informatics Olympiad

Not all IOI tasks follow the general format illustrated in Figure 1. Other examples include *output-only tasks* (where students are given all of the judges' input files and they must generate their output offline), or *interactive tasks* (where students' algorithms must interact with software provided by the judges). See [9] for details and examples.

3. The mathematics of algorithm design

To solve an IOI task can require a great deal of mathematical skill. This includes not only working with mathematical concepts (such as combinatorics, geometry, graph theory and recurrence relations), but also creative application of mathematical techniques (such as case analysis, complexity analysis, invariant analysis, and, of course, proof and disproof).

We shall not attempt to discuss the full range of relevant mathematical concepts and techniques in this short article; instead see [1] for an overview or [10] for a detailed syllabus. Here we simply offer an illustration, namely the solution to the task *Backup* from Figure 1.

3.1. A brute-force solution

A simple 'brute force' algorithm might be to run through all possible ways in which the $2k$ cables could be laid, and choose the layout with the smallest total length. However, there is a *very* large number of possibilities to consider. We can reduce this number through the following observation (proof left to the reader).

Lemma 1. *In the optimal solution, every cable must join two adjacent buildings.*

Although this helps, it does not help nearly enough. Even with Lemma 1, there are still $\binom{n-k}{k}$ choices of cables to consider (exercise!). With just $n = 100$ and $k = 25$ this gives around $5{\times}10^{19}$ possibilities, which a modern computer could not process in a millennium (let alone a second). The maximal case $n = 100\,000$ simply does not bear thinking about. Clearly we must find a more clever solution.

3.2. A dynamic programming solution

It often helps to decompose a large problem into a family of smaller, similar problems. With this in mind, let $f(b, c)$ denote the shortest possible cable length if we restrict our attention to the first b buildings and lay precisely c cables (where $0 \leq b \leq n$ and $0 \leq c \leq \frac{b}{2}$). The final solution that we seek is $f(n, k)$, and at the other end of the spectrum we clearly have $f(b, 0) = 0$ for all b. Unfortunately, we know little about the values in between.

Our challenge then is to find a recurrence relation that links together the different values $f(b, c)$, so that we can find our solution by incrementally computing values of $f(b, c)$ for all b, c. This is an example of a technique known as *dynamic programming*. With a little thought we arrive at the following formula.

Lemma 2. *Suppose that $1 \leq c \leq b/2$. Then $f(b, c)$ is the smaller of $D + f(b-2, c-1)$ and $f(b-1, c)$, where D is the distance between the $(b-1)$th and bth buildings.*

Why does this hold? If the bth building has a cable attached, then by Lemma 1 this cable goes to building $b-1$ with length D, and we are left to lay the remaining $c-1$ cables amongst the first $b-2$ buildings. If the bth building does not have a cable attached, then we must lay all c cables amongst the first $b-1$ buildings.

Our algorithm is now to compute $f(2, 1), \ldots, f(n, 1)$, then $f(4, 2), \ldots, f(n, 2)$ and so on, each time using Lemma 2 for the computation. Eventually we arrive at $f(n, k)$ and the algorithm is complete.

This is certainly faster than brute force, but is it fast enough? Our algorithm requires (roughly) up to nk computations. For $n = 100$ and $k = 25$ this total is 2 500, which fits easily within one second. However, for our maximal case

$n = 100\,000$ and $k = 50\,000$ we have up to 5 billion computations, which is still too much to squeeze into our time limit[2]. We must do better still.

3.3. Fixing the greedy solution

It is tempting to try a *greedy solution*, where we repeatedly lay the shortest allowable cable until all k cables have been used. A little experimentation shows this to be incorrect — in the Figure 1 example, for instance, laying the shortest cable B–C (10 m) would then force us to lay the much longer cable D–E (40 m), giving a suboptimal solution with 50 m of cable in total.

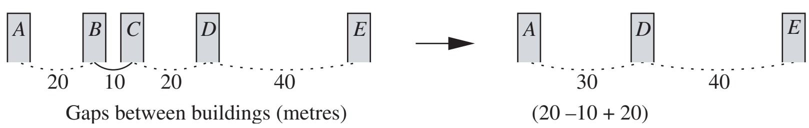
However, what if we allow ourselves to undo a bad decision? That is, we lay the shortest possible cable but also create a method for removing it later on. Further thinking along these lines leads to the following observation.

Lemma 3. *Suppose we have not yet laid any cables, and that the shortest possible cable runs from building b to $b + 1$. If the optimal solution does* not *lay this cable, then it must lay two cables immediately on either side (i.e. from $b - 1$ to b and from $b + 1$ to $b + 2$).*

We prove this by showing that, if we do not lay both cables on either side, then we can swap some cable in our solution for a shorter cable (yielding a contradiction). Again the details are left for the reader.

We therefore begin our algorithm by choosing the shortest possible cable; suppose this runs from building b to $b+1$ as before. We are now free to lay a cable anywhere within the range $1, \ldots, b - 1$ or within the range $b + 2, \ldots, n$. In addition, we are free to *replace* our original cable with two cables joining $b - 1$ to b and $b + 1$ to $b + 2$.

With some creative rearrangement of our diagram, we can make this look like a new version of the original problem. Remove buildings b and $b + 1$, and squeeze the surrounding buildings together so that $b-1$ and $b+2$ are separated by a gap of size $D_{b-1,b} - D_{b,b+1} + D_{b+1,b+2}$ (where $D_{i,j}$ is the old distance between buildings i and j). If we ever try to lay a cable across this new 'artificial' gap, we remember that in reality we must delete the old cable from b to $b + 1$ and replace it with two on either side. The full rearrangement operation is illustrated below, where we begin by choosing the 10 m cable B–C.



[2]These numbers might seem arbitrary, but with experience students quickly gain an order-of-magnitude feel for how many computations can fit into one second. A rough figure nowadays is around 50 million.

Our new diagram now looks like another empty road, but with only $n-2$ buildings and $k-1$ cables to lay. We continue choosing the shortest possible cable and adjusting our diagram until all k cables have been laid, whereupon we have our final solution.

Returning to our example, the shortest gap on this new road is the 30 m gap A–D. We lay this 'artificial' cable, which entails replacing the old B–C with both A–B and C–D. With no more cables to lay, we have a final (and optimal) solution of total length 40 m.

But what of running time? Our algorithm takes k iterations, each of which requires us to find the shortest possible cable and then adjust the diagram accordingly. This can be made faster if we store the gaps *between* buildings, not the locations of the buildings themselves. Using techniques from computer science, we store the gaps in a priority queue where each find-and-adjust operation has worst-case running time proportional to $\log_2 n$. The entire algorithm then has running time proportional to $k \log_2 n$, which for $k = 50\,000$ and $n = 100\,000$ is under a million, fitting comfortably within our one second time limit.

4. Further reading

Australia has a well-established program of events leading up to the IOI; this program is detailed by the author in [2]. On the international front, Cormack *et al.* [5] give more detailed descriptions of the IOI and related competitions.

Skiena and Revilla [8] offer a problem-filled book aimed specifically at students training for the IOI and related contests. For this year's 20th anniversary of the IOI, Verhoeff [9] has published a paper covering the history and evolution of IOI tasks over the years.

For high-school students with no training in programming or algorithm design, the Australian Informatics Competition [4] and the Beaver Contest [6] are accessible entry-level events that aim to encourage and develop algorithmic thinking.

Anyone is welcome to try their hand at solving IOI-style problems (and easier tasks also!) on the Australian training site at http://orac.amt.edu.au/aioc/train/, or the USACO training site at http://www.usaco.org/. The official IOI website is http://www.ioinformatics.org/.

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Benjamin Burton has been involved with the Informatics Olympiad since Australia became a regular participant a decade ago. He currently sits on the international scientific committee that guides and oversees the IOI, and will chair the host scientific team when the Olympiad comes to Brisbane in 2013. He finds the IOI a stimulating counterpoint to his mathematics research in computational geometry and topology at the University of Queensland.

Winners of the AustMS medal for 2009

Arun Ram*, **Tony Dooley**** and **Brendan McKay*****

The AustMS medal for 2009 is shared by Dr Stephen Lack and Dr Ian Wanless.

Nalini Joshi (AustMS President), Ian Wanless and Stephen Lack

Dr Stephen Lack

Dr Lack works in category theory and its applications. He is a leading figure in both general and applied category theory. His research on categories and 2-categories is fundamental, and increasingly important in a large number of subjects, ranging from computer science to topology to mathematical physics.

Steve Lack is recognised as one of the primary developers of the foundations of higher categories and of categorical homotopy theory. He is responsible for establishing the notions of distributive and adhesive categories. He has been described as the world's leading expert on 2-categorical structures where his papers on 2-monads and pseudomonads are considered primary references.

Steve Lack's research is a constant interplay between fundamentals and applications. Joint work with Cockett examines categories whose logic is pertinent to

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computation. Their work lays the foundation of restrictive categories, an important construct for the study of syntax and semantics in languages and recursion theory.

Steve Lack's mathematics has been described as 'mathematics ahead of its time'. In particular, in homotopy theory, Lack's work on Quillen model structures provided a firm homotopical foundation for the theory of 2-categories. Other work gave definitive answers for when limits of lax morphims can make sense, and recent work with Simona Paoli has paved the way for a better understanding of how internal category theory relates homotopically to enriched category theory.

Steve Lack is on the editorial board of three international journals and a regular speaker at international conferences.

Dr Ian Wanless

Dr Ian Wanless' research can roughly be divided into analytic and combinatorial, with some overlaps. He is recognised as one of the top researchers in asymptotic combinatorics, a difficult field which uses the tools of real and complex analysis to study en masse characteristics of classes of discrete structures. His initial contributions were in the study of sets of discordant permutations, which can also be described in terms of Latin rectangles and 0–1 matrices. In joint work with McKay and Wormald he gave a tour de force solution of the long-standing important problem of the asymptotic enumeration of graphs with bounded degree.

