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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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Notes for contributors

Please send contributions to gazette@austms.org.au. Submissions should be fairly short, easy to read and of interest to a wide range of readers.

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Deadlines for submissions to 38(3), 38(4) and 38(5) of the *Gazette* are 1 June 2011, 1 August 2011 and 1 October 2011.

Volume 38 Number 2 2011

Editorial

Welcome to the May issue of the *Gazette*!

It is certainly evident in this *Gazette* that the AustMS is involved in a wide range of activities in Australia and overseas, and in establishing awards and initiatives to support members of the Society.

Both the President's and Secretary's columns announce two new initiatives — the AustMS Best Paper Prize, and the Alf van der Poorten Travelling Fellowship for recent PhD graduates in pure mathematics. We look forward to publicising the outcomes of these awards in due course.

Along these lines, in this issue we include the first report from a recipient of a recent AustMS initiative, the Lift-off Fellowships, designed to support those between the submission of their PhD and their first post-doctoral position. Roslyn Hickson describes her Fellowship, used to advance her work on modelling infectious diseases.

AustMS and AMSI continue to campaign to government on a range of issues on behalf of the mathematical sciences. AustMS President Peter Taylor and AMSI Director Geoff Prince provide updates on the submission to the Base Funding Review, the ARC's review of journal rankings, and the Research Workforce Strategy exercise.

In another important arena, this issue's Classroom Notes focuses on threshold concepts in mathematics and asks pertinent questions on how to identify, communicate and assess these concepts in the classroom. This article arises from the AustMS-supported ALTC project, led by Leigh Wood, on developing a discipline-specific professional development program for university educators.

The multitude of activities of the AustMS are thanks, in no small part, to tireless efforts of Council. Nominations are now invited for Officers and Ordinary Members of Council; see the Secretary's column for more details.

Enjoy your reading of the *Gazette*.

President's column

Peter Taylor[1]

Last week, I had the interesting experience of attending a 'Maths Evening' at my children's primary school. The presenter was Rob Vingerhoets, an educational consultant who advises teachers and parents on how best to help children learn basic mathematical skills. The main purpose of the evening was to educate parents in the current ways of teaching arithmetic in primary schools, so that they would be aware of these methods when asked questions by their children.

I have to say that I saw ways of adding, subtracting and multiplying two, three and four digit numbers that I had not seen before, and that were certainly not taught 'in my day'. Rob's main emphasis was on the importance of 'place value' (decomposing numbers into sums of powers of ten). Essentially the methods that he discussed involved clever use of the associative, distributive and commutative laws to organise the calculations in a way that has the best chance of imparting understanding to children. I was very impressed by what he had to say, and I'm sure that both his theoretical instruction and practical advice will prove very useful to many of the parents who were there.

One interesting aspect of the evening occurred at the beginning when Rob gave the audience a warm-up exercise. He told us that he had an integer sum of money between \$0 and \$500 in his pocket, that we could ask eight 'yes-no' questions about it, and then he would expect us to nominate the amount in a ninth question. Different parents got to ask questions in turn: the first was 'Is it a two-digit amount?', the second was 'Are there any coins?' and the third was 'Is it a prime number?'. After the eight questions, the group was reduced to guessing between two numbers that satisfied all the previous criteria, which was a better outcome than we deserved.

During the exercise, I was feeling a little frustrated, because I didn't think that other parents were asking the right questions. I wanted the group to use a bisection search, asking questions that are guaranteed to eliminate half of the possibilities at each step. It is certain that this will reduce the number of possibilities to two after eight steps, and it is not possible to do better, at least using the standard criterion of minimising the final number of options under the worst-case outcome.

Since the night, I've been reflecting on the way that the group of parents approached the exercise in the context of what a mathematical education brings to a person's problem-solving ability. The 'Maths Evening' was attended by a

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group of parents sufficiently interested in their children's mathematics to go out on a rainy evening, and yet I'd suggest that they didn't approach the exercise like mathematicians would.

To test this hypothesis, I've since tried Rob's exercise on a group of Operations Research professors that I was talking to after a seminar, and also on a single student from my second year probability class. Each suggested using a bisection search. This made me feel pretty good, because I've been known to suggest in a number of forums that a mathematical education gives students problem-solving ability *par excellence*. I'd be interested to hear what readers of the *Gazette* think of this suggestion.

Apart from attending primary school evenings, I've also been involved, along with colleagues, in a number of issues of interest to the mathematical sciences community. My report to the recent meeting of the Australian Mathematical Society (AustMS) Steering Committee contained the following items.