Dr Wanless is the undisputed leader in the combinatorics of Latin squares. He was the first to determine which orders admit Latin squares having no subsquares, a problem that had been around for more than a century. In subsequent work he has developed a theory of cycles in Latin squares that is playing an essential part in subsequent developments in the theory of Latin squares. In the field of combinatorial permanents Dr Wanless has completely solved several conjectures and established important subcases of several more outstanding conjectures.

Further notable examples of the creativity of Ian Wanless include his work on the Hall–Paige conjecture where he established (with Vaughan-Lee) the equivalence of two disparate conditions, and the problem of the existence of Latin squares without orthogonal mates which he solved with Webb. A recent seminal paper shows for the first time how the structure of a random Latin square can be investigated theoretically. He has made use of differential equations to enumerate a class of planar triangulations, and used probabilistic methods to prove the existence of regular graphs of large girth which have no homomorphism onto a cycle of a given length.

Dr Wanless is a Managing Editor of the *Electronic Journal of Combinatorics*, President of the Combinatorial Mathematics Society of Australasia since 2006, and winner of the 2008 Hall Medal, the 2008 Victorian Young Tall Poppy award, and the 2002 Kirkman Medal.

Bob Anderssen awarded the 2010 ANZIAM Medal

Graeme Wake*, Jim Hill and Charles Pearce*****
On behalf of ANZIAM

The ANZIAM Medal is the premier award offered by ANZIAM. It is currently awarded biennially. This year, it was awarded to Dr Robert (Bob) Scott Anderssen, CSIRO Mathematics, Informatics and Statistics, Canberra. The presentation was made at the 46th ANZIAM Applied Mathematics Conference in Queenstown, New Zealand on 3 February 2010.

Citation for the 2010 ANZIAM Medal

Dr Robert Scott Anderssen

Bob Anderssen

Bob Anderssen's research career is broad and wide-ranging. He has operated across the ever-expanding spectrum of Applied and Industrial Mathematics, since receiving his first doctorate in 1968 from the University of Adelaide. His work is noted world-wide for its originality and depth. His contributions have had, and are having, a high impact across applied mathematics, industrial mathematics, science, the profession (ANZIAM and the Australian Mathematical Society) and the community generally.

The crucial importance of Bob's research is its utility in a wide and diverse range of applications: from the current work in cell-signalling models of patterns in plants; the extension of rheological interconversion methodology; to the stability analysis of first-kind Volterra integral equations; the ordinary differential equation modelling or gene silencing — in the rapidly growing area of epigenetics; the differentiation of matrix functionals — a core piece of theoretical mathematics; algorithms for determining the regularisation parameter for robust smoothing splines; derivative spectroscopy; resolution enhancement; and dilational Hilbert scales/interpolatory

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inequalities. Going back to only 1973, the Web of Science has listed more than 950 citations of his work, which underscores the significance of his creative work.

Bob Anderssen is a strong supporter and worker for the profession of Applied and Industrial Mathematics. At both state and national levels, he is a regular contributor to ANZIAM and the Mathematics-in-Industry Study Groups, and he helped ANZIAM, and its fore-runner the Division of Applied Mathematics to establish and sustain a Special Interest Group (SIG) in Computation (CTAC). He has strongly supported the expansion of the ANZIAM umbrella to embrace both countries (Aust/NZ), and he has been active so as to ensure Mathematics has a stronger voice in national and science forums. He served as Chair of the Division of the Australian Mathematical Society (AustMathSoc) and separately as President of the Society.

He is now continuing his research and wider activities productively into 'retirement' as a Post Retirement Research Fellow in CSIRO Mathematics, Informatics and Statistics, Canberra, having served CSIRO through to the role of Research Chief Scientist until 2007. His influence on, and nurturing of, emerging young scientists is well known and many can attest to his encouragement at critical points of their careers. He is always willing to participate in mathematical meetings, and he can be relied upon to give an outstanding and enthusiastic presentation. On many occasions he has acted as judge to select the prize winner for the Best Student Presentation at the NSW/ACT ANZIAM Mini-meeting. He performs this difficult and sensitive task with considerable awareness, sensitivity and flair, such that all participants, and not just the prize winners, are given positive encouragement and their confidence materially uplifted.

Bob Anderssen has lived the life of the committed Applied and Industrial Mathematician, and he has demonstrated, through his enthusiasm, energy and sustained achievement, that he well and truly meets the criteria for this award. The selection panel unanimously recommends that Dr Robert Scott Anderssen be awarded the ANZIAM medal for 2010.

Obituary

Clive Selwyn Davis
15 April 1916 – 29 October 2009

Clive Selwyn Davis, Emeritus Professor of Mathematics and former Head of Department at the University of Queensland, died in Brisbane on 29 October at the age of $93\frac{1}{2}$ years. Clive was born in Sydney and grew up in Strathfield. He had two brothers, Lionel and Lance, who predeceased him by many years, and a sister, Audrey Zedora now 96, who, like Clive in recent years, is still sharp of mind, though frail in body.

Clive was a brilliant child, and was raised by parents who encouraged him to develop his many talents. He could read by the age of four, and retained a life-long interest in words, language and reading. For many years he learned two new words per day from the dictionary, and read and memorised many poems. But he also had a practical bent which first showed itself in his love of tools. His first Stanley plane was bought when he was 12 years old, and it formed the basis of a large collection of wood-working tools. His other notable collection started with his first car, a Crossley, and this was followed by a 1935 Sunbeam and several Rovers. All were kept beneath his house in Corinda — to be restored in due course.

Clive's education started at primary schools in Summer Hill and Homebush, and later at Sydney Technical High School. He then enrolled in Engineering at Sydney University, but found it too practical and transferred to Science. He obtained a First Class Honours degree in Mathematics in 1937, followed by First Class Honours in Physics in 1938, and then by an MSc in 1939.

An extracurricular activity followed from his membership of Sydney University Air Squadron in 1936. He spent many a weekend at Richmond being trained by the Royal Australian Air Force Reserve, and became an experienced pilot.

After graduation Clive was employed by the Australian Government, and was sent to England to undertake research on aircraft instruments and aerodynamics at the Royal Aircraft Establishment, Farnborough. Upon the outbreak of the Second World War, he volunteered for the Royal Air Force, where he served with distinction, being awarded the Distinguished Flying Cross in August 1941. He later transferred to the RAAF, and returned to Australia, albeit with some difficulty.

Clive also served on the Air Staff, and he is mentioned in the official war history as being prominent in the development of Operations Research in air operations. In the later stages of the war, Clive commanded 103 squadron of Liberator heavy bombers in operations from North Queensland and Papua New Guinea, retiring with the rank of Wing Commander.

After the war, Clive obtained a scholarship to travel to Trinity College, Cambridge, where he was awarded his PhD in 1949 for a thesis on number theory under the supervision of L.J. Mordell. A lectureship at Bristol University was followed by his appointment to the chair of Mathematics at the University of Queensland in 1956.

Clive served in the Mathematics Department for 27 years until retirement in 1983. He was Head of Department from 1956 to 1972, and during these years he worked hard for a new building for Mathematics, and to build up staff numbers and to develop courses. Such was the scarcity of qualified staff at that time that on one occasion Clive had to travel to Britain and Ireland on a recruiting drive. The total of Mathematics staff in 1956 was 6, compared to 47 in 1977. He also fought for a separate Mathematics library in the Mathematics Department building, which, when it eventuated, was greatly appreciated by staff. It is now named after him.

Clive Davis was an excellent and stimulating lecturer with a commanding personality. Former students remember the clarity, vigour and high standard of his lectures. His handwriting on the board was immaculate, and his brief dictated final summary of each lecture was much appreciated.

He was a member of the University Senate for ten years, and during that time was active in improving staff conditions, including the setting up of the FSSU superannuation system. He also served on the University Research Committee for seven years, being Chairman for the last three of those years. In 1966 he was President of the Royal Society of Queensland. From 1956 to 1968 he was Treasurer of the Australian Mathematical Society and from 1968 to 1970 was its President.

To a life of distinction and service Clive added a keen interest in nature and the environment. He was a founding member of the Barrier Reef Committee, and of the Wildlife Preservation Society of Queensland. He had a keen interest in plants, and especially in growing bromeliads. Also he was a keen and canny squash player, and continued playing until he was 78.

Clive and Toni were married in May, 1943, in Melbourne. They had three children: Dinah, Penny and Julian. Later in life they adopted a young boy, Robert, aged two, who needed a home. They provided him with love and care for many years, and took him on endless outings. A great tragedy for Toni and Clive was the death of their son, Julian, in a light-plane crash in 1986.

Toni predeceased Clive on 20 November, 2008, also aged 93 years. Clive is survived by daughters, Dinah and Penny, adopted son Robert, son-in-law Patrick, daughter-in-law Carolyn, 11 grandchildren and five great-grandchildren.

Clive's first paper appeared in 1945 and was written while he was in the RAAF. It was an elegant derivation of the regular continued fraction expansions of $e^{1/k}$ and $e^{2/k}$, using definite integrals reminiscent of Hermite's proof of the transcendence of e. Clive subsequently went to Cambridge and studied geometry of numbers with L.J. Mordell. This resulted in four papers published in 1948–1951. His 1948 paper disproved a conjecture of Minkowski on the critical determinant of the region $|x|^p + |y|^p < 1$ and replaced it by a conjecture that was later proved by A.V. Malyshev and A.B. Voronetsky in 1977. His 1950 paper on the minimum of an indefinite binary quadratic form typified Clive's ability to present a topic in its simplest and most elegant form. His Cambridge PhD, awarded in 1949, was titled *The Minimum of a Binary Quartic Form* and was published in two papers in *Acta Math.* in 1951.

Clive was among several bright Cambridge number theory graduates, including David Burgess and Christopher Hooley, who joined the staff at University of Bristol during Hans Heilbronn's leadership. His arrival in 1956 to take up the headship of the University of Queensland Mathematics Department resulted in a rejuvenation of the department and of the mathematics library, but also caused a hiatus in his mathematical publication until 1978–1979, when he returned to a definitive study of the rational approximations to e. Two notes in the *Gaz. Aust. Math. Soc.* were published when Clive was in his eighties.

Clive's presidential address in *Proc. Royal Soc. Queensland* **78** (1966), 1–9, is a good example of his clarity of exposition.

R.F.C. Walters (MSc 1967) and K. R. Matthews (MSc 1966, PhD 1974) completed their degrees under his supervision.

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Some constraints on the existence of a perfect cuboid

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Abstract

The existence or otherwise of a perfect cuboid is a problem known since at least the time of Euler. This paper uses only the most elementary mathematics to arrive at three previously unpublished constraints on the dimensions of such a cuboid.

A perfect cuboid is a rectangular parallelepiped where all of the seven dimensions — length, breadth, height, the three face diagonals, and the space diagonal — are integers (if all but the space diagonal are integers, it is known as an Euler brick). Thus, if the edges are of lengths a, b, and c, we require solutions to

$$a^2 + b^2 = d_{ab}^2 \tag{1}$$
$$a^2 + c^2 = d_{ac}^2 \tag{2}$$
$$b^2 + c^2 = d_{bc}^2 \tag{3}$$
$$a^2 + b^2 + c^2 = d_s^2, \tag{4}$$

where a, b, c, d_{ab}, d_{ac}, d_{bc}, and d_s are all integers.

It is known that a perfect cuboid, if one exists, has one odd and two even edges (and hence, the space diagonal d_s is odd); that one edge is divisible by 9, and another by 3; that one edge is divisible by 16, and another by 4; that one edge is divisible by 5; and that one edge is divisible by 11 (for example [3], [4], [2], [5]).

We will prove three previously unpublished results regarding primitive perfect cuboids, that is, where the edges have no common factor: (a) that at least one edge must be divisible by 7; (b) that at least one edge must be divisible by 19; and (c) that the prime factors of the space diagonal d_s are all of the form $4n + 1$.

Theorem 1. *One edge of a perfect cuboid must be divisible by 7.*

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Proof. The table of squares mod 7 is

n	$n^2 \pmod 7$
0	0
1	1
2	4
3	2
4	2
5	4
6	1

The squares $\pmod 7$ consist of the set $\{0, 1, 2, 4\}$. We require, for a^2, b^2, $c^2 \pmod 7$, three numbers n_1, n_2, and n_3 from this set (with repetitions allowed) such that n_1+n_2, n_2+n_3, n_3+n_1 and $n_1+n_2+n_3$ are all members of the set. For example, we cannot have edges $a = 1 \pmod 7$ and $b = 2 \pmod 7$, since the squares have sum $5 \pmod 7$, which is impossible. By inspection, one can see that the only possible combinations from this set are

$$\{0,0,0\}, \{0,0,1\}, \{0,0,2\}, \{0,0,4\}, \{0,2,2\}, \{0,4,4\}.$$

All include 0, so at least one square is divisible by 7, and therefore at least one edge is divisible by 7 (since 7 is prime). □

Theorem 2. *One edge of a perfect cuboid must be divisible by 19.*

Proof. The reasoning is similar to that of the previous proof. The squares $\pmod{19}$ consist of the set $\{0, 1, 4, 5, 6, 7, 9, 11, 16, 17\}$. Remarkably, all acceptable sets $\{n_1, n_2, n_3\}$ include 0, therefore some n is divisible by 19, and since 19 is prime, at least one edge is divisible by 19. □

Theorem 3. *All prime factors of the space diagonal d_s are of the form $4n + 1$.*

Proof. The following follow directly from (1), (2), (3), and (4):

$$a^2 + d_{bc}^2 = d_s^2 \tag{5}$$

$$b^2 + d_{ac}^2 = d_s^2 \tag{6}$$

$$c^2 + d_{ab}^2 = d_s^2. \tag{7}$$

Consider a primitive perfect cuboid, that is, one where $\gcd(a, b, c) = 1$. The space diagonal d_s is odd, hence all prime factors of d_s are of the form $4n + 1$ or $4n + 3$. Fermat proved that all prime factors of the hypotenuse of a primitive Pythagorean triple (PPT) are of the form $4n+1$ (see, for example, [1, pp. 288–290]). Therefore, if any of (5), (6), or (7) are PPTs, we are done.

If (5), (6), and (7) are not primitive, then the terms in each of (5), (6), and (7) have a greatest common divisor greater than 1 (of course, the gcd is likely to be different in each case). Thus, if the factors of d_s include a prime, say p, of the form $4n + 3$, then this must divide the greatest common divisor in each case. It follows that a, b, and c must all have the divisor p. This contradicts the assumption that

$\gcd(a, b, c) = 1$. Hence, d_s contains no prime factors of the form $4n + 3$. Thus, since d_s is odd, all its prime factors must be of the form $4n + 1$. □

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Some results in the study of the continuous real functions

Dinu Teodorescu*

Abstract

In this paper we consider two functions $f, g\colon \mathbb{R} \to \mathbb{R}$, which satisfy a condition of the type $f(I) \cap g(J) \neq \varnothing$ where $I, J \subset \mathbb{R}$ are nonempty open intervals. We study some properties of the functions f and g about their continuity.

Let $f, g\colon \mathbb{R} \to \mathbb{R}$ be two real functions of one variable. In the first part of this paper we consider that the functions f and g satisfy the condition $f(I) \cap g(J) \neq \varnothing$ for all $I, J \subset \mathbb{R}$ nonempty open intervals. We have the following result:

Theorem 1. *If* $\lim_{x\to\infty} g(x) = \infty$*, then* f *is discontinuous at every point* $x \in \mathbb{R}$.

Proof. Let $x \in \mathbb{R}$ and n be a natural number, $n \geq 1$. Let $I_n = (x - \frac{1}{n}, x + \frac{1}{n})$ and $J_n = (n, \infty)$. We have $f(I_n) \cap g(J_n) \neq \varnothing$. It results that there exists $y_n \in f(I_n) \cap g(J_n)$. Consequently $y_n = f(u_n) = g(v_n)$ where $u_n \in I_n$ and $v_n \in J_n$. So we have obtained two sequences $(u_n)_n, (v_n)_n \subset \mathbb{R}$ with the properties $u_n \to x$ and $v_n \to \infty$. From $\lim_{x\to\infty} g(x) = \infty$, we obtain $y_n = g(v_n) \to \infty$. If f is continuous at the point x, then we have $y_n = f(u_n) \to f(x)$ and this is contradictory to the fact that $y_n \to \infty$. Thus the proof of Theorem 1 is complete. □

We can observe that we obtain the same conclusion as in Theorem 1 if we replace the hypothesis $\lim_{x\to\infty} g(x) = \infty$ with one of the following:

$$\lim_{x\to\infty} g(x) = -\infty, \quad \lim_{x\to-\infty} g(x) = \infty \quad \text{or} \quad \lim_{x\to-\infty} g(x) = -\infty.$$

Now we suppose that $f(I) \cap g(I) \neq \varnothing$ for every nonempty open interval $I \subset \mathbb{R}$. Then the following result holds.

Theorem 2. *If* f *and* g *are continuous on* $\mathbb{R}$*, then* $f = g$.

Proof. We use the same type of reasoning as in the proof of Theorem 1.

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Let $x \in \mathbb{R}$ and n be a natural number, $n \geq 1$. Let $I_n = (x - \frac{1}{n}, x + \frac{1}{n})$. We have $f(I_n) \cap g(I_n) \neq \varnothing$. It results that there exists $y_n \in f(I_n) \cap g(I_n)$. Consequently $y_n = f(u_n) = g(v_n)$ where $u_n \in I_n$ and $v_n \in I_n$. So we have obtained two sequences $(u_n)_n, (v_n)_n \subset \mathbb{R}$ with the properties $u_n \to x$ and $v_n \to x$. From the continuity of f and g at the point x, it results that $y_n = f(u_n) \to f(x)$ and $y_n = g(v_n) \to g(x)$. Consequently $f(x) = g(x)$ and the proof of Theorem 2 is complete. □

Finally, we present an application of Theorem 2.

Problem 1. Let x_0 be a real number. Find all the $\boldsymbol{C}^1$ functions $f: \mathbb{R} \to \mathbb{R}$ which satisfy the conditions:

(i) $f(I) \cap f'(I) \neq \varnothing$ for every $I \subset \mathbb{R}$ nonempty open interval;
(ii) $f(0) = x_0$.

To solve the problem, we first use Theorem 2 and we obtain $f = f'$ because f and f' are continuous. Then f is the solution of the Cauchy problem $y' = y$; $y(0) = x_0$, and consequently $f(x) = x_0 \exp(x)$.

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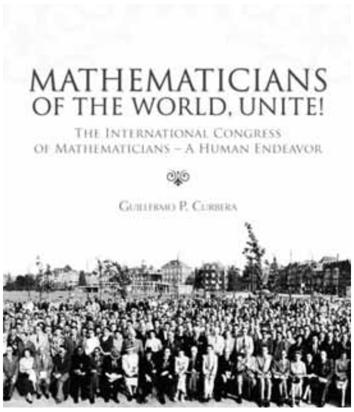
Book reviews

Mathematicians of the World, Unite!
The International Congress of Mathematicians – A Human Endeavor

Guillermo P. Curbera
A K Peters Ltd, 2009, ISBN 978-1-56881-330-1

This book describes the history of the International Congress of Mathematicians (ICM) and how mathematics has interacted with other disciplines. It also describes how political events (e.g. World Wars I and II, and the Cold War) and controversies have influenced the mathematical community and the ICMs.



The 25 congresses, from Zürich in 1897 to Madrid in 2006, are divided into five periods, according to historical events. *Early Times* (covering the congresses from Zürich (1897) to Cambridge (1912)) describes how the ICMs progressed and consolidated during that period. *Crisis in the Interwar Period* (congresses from Strasbourg (1920) to Oslo (1936)) shows how the ICMs struggled after World War I when nonscientific influences were very strong. *The Golden Era* (Cambridge, MA (1950) to Stockholm (1962)) was a period of great success for the ICMs. It was marked by the re-foundation of the International Mathematical Union (IMU), and a new era of international cooperation was built after World War II. *On the Road* (congresses from Moscow (1966) to Berkeley (1986)) was a period of increased attendance, with more than 4000 participants attending the Moscow congress. The last period, *In a Global World* (congresses from Kyoto (1990) to Madrid (2006)), saw developments such as the congress being held in the East for the first time, women as plenary speakers (apart from Emmy Noether in 1932), and the introduction of the Gauss Prize for work in the application of mathematics (the first being awarded to Kiyoshi Ito in Madrid in 2006).