(i) *The Journal Ranking Tender.* Under the leadership of Tim Marchant, AustMS has submitted a tender to the ARC to undertake work at Phase 2 of the Review of the ERA 2010 Ranked Outlet Lists. Readers interested in finding out more about this should visit the web page at http://www.arc.gov.au/era/era_2012/review_of_era10_ranked_outlet_lists.htm. I'd like to thank Tim and his team for the excellent job that they did in putting together this tender under a great amount of time pressure.

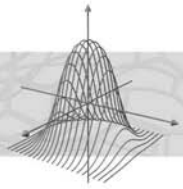
(ii) *The Base Funding Review.* The Director of the Australian Mathematical Science Institute, Geoff Prince, has coordinated a submission from the mathematical science disciplines to the Base Funding Review, which is looking at the amount of funding that universities receive for teaching students in different disciplines. Along with a number of senior members of our community, I have been helping Geoff with this.

(iii) *Special Interest Meeting Funding.* For a number of years, the AustMS Council has authorised the use of funds to support Special Interest Meetings, provided that they meet certain conditions. The details of these can be found on the AustMS website. In the past, the funds set aside for this purpose have never been exhausted. However, for the first time, this year the total request for funding has exceeded the budget allocated by Council. The community appears to have 'discovered' the Special Interest Meeting funding. To deal with this, the AustMS Council will have to work out a way to resolve competing requests. This will probably require AustMS to announce annual or biennial funding rounds, rather than allowing applications to come in *ad hoc*, as is the current practice.

(iv) *The Best Paper Prize.* The AustMS Council has approved the rules for a Best Paper Prize to be awarded to the best paper with an author who is a member of the AustMS in each of Pure Mathematics, Applied Mathematics and Statistics (in succeeding years). Papers will be eligible for six years after their publication, and so get the chance to be considered for two rounds of the prize in the appropriate discipline.

(v) *The van der Poorten Travelling Fellowships.* The family of the late Alf van der Poorten has offered to endow a travelling fellowship, named in honour of Alf, to enable an early-career pure mathematician to travel overseas. On behalf of AustMS, I'd like to thank Alf's family for this very generous gesture. It is a fitting tribute to someone of Alf's great standing in our community.

Peter Taylor became the inaugural Professor of Operations Research at the University of Melbourne in 2003 and held the position of Head of Department from 2005 to 2010. His research interests lie in the field of applied probability, with particular emphasis on applications in telecommunications, biological modelling and healthcare. Recently he has become interested in the interaction of stochastic modelling with optimisation and optimal control under conditions of uncertainty.



Threshold concepts

ALTC project: A national discipline-specific professional development program for lecturers and tutors in the mathematical sciences

You will hear the word *threshold* a lot in the next year. The government is looking at *Threshold learning outcomes* for a graduate of a science degree in mathematics. These are the minimum outcomes you would expect of a mathematics graduate. More on this in a later edition. Here we want to look at the idea of threshold concepts.

Threshold concepts in mathematics are aspects that transform and integrate ideas. Many people would consider *linearity* as a threshold concept that threads through mathematics learning at all levels. Once linearity is truly understood then common errors such as

$$\sin\alpha \pm \sin\beta = \sin(\alpha \pm \beta)$$

are less likely to occur. Linearity is key to many areas of mathematics such as differential equations; it is met time and time again throughout a mathematics degree.

Another example is that of a complex number. It is conceptually difficult to grasp and almost seems absurd, yet an understanding of complex numbers underpins the solutions to many mathematical problems, even those that, on the surface, appear to involve only real numbers, and has applications in both the pure and applied sciences [2]. Limit is another threshold concept. For instance, the fact that

$$\lim_{x\to 0} \frac{\sin x}{x} = 1$$

may be counter-intuitive when first encountered, but being able to calculate such limits 'is the gateway to mathematical analysis and constitutes a fundamental basis for understanding some of the foundations and application of other branches of mathematics such as differential and integral calculus' [1, p. 2].

Threshold concepts are:

- transformative (they trigger a shift in perception)
- irreversible (they usually cannot be easily unlearned or discarded)
- integrative (they expose previously hidden or unrecognised connections and interrelations)
- bounded (often bordering thresholds into new conceptual spaces—in fact may demarcate disciplines)
- troublesome (appearing complex, alien, counter-intuitive or incoherent) [2].

Think about the threshold concepts in your area of mathematics. What are the key concepts or procedures needed to move to a higher level of mathematical thought? Do you think colleagues in your area would agree to these key ideas?