At the end of each section, there are photographs of buildings and social life, details of awards and the chronology of landmarks in the history of the IMU. For each congress, there is a short history which includes details of plenary sessions and awardees of the Fields Medal, the Nevanlinna Prize and the Gauss Prize. Additionally, the histories of the first two awards are given in a separate chapter entitled 'Awards of the ICM'. The Fields Medal was first awarded in 1936, while the Nevanlinna Prize was first awarded in 1982.

I was impressed by two statements regarding the ICMs and mathematics. The first was made by Ludwig Faddeev (Russian Academy of Sciences in St Petersburg) at the closing ceremony of the Beijing congress (2002): 'The main idea of the ICM is to confirm the unity and universality of mathematics' (p. 292). The second came from Sir John Ball (the president of the IMU) at the opening ceremony in Madrid: 'Mathematicians do not own mathematics' (p. 297).

This is an excellent book, and the author is to be congratulated on his efforts in collecting references from many sources (congress proceedings, books, articles, notes and announcements in journals), especially old sources from the early times of the ICMs.

The next ICM will be held in Hyderabad, India, August 19–27, 2010.

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A Lifetime of Puzzles: Honoring Martin Gardner

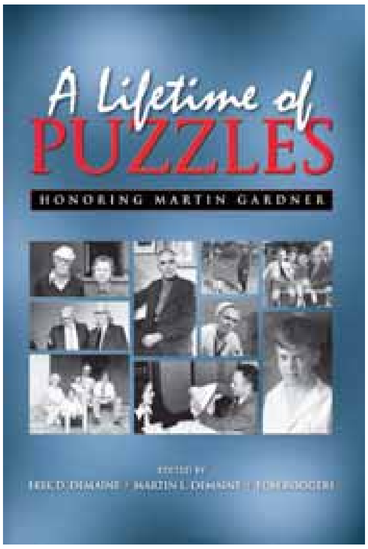
Erik Demaine, Martin Demaine and Tom Rogers (eds)
A K Peters Ltd, 2008, ISBN: 978-1-56881-245-8

Martin Gardner is best known to mathematicians as a highly successful populariser of mathematics, both through his 'Mathematical Games' column, which ran for 25 years in the magazine *Scientific American*, and through his many books, which are mainly collections of those columns. Some know him also as a designer of intriguing card and conjuring tricks, as well as the author of the best-seller *The Annotated Alice*, and as a persistent debunker of pseudo-scientific fads.

The volume under review is a *Festschrift* in honour of Martin Gardner's ninetieth birthday. He is now 95, and still going strong, having published his latest book in 2009. As well as his close connection with mathematicians, Gardner is equally highly regarded in the magic community. *Magician* is the American word for what we call a conjurer, but Gardner is not just a literal magician in this sense, but also a figurative one through the magic of his words, so I shall adopt the American usage.

The book contains 25 short articles, three of which are specifically about Martin Gardner and his influence on the worlds of magic and mathematics. Many of the others, including contributions from Persi Diaconis, Ron Graham, Roger Penrose, David Klarner, Solomon Golomb, Raymond Smullyan and Bill Gosper, include revealing anecdotes about Gardner and his peculiar ability to interest young people in mathematics.

There are three historical articles. Two describe the life and times of Luca Pacioli (ca. 1445–1517) who published the first work in Europe describing magic and card tricks, *De Viribus Quantitatis*, (On the Powers of Numbers, ca. 1500). The other describes the remarkable story of the world's first puzzle craze, Tangram.



Several articles describe astonishing card tricks — astonishing because they depend not on sleight-of-hand, but on combinatorial properties of permutations. Colm Mulcahy, for example, describes an apparently well mixing shuffle which returns the pack to its original order in exactly four shuffles. Other areas of recreational mathematics covered include various types of mazes, two- and three-dimensional dissections and new graph theoretic paper-and-pencil games.

The areas of mathematics that most interest Gardner are combinatorics and logic. Both topics are covered in the book. For example, there are articles on symmetric graphs, magic squares, scheduling tennis doubles competitions, continued fractions and logical surprises related to Gödel's Incompleteness Theorem.

This book contains no deep mathematical theorems, but for fans of Martin Gardner and for all concerned with communicating to the public the fascination of mathematical research, it is an ideal bedside book.

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Topics in Graph Theory: Graphs and Their Cartesian Products

Wilfried Imrich, Sandi Klavžar and Douglas F. Rall
A K Peters Ltd, 2008, ISBN: 9-781568-814292

This book discusses graph theory in the context of a survey of Cartesian products of graphs. The intent is similar to that of Holton and Sheehan [5] who use the Petersen graph as a centrepiece for exploring graph theory.

Sabidussi [6] presented the foundations of the study of products of graphs in 1960, and gave definitions of several different products of two graphs. Products of graphs are not often discussed in contemporary texts on graph theory. Neither Diestel [3] nor Bollobás [1] mention them, and Bondy and Murty [2] mention them only briefly.

Imrich, Klavžar and Rall focus on the Cartesian product, and in 18 short chapters cover typical graph theory topics such as connectivity, planarity, crossing numbers, Hamiltonicity, colouring, domination, and independence, as well as some ideas from algebraic graph theory. Each chapter ends with a dozen or so exercises for which there are nearly 40 pages of hints and solutions. Many of the exercises fill in details required to understand the proofs of the theorems.

Let G and H be graphs with m and n vertices respectively. Informally, the Cartesian product is a graph on an $m \times n$ grid of vertices, with n copies of G in one direction superimposed on m copies of H in the other.

More formally, the Cartesian product $G \square H$ is the graph whose vertex set and edge set are as follows. The vertex set $V(G \square H)$ is simply the Cartesian product $V(G) \times V(H)$. We say that $[(g_1, h_1), (g_2, h_2)]$ is an edge if and only if either $g_1 = g_2$ and $[h_1, h_2]$ is an edge in H, or, $h_1 = h_2$ and $[g_1, g_2]$ is an edge in G.

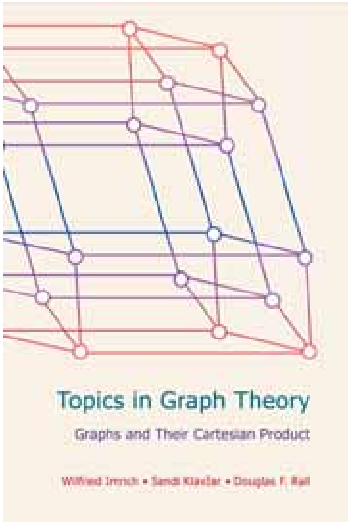
To convey the flavour of the book, we will describe a few selected chapters.

In Chapter 2, the authors show how the popular Towers of Hanoi puzzle can be modelled using Cartesian products of graphs. This puzzle has generated a considerable amount of mathematical research; see Hinz [4] for a review. The difficulties arise when there are more than three pegs and you want to find the smallest number of moves to complete the puzzle. So we go from a well-known puzzle to a mathematical model using Cartesian products of graphs, and, before you know it, you are at the frontiers of knowledge. This trip from the known to the unknown contains all the ingredients for an inspiring lecture.

In Chapter 5 the authors discuss connectivity of a Cartesian product, of which there are two types. Vertex connectivity is the minimum number of vertices whose deletion will disconnect a connected graph, and edge connectivity is the minimum number of edges whose deletion will disconnect a connected graph. They aim to show that the vertex connectivity and the edge connectivity of a Cartesian product depend only on the connectivities, the minimum degrees, and the orders of the factors. The authors use the concepts of separating sets and disconnecting sets to gain an understanding of connectivity, and these form the basis for their proof.

Tower of Hanoi (photo by Frances Mills)

The only other concept used is that of a fibre, which is the Cartesian product of a single vertex with a graph. Thus the authors accomplish their task with a minimum of mathematical machinery in a well laid-out and easy to understand style.



Prime factorisation is discussed in Chapter 15 wherein it is shown that connected graphs have unique prime factorisations. Analagous to prime integers, a graph is prime if it can not be represented as a product of nontrivial graphs. Surprisingly, factorising a connected graph can be done in linear time, and although the algorithm is not given in detail, the authors do sketch the basic idea and point the reader to a recent paper. These ideas are revisited in the final chapter with a different proof of the unique prime factorisation of connected graphs together with a very simple factorisation algorithm which does not run in linear time. In the remainder of Chapter 15, the structure of a prime factorisation is then used to describe the structure of a graph's automorphism group which is the subject of the intermediate chapters.

The format and style is ideally suited to an honours or post-graduate seminar series covering one chapter per session. *Topics in Graph Theory: Graphs and their Cartesian Products* would be a useful addition to any university library.

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AMSI News

Geoff Prince*

I had the pleasure of attending the CSIRO's Big Day In at Macquarie University on 11 and 12 February. The AMSI vacation scholars have been participating in the Big Day In for a number of years thanks to the generosity of CSIRO Mathematics, Informatics and Statistics. It is a tremendously upbeat event and a real credit to CSIRO. The quality of the presentations by the AMSI students was outstanding; a strong assessment but completely justified. The slideshows were high quality, the deliveries confident and fluent and, importantly, the discussions were enthusiastic and intelligent. It was clear to me that every one of these young undergraduates had spent a very productive summer on their scholarships. I was also very pleased to see so many of the supervisors there to support their students.

February is also the meeting season for AMSI and from 16 to 18 February I attended meetings of the National Committee for Mathematical Sciences, the Australian Council of Heads of Mathematical Sciences and the AMSI member and Board meetings. On one of the afternoons we had a briefing on the national curriculum, both K to 10 and the senior curriculum. I urge all of you to read the details once they are announced and to respond if you wish. The processes behind the development are open and consultative and the tertiary mathematics community has been involved from the start.

One of the highlights of the three days was the presentation by Celia Hoyles, former UK Government Advisor on Mathematics. Celia briefed us on the various measures put in place that have put the mathematical sciences on the front foot in England in particular. I'm sure that we can learn a lot from her experience — the challenge will be to convince the Australian government to act! The video of Celia's presentation can be found at http://www.amsi.org.au.

And finally there was the AMSI Summer School. Thanks to the director, Grant Cairns, and all my old friends at La Trobe for delivering another success in this flagship AMSI program. Both the students and the lecturers were in high spirits every time I saw them and I personally believe that this event is a significant factor in the increased cohesion amongst early career researchers around the country, evidenced by the enthusiasm and camaraderie at AustMS annual meetings, for example.

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I'm glad that every month isn't a February, but it's certainly a month when AMSI's virtues are self evident.

I completed a BSc (Hons) and secondary Dip Ed at Monash in the 1970s and moved to La Trobe where I took out a PhD in 1981 in geometric mechanics and Lie groups. I did a postdoc at the Institute for Advanced Study in Dublin.

I've taught at RMIT, UNE and La Trobe where I've been Head of Department a couple of times this decade. I worked at AMSI in 2004 through to 2006 in part as executive director to Garth Gaudry and I oversaw the introduction of the AMSI/ICE-EM Access Grid Room project.

My research interests lie mainly in differential equations and differential geometry and I work with friends in Europe: Mike Crampin, Willy Sarlet, Olga Krupkova and Demeter Krupka.

My partner is a mathematician and we have two children with a refreshing lack of interest in mathematics. On the margins I brew beer and ride a bike.

I'm a proud fellow of the Society, currently a council and steering committee member.

News

General News

ARC's College of Experts

There is a new panel structure now in place for the ARC's College of Experts. Please note that there are also new members of the College from the mathematical sciences (or cognate area).

The webpage http://www.arc.gov.au/about_arc/expert.htm shows that there are now five discipline panels:

- Biological Sciences and Biotechnology (BSB)
- Engineering, Mathematics and Informatics (EMI)
- Humanities and Creative Arts (HCA)
- Physics, Chemistry and Earth Sciences (PCE)
- Social, Behavioural and Economic Sciences (SBE)

On EMI, we have the following members from mathematical sciences:

- Professor Tony Guttmann, The University of Melbourne
- Professor Vladimir Gaitsgory, University of South Australia
- Professor Geoffrey McLachlan, The University of Queensland
- Associate Professor Jacqui Ramagge, University of Wollongong

On PCE, we have

- Professor Igor Bray, Curtin University
- Professor Peter Bouwknegt, Australian National University
- Professor Ian McArthur, University of Western Australia

Remember that both Field of Research (FoR) codes and keywords have an effect on how your proposal is processed by the ARC. The FoR codes influence the choice of panel to which your proposal may be assigned. The keywords influence the choice of assessors to whom the proposal is sent for review. The two together may influence the assignment of multidisciplinary proposals that span more than one panel.

CSIRO

CSIRO Mathematics, Informatics and Statistics (formerly CSIRO Mathematical and Information Sciences) Chief Scientist Frank de Hoog has been elected as a Fellow of the Australian Academy of Technological Sciences and Engineering (ATSE). In November, Frank was honoured at a ceremony in Brisbane where he received the Fellowship for his exceptional insights and major impact on key industrial processes through mathematical research.

Institute for Geometry and its Applications

The Institute for Geometry and its Applications (School of Mathematical Sciences, University of Adelaide, http://www.iga.adelaide.edu.au/) announces an exciting special year in Geometry in 2010! Special events include several IGA lecture series by eminent mathematicians possibly including Nigel Hitchin (FRS, Oxford) and Mohammed Abouzaid (Clay Research Fellow, MIT).

Also, three new positions in 2010 (see AustMS jobs site).

Monash University

Theoretical Astrophysics Summer School. Monash University proudly hosted the ASA/ANITA Summer School on theoretical astrophysics, between 17 and 22 January 2010.

This was sponsored by the Astronomical Society of Australia and organised by the Australian National Institute for Theoretical Astrophysics. For 2010 the topic was Stellar Nucleosynthesis and the School was hosted by the Stellar Interiors and NucleoSynthesis group (SINS) within the Centre for Stellar and Planetary Astrophysics.

The School consisted of 29 postgraduate and 13 undergraduate students from around Australia (including two from New Zealand). Lecturers were mostly from the SINS group at Monash, and also included some prestigious international speakers. Topics covered ranged from the quantum mechanics of nuclear reactions, through stellar structure and evolution, to X-ray burst and the composition of extremely metal-poor stars.

Workshop on Geometric Analysis and General Relativity. Monash University School of Mathematical Sciences is proud to have hosted a workshop on Geometric Analysis and General Relativity, from 22 to 28 January 2010. The workshop, which was supported by contributions from AMSI, NSF and ARC grants and the Monash School of Mathematical Sciences, featured a number of prominent local and international researchers, including Thomas Leistner, Ben Andrews, Charles Baker, Julie Clutterbuck, Bryan Wang, Shing-Tung Yau, Richard Schoen, Mu-Tai Wang, Xiao-Dong Wang, Youguang Shi, Jan Metzger, Lars Andersson and Shiu-Yuen Cheng.

It was particularly pleasing to welcome the participation of Shing-Tung Yau and Rick Schoen — their 1979 proof of the Positive Mass Theorem marked a watershed in the development of geometric analysis techniques in general relativity.

Shortly after the Workshop concluded, it was announced that, together with Dennis Sullivan (SUNY Stonybrook), Yau has been awarded the prestigious Wolf Prize for 2010, ‘for his work in Geometric Analysis that has had a profound and dramatic impact on many areas of geometry and physics’.

Stories of Australian Science 2010

The Society has received a message advertising paid opportunities for contributions to be placed in *Stories of Australian Science 2010*. The fees charged for placement range from $650 for a story to $1800 for a full page advertisement.

While not wishing to push paid advertising to our members who may not want this information, we are aware that some of you may want to know about this opportunity, which is designed to create a presence in a publication that is sent to science journalists and television producers around the world.

Please email secretary@austms.org.au or visit the website www.scienceinpublic.com.au/blog/storybook for full particulars.

University of Adelaide

The Institute for Geometry and its Applications hosted Professor Frank Kutzschebauch's (University of Berne, Switzerland) series of lectures (a total of eight hours) in January 2010. The topic was 'Group Actions in Complex Analytic Geometry'.

Dr Mohammed Abouzaid (Clay Research Fellow, MIT) will be conducting 10 hours of lectures on 'Introduction to Mirror Symmetry and the Fukaya Category' during 14–22 July 2010.

See http://www.iga.adelaide.edu.au/lectureseries.html for updates.

University of Queensland

Dr Murray Elder and Dr Stephan Tillmann held a successful conference entitled 'New Directions in Geometric Group Theory'. The conference attracted around 50 mathematicians from across Australia and the globe, and featured not just the usual research talks, but a highly entertaining public lecture, two mini-courses and several 'what is' talks aimed at making difficult research topics accessible to our graduate students.

Completed PhDs

La Trobe University

- Dr Davide Farchione, *Interval estimators that utilize uncertain prior information*, supervisors: Paul Kabaila and Luke Prendergast.
- Dr Belinda Trotta, *Axiomatisability of topological prevarieties*, supervisors: Brian Davey and Marcel Jackson.

Macquarie University

- Dr Ji Li, *Boundedness of singular integrals with non-smooth kernels and Hardy spaces associated with operators*, supervisor: Professor X.T. Duong.

Monash University

- Dr Anthony Morrison, *Cloud seeding over Tasmania: a long-term evaluation and modeling plausibility study*, supervisor: Associate Professor Steven Siems.
- Dr Mick Pope, *Regimes of the North Australian wet season*, supervisor: Professor Michael Reeder.
- Dr Martin Robinson, *Turbulence and viscous mixing using smoothed particle hydrodynamics*, supervisor: Professor Joseph Monaghan.
- Dr David Alexander May, *The implicit material point method for variable viscosity stokes flow*, supervisor: Professor Louis Moresi.
- Dr Juan Carlos Martinez-Oliveros, *Multi-wavelength analysis in flare seismology and the role of magnetic field dynamics in the seismicity of solar active regions*, supervisor: Professor Paul Cally.

University of Adelaide

- Dr Nathaniel Jewel, *The development and stability of some non-planar boundary-layer flows*, supervisors: Jim Denier, Peter Gill.

University of Queensland

- Dr Farah Abdullah, *Numerical methods for fractional differential equations and their applications to system biology*, supervisors: Professor Kevin Burrage.
- Dr Vivien Challis, *Multi-property topology optimisation with the level-set method*, supervisors: Dr Anthony Roberts.
- Dr Gareth Evans, *Parallel and sequential Monte Carlo methods with applications*, supervisors: Professor Dirk Kroese.
- Dr Justin Zhu, *Statistical analysis of high-dimensional gene expression data*, supervisors: Professor Geoffrey McLachlan.

University of South Australia

- Dr Paul Haynes, *Solutions of a selection of partial differential equations with application to micro-pore diffusion and fixed-bed adsorption*, supervisors: Dr Jorge Aarao, Mr Basil Benjamin, Professor Phil Howlett.
- Dr Marie Thandrayen, *Mixture models in capture–recapture studies*, Dr Yan Wang.

University of Wollongong

- Dr Damian Collins, *The performance of estimation methods for generalized linear mixed models*, supervisor: Ken Russell.
- Dr Russell Familar, *Scale effects in multilevel modeling*, supervisor: David Steel.
- Dr Maureen Morris, *Evaluating university teaching and learning in an outcome-based model: replanting bloom*, supervisors: Anne Porter and David Griffiths.