Next, how do you ensure students learn these key ideas and move to higher levels of mathematics? How do you communicate to students about these threshold concepts? How do you design learning and assessment strategies to develop and test these ideas? We suggest that it is valuable when planning your unit and learning activities to spend some time considering the threshold concepts in your discipline. We suggest that teachers dedicate adequate time and focus to developing students' understanding of threshold concepts. Possible strategies include extra time dedicated to instruction (including provision of applied examples), time for students to experiment with problems, and peer explanation tasks.

There are several projects under way looking at threshold concepts. One is investigating what lecturers state as the threshold concepts in their subject area and then interviewing students to see whether the students articulate the same threshold concepts as the lecturer. Other projects are looking at problems and examination questions that students who understand a particular concept get correct and those who don't understand it are unable to do.

The idea of threshold concepts can assist lecturers and departments make sure that the really important ideas in mathematics are taught and assessed, and that students are ready to move to higher levels of mathematical understanding.

References

[1] Meyer, J. and Land, R. (2003). Threshold concepts and troublesome knowledge: Linkages to ways of thinking and practicing within the disciplines (Occasional Report 4). Edinburgh: Enhancing Teaching-Learning Environments in Undergraduate Course Project.

[2] Meyer, J. and Land, R. (2005). Threshold concepts and troublesome knowledge (2): epistemological considerations and a conceptual framework for teaching and learning. *Higher Education* **49,** 373–388.

This article is adapted from a professional development unit for lecturers and tutors in the mathematical sciences. Threshold concepts are addressed in the learning module on models of mathematics learning. Other topics in the unit include planning and conducting mathematics lessons, teaching in service units, assessing students in classes and units, planning and managing mathematics units, evaluating mathematics teaching and developing mathematics learning communities.

We are currently trialling this unit before launching it publicly on the Australian Mathematical Society website later in 2011. We hope that all new lecturers and tutors in the mathematical and other quantitative sciences will complete this unit as part of their professional development in teaching. We will run a professional development workshop focused on learning and teaching in mathematics on 29–30 September 2011 in conjunction with the University of Wollongong immediately following the annual meeting of the Australian Mathematical Society.*

*www.austms.org.au/ALTC

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Maths matters

A critique of 'Best Current Practices for Journals'

Michael G. Cowling [1]

The International Mathematical Union (IMU) recently issued a statement of 'best current practices for journals'*. It is an interesting and thought-provoking document, with a number of very useful suggestions. However it appears to me, as a journal editor, referee and user, that it has a number of gaps and omissions. The IMU seems to be focussing on the responsibilities of journals, but has little to say about the responsibilities of authors, not only in the document in question, but generally in the material visible at the IMU's website. Also I think that we are all aware that universities are finding it increasingly difficult to pay journal subscriptions. I will touch on the question of price after first discussing the IMU statement from an editor's point of view.

Poor behaviour by authors

For many editors, plagiarism is a worsening problem. I recall the case of an Italian mathematician who translated papers (by others and without their consent) from Romanian and published them in Italian under his own name. While I was editor of the *Bulletin of the Australian Mathematical Society*, I identified a Korean mathematician who was taking preprints and changing the title and author's name, then submitting them as his own work. This is clearly plagiarism; but neither Italian law nor the Korean university was able to deal with the problem adequately.

There are many cases of authors who write essentially the same article in two different languages. There is an argument that this is legitimate, if the second version of the paper is written in a language that is more widely understood than the first version, but there is also an argument that it is not, especially if the original article is not cited.

As an editor for the Australian Mathematical Society, I have seen a range of what might be considered unethical practices, ranging from the blatant copying mentioned above, to the simultaneous submission to different journals of papers where the authors have found a new and powerful technique and turned it into a number of almost identical papers, each an application of the same technique but in a slightly different situation. I have seen many papers whose introductions were almost *verbatim* copies of introductions of previous papers by the same authors.

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*Re-printed in the *Gazette* **37**(5), November 2010.

For a non-English-speaking author, the effort of writing the introduction is often as great as writing the rest of the paper, and it is hardly surprising that many choose to vary the introduction of a previous effort. In my own area, mathematical analysis, one can prove results in Hilbert spaces, in Lebesgue spaces, in Sobolev spaces, in Lorentz spaces, in Triebel–Lizorkin spaces, in Besov spaces, and so on. In general, new ideas are needed to prove the results in Hilbert spaces and then more new ideas are needed to generalise from Hilbert spaces to Lebesgue spaces, but thereafter it is usually just a matter of being a little more careful with convergence of sums and making the paper longer to deal with the additional indices on the spaces. Are extensions beyond Lebesgue spaces plagiarism? I tend to think not, but when a number of essentially identical extensions are published in a number of different papers in different journals at the same time, then I wonder. In a world where many institutions reward their staff according to the number of papers produced, it is hardly surprising that some mathematicians cut corners to produce more.