Awards and other achievements

Monash University

- Dr Daniel Price has been awarded a Victorian Young Tall Poppy Science Award.
- Dr Maria Athanassenas has been awarded Vice-Chancellor's Award for Excellence in Honours Supervision.
- Professor Michael Reeder has been awarded a three-year research grant of about AUD$1.6 million, from the National Oceanographic Partnership Program in Washington, DC. The title of the research project is *Initialization, Prediction, and Diagnosis of the Rapid Intensification of Tropical cyclones using the Australian community Climate and Earth System Simulator, ACCESS*.
- Dr Duncan Galloway has been awarded a 2009 Australian Research Council Future Fellowship for his project entitled *High-energy probes of dense matter and distorted spacetime*.
- Dr Ian Wanless has been awarded a 2009 Australian Mathematical Society Medal. The medal is awarded to a member of the Society under the age of 40 years for distinguished research in mathematical sciences.
- Professor John Lattanzio has been invited to serve on the panel of galactic astronomy for the Space Telescope Science Institute's cycle 18 Hubble Space Telescope grants.

University of South Australia

- Professor Phil Howlett and Professor Charles Pearce (University of Adelaide) have been awarded an ARC Discovery Grant for 'Perturbation and approximation methods for linear operators with applications to train control, water management and evolution of physical systems'. The total funding is $195 000.

University of Western Australia

- Professor Cheryl Praeger has been named WA Scientist of the Year for 2009.

University of Western Sydney

- Dr Stephen Lack has been awarded a 2009 Australian Mathematical Society Medal.

University of Wollongong

- Duangkamon Baowan was a joint winner of best PhD thesis by a Thai citizen (supervisors Barry Cox, Jim Hill and Natalie Thamwattana).

Appointments, departures and promotions

Charles Sturt University

- Sharon Nielsen has recently joined the School of Computing and Mathematics. Sharon's previous position was as a statistical consultant with the Biometrics group within the NSW Department of Industry and Investment. Sharon's role at CSU will encompass a lectureship in statistics within the school as well as a leadership role within the Quantitative Consultancy Unit.

Deakin University

- Dr Gleb Beliakov has been promoted to Associate Professor, effective 1 January 2010.

La Trobe University

- Chris Ormerod has accepted a position as Associate Lecturer from February 2010.
- Yuri Nikolayevsky has accepted a position as Lecturer from February 2010.
- Siew Pang Chan has accepted a joint position with the Faculty of Health Sciences from February 2010.
- Todd Niven has been appointed as a postdoctoral fellow on the ARC Discovery grant held by Marcel Jackson and Brian Davey.

Macquarie University

- Dr Frank Valckenborgh has been appointed as Mathematics Lecturer.

Monash University

- Dr Jonathan Keith commenced with the School on 4 January 2010. Jonathan's research interests are in Bayesian methods, bioinformatics and genetic epidemiology.
- Dr Dietmar Dommenget commenced with the School on 4 January 2010. Dietmar's research interests focus on the understanding of the physical climate system and variability.
- Dr Tianhai Tian has left the University and moved to Glasgow University, Scotland.
- Dr Boris Buchman has left the University and moved to the Australian National University, Canberra.

Murdoch University

- Dr Leanne Scott has resigned.
- Doug Fletcher has been appointed as Lecturer for a one-year term.

Swinburne University of Technology

- Dr Nian Li retired from his position as Lecturer in Mathematics at Swinburne University of Technology on 31 January.

University of Adelaide

- Dr Pedram Hekmanti has been appointed as an IGA postdoctoral fellow, starting on 1 April 2010).
- Dr Snigdhayan Mahanta has been appointed as an IGA postdoctoral fellow, starting on 1 July 2010.

University of Ballarat

- Prabhu Manyem has taken up a three-year position as Professor at the Department of Mathematics, Shanghai University, Baoshan campus, starting on 15 November 2009.
- Professor Sidney Morris is retiring on 16 April 2010.
- Dr David Yost, Dr Adil Bagirov, and Dr Zhiyou Wu have been promoted to Associate Professors.

University of Canberra

- Dr Scott H. Murray has been appointed as Assistant Professor, commencing in 2010.
- Dr Sergey M. Sergeev has been appointed as Assistant Professor, commencing in 2010.

University of Queensland

- Geoff Goodhill has been promoted to Professor.
- Joseph Grotowski has been promoted to Associate Professor.
- Dr Phil Isaac has been promoted to Lecturer.
- Associate Professor Joseph Grotowski has taken over from Professor Geoff McLachlan as Head of Mathematics at UQ from 1 January 2010.

University of South Australia

- Dr Gerald Cheang has been appointed as Senior Lecturer in statistics.
- Mr Davide Farchione has been appointed as Lecturer in statistics.
- Dr Charlie Mao has been appointed as Senior Research Fellow.
- Dr Mahmood Golzarian has been appointed as Research Associate.
- Dr John Hewitt has retired.
- Dr Zen Lu has resigned from the School of Mathematics and Statistics.

University of Southern Queensland

- Dr Ash Plank has accepted voluntary separation and left the university in November 2009 after 19 years of service.

- Dr Amirul Islam has been appointed as Senior Lecturer. His research interests are both in biostatistics and genetic statistics, especially risk modelling, linear structural equation modelling, genome wide association studies and associations of single nucleotide polymorphisms with disease phenotypes.

University of Sydney

- John Ormerod has started a lectureship in statistics.
- Ruibin Zhang has been promoted to Professor.
- Shelton Peiris has been promoted to Associate Professor.
- Professor Neville Weber has taken up the duty of Head of School, taking over from Professor Nalini Joshi.
- Professor Norman Dancer has been awarded an honorary Doctor of Science from University of New England.

University of Technology, Sydney

- Tim Langtry has been promoted to Associate Professor but has finished his term as Head of Department. The new Head of Department is Beverly Moore.

University of Western Australia

- Pablo Spiga, a postdoctoral Research Associate, commenced in October 2009.
- Simon Guest, a postdoctoral Research Associate, commenced on 1 January 2010.
- James Springham, a postdoctoral Research Associate, commenced on 4 January 2010.

University of Wollongong

- Barry Cox has been promoted to Senior Lecturer.
- Aidan Sims has been promoted to Senior Lecturer.

New Books

Monash University

- Abramov, V. (2009). *Queueing Systems, Networks and Telecommunication Systems: Asymptotic for Queueing System and Networks with Application to Telecommunications.* Lambert Academic Publishing.

Conferences and Courses

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

Adelaide Phylogenetics Conference, Adelaide Phylogenetics Workshop

Conference
Date: 12–16 April 2010
Venue: Port Elliot, South Australia
Web: http://www.adelaide.edu.au/acad/events/biomaths10/

Workshop
Date: 5–10 April 2010
Venue: The University of Adelaide
Web: http://www.adelaide.edu.au/acad/events/phylo_workshop10.html

The third annual Adelaide Phylogenetics Conference (formerly known as the Mathematical and Evolutionary Biology Conference) will be held on Port Elliot beachfront, 12–16 April 2010. It follows the successful meetings held in Blanche Cave, Naracoorte 08, and Pt Elliot 09.

This meeting series aims to bridge the current gap between evolutionary biologists and mathematicians in Australia, and overseas, by providing a relaxed, informal setting (with just 50 attendees) to encourage the discussion of new results and methods. The conference is designed to allow maximum student/academic interaction, and contains a session on the analysis of datasets during the meeting itself. The emphasis is on the development and application of advanced new analytical methods, and building trans-disciplinary collaborations. Topics covered at the previous meeting include: Phylogenetics and Networks; Mathematical methods and Algorithms; Macroevolution; Evolutionary rates and dates; Genome analysis; Bioinformatics; Human evolution; and Disease.

There are only a few seats remaining for the Phylogenetics workshop. This extremely successful workshop is aimed at graduate students featuring an intensive four-day hands-on training, from four international experts in leading software packages for the analysis of genetic data. Registration for this workshop gains you free entry to the Port Elliot meeting and participants are strongly encouraged to attend and present.

Visit the official website for further details.

Call for Contributions:
Educational Interfaces between Mathematics and Industry

Date: 19–23 April 2010
Venue: Lisbon, Portugal
Web: http://www.cim.pt/eimi/
Contact: Gail FitzSimons (gail.fitzsimons@education.monash.edu.au)

Call for papers: 10th Australasian Conference on Mathematics and Computers in Sport

Date: 5–7 July 2010
Venue: Crowne Plaza, Darwin
Web: http://www.anziam.org.au/The+10th+Australasian+Conference+on+Mathematics+and+Computers+in+Sport
Directors: Dr Anthony Bedford (anthony.bedford@rmit.edu.au)
A/Prof Ian Tim Heazlewood (ian.heazelwood@cdu.edu.au)

You are cordially invited to submit papers for the 10th Australasian Conference on Mathematics and Computers in Sport. This conference will bring together sports scientists, mathematicians and statisticians who are interested in

- the use of computers in sport
- statistics and statistical modelling in sport
- mathematical modelling in sport
- teaching of mathematics, computers and sport
- the application of these to improve coaching and individual performance.

Paper Submissions: Abstracts (up to 300 words) should be emailed to Dr Anthony Bedford (see header for address) by 29 January 2010, and full papers by 20 March 2010. Templates are available on the website. All submitted papers will go through peer reviewing.

Keynote: Professor Ray Stefani, California State University. Ray has contributed a number of papers and chapter on prediction, modelling and analysis on sport. We are proud to announce Ray as our opening-day keynote speaker.

Student Awards: This year we are proud to announce the Neville De Mestre Award for the best student presentation. Students will be rated by the scientific committee on presentation clarity, technical aspects of paper, paper quality and response to questions. Student scholarships are also available for travel. Please contact the conference directors (see above for addresses).

Dynamics Days Asia Pacific 6 (DDAP6)

Date: 12–14 July 2010
Venue: School of Mathematics and Statistics, UNSW
Web: http://conferences.science.unsw.edu.au/DDAP6/DDAP6.html

Dynamics Days Asia Pacific (DDAP) is a regular conference rotating among the Asia–Pacific countries every two years. Its purpose is to bring together researchers world-wide to discuss the most recent developments in nonlinear science. It also serves as a forum to promote regional as well as international scientific exchange and collaboration. The conference covers a variety of topics in nonlinear dynamics including ergodic theory, algebraic dynamics, pattern formation, nonequilibrium physics, biomathematics, complex networks, econo-physics, and quantum/classical chaos. DDAP started in Hong Kong in 1999, and was subsequently held in China, Singapore, Korea and Japan.

DDAP6 is also a satellite meeting of StatPhys24 (Cairns, 19–23 July 2010). It has received financial support from COSNet, Asia Pacific Center for Theoretical Physics and the School of Mathematics and Statistics, UNSW.

For further details, please see the conference website.

1st Conference of the European Society for Mathematics and the Arts

Date: 19–20 July 2010
Venue: Institut Henri Poincaré, Amphi Hermite, Paris
Contact: C.P. Bruter (bruter@univ-paris12.fr), Hervé Lehning (lehning@noos.fr)

Description: Contributions to the Conference will belong to one of the four sections:

- static works (paintings, sculpture, architecture);
- cinematic works (videos, films, installations);
- tool in math art (softwares, 3D printers);
- education, history and philosophy in and through math art.

Scientific and Artistic Committe: François Apéry (Mulhouse), Luc Bénard (Montréal), Claude Bruter (Paris), Jean Constant (Santa Fe), Michele Emmer (Rome), Michael Field (Houston), Jos Leys (Anvers), Dmitri Kozlov (Moscou), Konrad Polthier (Berlin).

Late date for registration: 15 May 2010.

STATPHYS 24: The XXIV International Conference on Statistical Physics of the International Union for Pure and Applied Physics

Date: 19–23 July 2010
Venue: Convention Centre, Cairns, Queensland
Web: http://www.statphys.org.au/

The STATPHYS Conference series takes place every three years in a different continent to enhance the international relevance and visibility of the leading world event in the broad field of Statistical Physics and all its interdisciplinary developments.

Recent meetings have been held in GENOVA (Italy), BANGALORE (India), CANCUN (Mexico) and PARIS (France). STATPHYS 24 will be the first time this event is held in Australia and only the second time in the southern hemisphere. The entire Australian scientific community enthusiastically supports this meeting and warmly welcomes all international participants.

According to tradition, the highest international recognition in the field of Statistical Physics, the Boltzmann Medal, will be awarded at this meeting. In addition several satellite meetings will be held along with the main event, adding to the scientific value of the meeting.

The lineup of plenary and invited speakers will feature two Nobel Prize winners, as well as a Fields Medallist, and numerous other distinguished speakers from around the world. The confirmed plenary speakers for StatPhys24 are: R. Baxter, M. Cates, S. Ciliberto, B. Eynard, D. Fisher, M. Freedman, W. Ketterle, H. Nishimori, S. Sachdev, M. Wang and C.N. Yang.

Please visit the website for more information and registration details.

International Congress of Mathematicians: ICM2010

Date: 19–27 August 2010
Venue: Hyderabad International Convention Centre, Hyderabad, India
Web: www.icm2010.org.in

The invited speakers at the ICM 2010 have now been announced:
see http://www.icm2010.org.in/speakers.php.

There are two invited Sectional Speakers from Australia: Professors Norm Dancer and Professor Brendan McKay.

There are posters for ICM2010 at http://www.icm2010.org.in/posters.php. Feel free to print them out and display them at appropriate locations.

Vale

Emeritus Professor Evan James Williams

The death of Emeritus Professor Evan James Williams of the University of Melbourne, a long-standing member of the Australian Mathematical Society, was announced in *The Age* on 29 January. The funeral service took place at St Luke's Uniting Church on Wednesday 3 February.

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.

Dr Mohammed Abouzaid; MIT; 14–22 July 2010; – UAD; –
Dr Andrew Byrne; University College Cork, Ireland; 21 September 2009 to 30 June 2010; cryptography; RMT; Kristine Lally.
Dr Florica Cirstea; University of Sydney; 14 July 2008 to 14 July 2011; applied and nonlinear analysis; ANU; Neil Trudinger
Dr Robert Clark; University of Wollongong; 1 July 2008 to 1 July 2011; statistical science; ANU; Alan Welsh
Dr Ashraf Daneshkhah; Bu-Ali Sina University; 15 October 2008 to 24 June 2010; –; UWA; Cheryl Praeger
Dr David Dereude; Universite De Valenciennes; 01 January 2010 to 31 August 2010; –; UWA; Adrian Baddeley

Prof Alexandru Dimca; Universite de Nice Sophia Dieudonne; 1 to 28 March 2010; theory of local Systems on hyper plane complements and configuration spaces; USN; G.I. Lehrer

Prof John Guckenheimer; Cornell University; 16 February 2010 to 28 March 2010; dynamical systems; USN; M. Wechselberger

Mr Christian Habighorst; Universität Münster; 16 November 2009 to 16 May 2010; random walks on p-adic Lie groups; USN; J. Parkinson

Prof Khoi Le Hai; NTU, Singapore; 28 February to 4 March 2010; –; UNE; Gerd Schmalz

Prof Mark Handcock; University of Washington; 30 November 2009 to June 2010; –; UWA; Adrian Baddeley

Wei Jin (student); Central South University, China; 20 September 2008 to September 2010; –; UWA; Cheryl Praeger

Dr Markus Kirschmer; RWTH Aachen University Germany; 1 October 2009 to 15 April 2010; computational group theory; USN; J.J. Cannon

Prof Hideo Kozono; Tohoku University; 5–24 March 2010; nonlinear analysis; N.C. Weber

Prof Frank Nijhoff; University of Leeds; 22 March 2010 to 18 April 2010; discrete integrable systems; USN; N. Joshi

Prof Daniel Nakano; University of Georgia; 1 February 2010 to 30 June 2010; classical Lie superalgebras, cohomological transfer theorems; USN; G.I. Lehrer

Prof Makato Ozawa; Komazawa University, Japan; 1 April 2009 to 31 March 2011; –; UMB; Prof Hyam Rubinstein

A/Prof Andrei Ratiu; Istanbul Bilgi University; 21 September 2009 to 31 August 2010; –; UMB; A/Prof Craig Hodgson

Emily Riehl; University of Chicago; 12 November 2009 to 26 March 2010; –; MQU; A/Prof Dominic Verity

Shujiao Song; Tsinghua University; 1 February 2010 to 31 July 2010; –; UWA; Cai Heng Li

Moharram Irandmusa; Shahid Behestiti University; March 2010 to September 2010; –; UWA; Cheryl Praeger

A/Prof Kay O'Halloran; Interactive and Digital Media Institute Singapore; 02 August 2010 to 28 January 2011; –; UWA; Kevin Judd

Mr Kyle Pula, PhD student; Colorado, USA; 31 August 2010; combinatorics and non-associative algebra, transversals of Latin squares; Ian Wanless

Dr Lyudmyla Velychko; Ukraine; December 2009 to March 2010; –; MQU; Prof Paul Smith and Dr Elena Vinogradova

Prof Xiaoyan Zhang; Shandong University, China; 13 January 2010 to 13 January 13 2011; –; UNE; Prof Yihong Du

2010 AustMS Early Career Workshop

Date: 25–26 September 2010
Venue: Rydges Oasis Resort, Caloundra, Queensland
Web: http://www.maths.uq.edu.au/~tillmann/austms10/
Organisers: Bronwyn Hajek (University of South Australia), Anthony Henderson (University of Sydney), Stephan Tillmann (University of Queensland)

The second Australian Mathematical Society Early Career Workshop will be held at Rydges Oasis Resort, Caloundra on 25–26 September 2010, from Saturday afternoon to lunch on Sunday. This is the weekend before the Society's Annual Meeting, to be held at the University of Queensland.

The Early Career Workshop will consist of short research presentations by leading young researchers, and advice on topics such as grant applications and engaging with or working in industry in the mathematical sciences.

Research speakers: Thomas Lam (University of Michigan), Scott McCue (Queensland University of Technology), Jean Yang (University of Sydney).

Advice speakers: Tony Guttmann (University of Melbourne), John Henstridge (Data Analysis Australia), Cheryl Praeger (University of Western Australia).

Accommodation for Saturday night, meals during the Workshop, and transport to the opening reception on Sunday at UQ will be provided free of charge to all registered participants. Participants can also attend a special Early Career lunch during the Annual Meeting, attended by the plenary speakers.

Registration is free for any registered participant in the Society's 2010 Annual Meeting who is either a current postgraduate student in the mathematical sciences at an Australian university or research organisation, or is in the early stages of a career in the mathematical sciences in Australian academia or industry. 'Early stages" means up to approximately five years (full-time equivalent) since award of postgraduate degree.

Numbers for the Workshop are strictly limited, so those who wish to attend are advised to indicate their interest as soon as possible, by ticking the Early Career Workshop box when registering for the Annual Meeting at http://www.smp.uq.edu.au/austms2010/. Those who are successful will receive a confirmation email with more details.

The Workshop is sponsored by the Australian Mathematical Sciences Institute and the Australian Mathematical Society.

54th Annual Meeting of the Australian Mathematical Society

www.smp.uq.edu.au/austms2010/

The 54th annual meeting of the Society will be held at the University of Queensland from Monday 27 September to Thursday 30 September 2010. The location is the beautiful St Lucia campus, which is bounded on three sides by the Brisbane river, and which is a 12-minute bus ride or 20-minute City-Cat ferry ride from the heart of the city.

The conference will take the usual format, with a welcome reception and registration on Sunday afternoon, 26 September; official opening on Monday morning; a mathematics education afternoon for teachers on Tuesday, followed by a public lecture on π by Jonathan Borwein; the Annual General Meeting on Wednesday afternoon, followed by the conference dinner that evening. The conference is expected to close by 4 pm on Thursday 30 September.

An Early Career Workshop precedes the conference, on 25–26 September.

The plenary speakers include:

James Borger, *Australian National University*
Jonathan Borwein, *The University of Newcastle*
Wolfgang Dahmen, *RWTH, Aachen*
Larry Forbes, *University of Tasmania* — ANZIAM Lecturer
Jan de Gier, *The University of Melbourne*
Vladimir Gaitsgory, *University of South Australia*
Ben Green, *University of Cambridge*
Michael Hopkins, *Harvard University*
Thomas Lam, *University of Michigan* — EC Lecturer
Elizabeth Mansfield, *University of Kent*
Cheryl Praeger, *University of Western Australia*
— Hanna Neumann Lecturer.