Dealing with plagiarism is complex, and perhaps the key problem that we face is that the definition is not clear. In Western cultures, repeating the words of another without acknowledgement is considered plagiarism, but in some other cultures, it is considered a sign of respect, especially for one's teacher or senior colleagues. It seems to me that the first thing that is needed to tackle this problem is a clear statement of what is plagiarism and what is not. The IMU document mentions both 'plagiarism' and 'self-plagiarism' but does not say clearly what these are. I would ask the IMU to please draw up definitions of plagiarism and self-plagiarism, and translate them into many languages so that we have an agreed statement of what is acceptable and what is not. The nature of mathematical generalisation is such that the dictionary definitions are not adequate.

Problems with editors and editorial boards

One of the worst things that can happen to the author of a paper is for the journal to hold on to a paper for several years and then reject it. The IMU document talks about 'timeliness', but I would suggest that stronger recommendations are needed than the IMU gives. An IMU recommendation that chief editors monitor the performance of the editorial board might not have gone astray.

The American Mathematical Society publishes information about the typical times between submission and publication of articles, but not all journals participate in their survey. Typically, editors have spreadsheets (or similar) of all the papers in their system, and it would be a simple exercise for journals to provide backlog information on their websites. They should also provide information about whether they have quotas for particular areas of mathematics. Such quotas may mean that the time from submission to publication may be four or five years for papers in some areas, while the published information about the journal may suggest that two years is typical. If a quota system is in place, then journals should be honest about this, and not mislead the mathematical public with incorrect information.

Problems with refereeing

The responsibility of the referee — to provide an impartial judgement on the paper — is mentioned in the IMU document. But there are problems with refereeing that should be acknowledged. First and foremost, as we move into the brave new world of Research Assessment Exercises and the like, it must be observed that 'the system' does not give credit for refereeing. Surely refereeing (and other editorial work) is important to uphold standards in the research community; so why is this not recognised? Perhaps the IMU might like to argue this case?

Refereeing is a job without rewards, but it is also a job with growing frustrations. I have been told rather too many times by referees that 'this is the nth time that I've seen this paper'. There are then two alternative ways in which such a report continues: in one case, it appears that the authors have received a rejection and a referee's report, but have not even bothered to make the corrections suggested by the referee, rather, they have simply resubmitted the paper to another journal. This is bad behaviour, but it is bad behaviour that goes unpunished. The IMU suggests that editors might apply sanctions such as black-listing an author for a while, but with several thousand journals available, being black-listed on some of these is not a real deterrent. So what should be done to such authors? It would not be hard to set up a system that would compare files sent to different journals and identify the offenders, but this would have to be done with the backing of a body such as the IMU.

Here is the other way in which 'this is the nth time that I've seen this paper' ends: 'I have made suggestions to correct the mathematics and improve the writing on four previous occasions, and finally the paper is beginning to look as though another few iterations will produce something publishable'. In other words, there are authors who rely on referees to correct their mathematics and proofread the English. One might conclude that the final paper owes as much to referees as to the author.

Until recently, various institutions regularly received 'proofs' of Fermat's Last Theorem (now they are 'short proofs of Fermat's Last Theorem', but mercifully they are fewer than in the past). One of these institutions is renowned for having produced a large number of copies of a printed note: 'Thank you for your paper on Fermat's Last Theorem. The proof does not appear to be complete. The first mistake is on line ...'. The referee would then just fill in the line number where the first mistake was noted. Is the IMU willing to encourage journals to respond in this way to authors who submit seriously flawed papers? If not, what action can be taken to protect referees from this sort of abuse?