The last date for early-bird registration is 2 July 2010, and the last date for abstract submission is 20 August 2010.

The following Special Sessions are planned as part of the conference:
algebra and number theory; applied differential equations; calculus of variations and partial differential equations; combinatorics: computational mathematics; control theory; dynamical systems; financial mathematics; general session; geometric analysis; geometry and topology; Lie groups and harmonic analysis; mathematics education; mathematics of conservation and resource management; mathematics in biology and medicine; mathematical physics; noncommutative geometry and operator algebras; optimisation and applications; probability and statistics; stochastic processes and modelling.

More complete information regarding the conference may be found at the conference website at www.smp.uq.edu.au/austms2010/ .

AustMS Accreditation

The secretary has announced the accreditation of:

- Associate Professor Peter Stacey of La Trobe University as an Accredited Fellow (FAustMS);
- Dr Guillermo Pineda-Villavicencio of the University of Ballarat, and Dr Julien Ugon of the University of Ballarat, as Accredited Members (MAustMS);
- Mr Don Coutts of the Canberra Institute of Technology as an Accredited Member (MAustMS).

Nominations sought for the 2010 AustMS Medal

The Medal Committee for the 2010 Australian Mathematical Society Medal is now seeking nominations and recommendations for possible candidates for this Medal. This is one of two Medals awarded by the Society, the other being the George Szekeres Medal, which is awarded in even-numbered years. The Australian Mathematical Society Medal will be awarded to a member of the Society for distinguished research in the Mathematical Sciences.

For further information, please contact (preferably by email) the Chair of the 2010 Medal Committee, Professor B.D. McKay, Department of Computer Science, ANU, ACT 0200 (bdm@cs.anu.edu.au). Nominations should be received by 1 June 2010.

The other three members of the 2010 Medal Committee are Professor A. Ram (Outgoing Chair), Professor B. Andrews (Incoming Chair) and Professor F. Sukochev (one year).

Visit http://www.austms.org.au/AMSInfo/medal.html for a list of past AustMS Medal winners.

Rules for the Australian Mathematical Society Medal

1. There shall be a Medal known as 'The Australian Mathematical Society Medal'.
2. (i) This will be awarded annually to a Member of the Society, under the age of 40 on 1 January of the year in which the Medal is awarded, for distinguished research in the Mathematical Sciences. The AustMS Medal Committee may, in cases where there have been significant interruptions to a mathematical career, waive this age limit by normally up to five years.

   (ii) A significant proportion of the research work should have been carried out in Australia.
   (iii) In order to be eligible, a nominee for the Medal has to have been a member of the Society for the calendar year preceding the year of the award; backdating of membership to the previous year is not acceptable.
3. The award will be approved by the President on behalf of the Council of the Society on the recommendation of a Selection Committee appointed by the Council.
4. The Selection Committee shall consist of three persons each appointed for a period of three years and known as 'Incoming Chair', 'Chair' and 'Outgoing Chair' respectively, together with a fourth person appointed each year for one year only.
5. The Selection Committee will consult with appropriate assessors.
6. The award of the Medal shall be recorded in one of the Society's Journals along with the citation and photograph.
7. The Selection Committee shall also prepare an additional citation in a form suitable for newspaper publication. This is to be embargoed until the Medal winner has been announced to the Society.
8. One Medal shall be awarded each year, unless either no-one of sufficient merit is found, in which case no Medal shall be awarded; or there is more than one candidate of equal (and sufficient) merit, in which case the committee can recommend the award of at most two Medals.

Nominations sought for the George Szekeres Medal

The Medal Committee for the 2010 George Szekeres Medal is now seeking nominations and recommendations for possible candidates for this Medal. This is one of two prestigious Medals awarded by the Society, the other being the Australian Mathematical Society Medal. The George Szekeres Medal is awarded for outstanding research achievement for work done substantially in Australia. It is awarded only in even-numbered years.

Nominations, to be sent to the Committee Chair, should include: (a) an extended citation, not more than two pages in length, arguing the case for awarding the Medal to the nominee; (b) a shorter citation, of not more than 100 words, which may be used to report the candidate's achievements in the event that the nomination is successful; (c) a full list of publications of the candidate, with the most significant (up to a maximum of 20) marked by an asterisk; (d) a curriculum vitae of the candidate's professional career, highlighting any achievements which add support to the nomination; and (e) the names of between three and six suitable referees, along with a brief statement as to their appropriateness. Nominations close on 31 May 2010.

For further information, please contact (preferably by email) the Chair of the 2010 George Szekeres Medal Committee, Dr F. de Hoog, email: Frank.deHoog@csiro.au.

Other members of the 2010 George Szekeres Medal Committee are: Professor A.J. Guttmann, Professor J. Coates and Professor M.G. Cowling.

The inaugural George Szekeres Medal in 2002 was awarded to Professor Ian Sloan *AO FAA FAustMS* and to Professor Alf van der Poorten *AM FAustMS*. The recipient in 2004 was Dr R.S. Anderssen *FAustMS*, in 2006 was Professor A.J. Guttmann *FAA FAustMS* and in 2008 was Professor J.H. Rubinstein *FAA FAustMS*.

Rules for the George Szekeres Medal of the AustMS

1. The award is for a mathematical scientist who is a member of the Australian Mathematical Society and normally resident in Australia.
2. The medal may, in exceptional circumstances, be shared by at most two candidates.
3. The Medal is awarded every two years.
4. (i) The award is for a sustained outstanding contribution to research in the mathematical sciences. The candidate should have been resident in Australia when the bulk of the work was completed.
   (ii) The successful candidate will have an excellent record of promoting and supporting the discipline, through activities such as extensive graduate student supervision, outstanding contributions to leadership in the Australian Mathematical Society, or other activities which have materially promoted the mathematical sciences discipline within Australia.
5. (i) The George Szekeres Medal can be awarded to a recipient of the Australian Mathematical Society Medal, provided that the sustained outstanding contribution to research in Rule 4(i) is subsequent to the work for which the Australian Mathematical Society Medal was awarded.
   (ii) The George Szekeres Medal cannot be awarded to the same person on more than one occasion.

Honorary Fellows: call for nominations

In the *Gazette* Vol. 33 No. 1, March 2006, pp. 69–70, the Rules for Honorary International Fellowship of the Australian Mathematical Society are listed. (See also www.austms.org.au/Publ/Gazette/2006/Mar06/austmsnews.pdf.)

In accordance with Rule 4(a) I hereby call for nominations. These should be sent electronically to secretary@austms.org.au before the end of August 2010.

AustMS Special Interest Meetings: call for applications

The Australian Mathematical Society sponsors Special Interest Meetings on specialist topics at diverse geographical locations around Australia. This activity is seen as a means of generating a stronger professional profile for the Society within the Australian mathematical community, and of stimulating better communication between mathematicians with similar interests who are scattered throughout the country.

These grants are intended for once-off meetings and not for regular meetings. Such meetings with a large student involvement are encouraged. If it is intended to hold regular meetings on a specific subject area, the organisers should consider forming a Special Interest Group of the Society. If there is widespread interest in a subject area, there is also the mechanism for forming a Division within the Society.

The rules governing the approval of grants are:

(a) each Special Interest Meeting must be clearly advertised as an activity supported by the Australian Mathematical Society;
(b) the organiser must be a member of the Society;
(c) the meeting must be open to all members of the Society;
(d) registration fees should be charged, with at least a 20% reduction for members of the Society. A further reduction should be made for members of the Society who pay the reduced rate subscription (i.e. student members, those not in full time employment and retired members);
(e) a financial statement must be submitted on completion of the Meeting;
(f) any profits up to the value of the grant are to be returned to the Australian Mathematical Society;
(g) on completion, a Meeting Report should be prepared, in a form suitable for publication in the Australian Mathematical Society *Gazette*, and sent to the Secretary;
(h) a list of those attending, their AustMS membership status, and a copy of the conference Proceedings (if applicable) must be submitted to the Society;
(i) only in exceptional circumstances will support be provided near the time of the Annual Conference for a Special Interest Meeting being held in another city.
(j) the meeting should be advertised on the Society's web pages and also in the *Gazette*.

In its consideration of applications, Council will take into account locations around Australia of the various mathematical meetings during the period in question. Preference will be given to Meetings of at least two days duration. Council has the discretion to specify the part of the budget being supported by the AustMS, and against which any repayments should be calculated.

The allocation for any one Meeting in 2010 will be up to $\$(2000+300n)$, where n is the number of AustMS members registered for and attending the meeting, with an upper limit of about \$8000.

In 2010 a total of up to $20 000 is available for Special Interest Meetings. There will be six-monthly calls for applications for Special Interest Meeting Grants, each to cover a period of 18 months commencing six months after consideration of applications.

Please email Secretary@austms.org.au for an application form.

Peter Stacey
AustMS Secretary
E-mail: 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 after many years as head of department and then associate dean. Retirement has enabled him to spend more time with his family while continuing with some research on C*-algebras 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 N. Joshi	School of Mathematics and Statistics The University of Sydney NSW 2006, Australia. n.joshi@usyd.edu.au
Secretary:	Dr P. Stacey	Department of Mathematics and Stastics La Trobe University Bundoora, VIC 3086, Australia. P.Stacey@latrobe.edu.au
Treasurer:	Dr A. Howe	Department of Mathematics Australian National University ACT 0200, Australia. algy.howe@maths.anu.edu.au
Business Manager:	Ms May Truong	Department of Mathematics Australian National University ACT 0200, Australia. office@austms.org.au

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: http://www.austms.org.au.

Local Correspondents

ANU:	K. Wicks	RMIT Univ.:	Y. Ding
Aust. Catholic Univ.:	B. Franzsen	Swinburne Univ. Techn.:	J. Sampson
Aust. Defence Force:	R. Weber	Univ. Adelaide:	T. Mattner
Bond Univ.:	N. de Mestre	Univ. Ballarat:	A. Kruger
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