Publishing costs and journal subscription prices

Last but not least, from the editorial point of view, we are sometimes told that the arrival of TEX means that the cost of producing journals has gone down. This is not true: many authors use TEX inexpertly. When I see that the TEX file of a paper begins with three hundred lines of macros (some of which may well mess up the macros in our style file), I groan, especially when they start `\def\a{\alpha}`

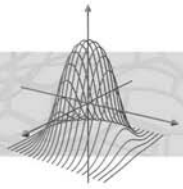
`\def\b{\beta}` and so on. I have a script to remove macros from papers, and make some other changes, but authors are sometimes so ingenious in their abuse of TEX that the script does not work correctly. Some journals simply retype all papers that are sent to them. This solution is as expensive as dealing with a traditional typescript. The other solution is to try to fix up the TEX file — when the authors are competent, this is quite an easy task, but when they are not, it is more time-consuming than retyping *ab initio*. The mathematical community itself is to blame for this. In many universities, mathematics students are taught outmoded dialects of TEX or LATEX by people who learnt them ten or twenty years ago, and who fail to teach the key structural ideas, such as environments. TEX is a programming language and it should be taught and written as a programming language.

I would argue that, if the international mathematical community wants to make use of the savings that TEX could offer, then journals should start charging, by the page, for papers that are written in poor-quality TEX. There is very good free information about TEX available online through sites such as the TEX Users Group (as well as bad and incorrect information, often through the websites of individuals). If our bosses in Canberra are right, financial incentives are the most effective way to get people to do things properly. Surely the long-term health of mathematics relies at least in part on inexpensive journals, and getting the mathematical community to educate itself would be a good step in this direction. Does the IMU have an opinion?

The problem of the increasing cost of journal subscriptions is not just due to the costs of production. Increasingly, we are seeing journals which were produced inexpensively by mathematical societies being handed over to commercial publishers, and the prices rise severely. In part, this is because libraries like to subscribe to packages of journals, and journals published by small organisations see their subscriptions drop dramatically, to the point where they become uneconomic. Further, there may well be efficiencies of scale in merging publishing operations (the Australian Mathematical Society decided to publish its research journals through Cambridge University Press for just this reason). But the cost problem remains, and we are not even supposed to talk about it. A commercial publisher sued the American Mathematical Society some years ago because that Society published figures on journal costs that made it clear that the publisher in question was substantially more expensive than most other publishers. The editorial board of *Topology* resigned a few years ago in protest at the pricing policies of the publisher, and set up an alternative journal. What is the IMU doing to promote less expensive publishing?

Conclusions

I confess that the Australian Mathematical Society's journals might be better managed, and the IMU's recommendations will be helpful in improving things. But I cannot help but feel that there are much more serious problems with journal production that the IMU is not tackling, and hope that this note will help provoke some action.



Puzzle corner

Ivan Guo[1]

Welcome to the Australian Mathematical Society *Gazette*'s Puzzle Corner No. 22. Each puzzle corner includes a handful of fun, yet intriguing, puzzles for adventurous readers to try. They cover a range of difficulties, come from a variety of topics, and require a minimum of mathematical prerequisites for their solution. Should you happen to be ingenious enough to solve one of them, then you should send your solution to us.

For each puzzle corner, the reader with the best submission will receive a book voucher to the value of $50, not to mention fame, glory and unlimited bragging rights! Entries are judged on the following criteria, in decreasing order of importance: accuracy, elegance, difficulty, and the number of correct solutions submitted. Please note that the judge's decision — that is, my decision — is absolutely final. Please email 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 22 is 1 July 2011. The solutions to Puzzle Corner 22 will appear in Puzzle Corner 24 in the September 2011 issue of the *Gazette*.

Distinctive solid

Does there exist a convex polyhedron such that no two of its faces have the same number of edges?

Triple cheque

Penny cashed a cheque at the bank, but the careless teller transposed the dollar figure with the cent figure, and gave her the wrong amount of money. For example, if the cheque was for $12.34, Penny received $34.12 instead. Assume that the teller has old copper coins available, so that all positive multiples of 1 cent are possible. After buying a newspaper for 50 cents, Penny discovered the mistake, but still had three times the amount on the original cheque. What was the value of the cheque?

Last ball remaining

Mr Bored has 2011 blue balls and 2011 red balls in a gigantic bag. There is also an abundance of red and blue balls on the floor. Mr Bored randomly selects two balls from the bag and drops them onto the floor. If the two balls have the same colour, he places a blue ball into the bag, otherwise, he places a red ball into the

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bag. This is repeated until only one ball is left in the bag. What is the chance of it being red?

Midpoint madness

$ABCDE$ is a pentagon with side lengths of 2010, 2011, 2012, 2013 and 2014 in some order. Let P, Q and R be the midpoints of AC, BD and CE respectively. Then let X and Y be the midpoints of PQ and QR. If line segment XY has integer length, find this length.

Tangled tangents

Let

$$X = \sum_{n=1}^{2011} \tan^{-1}\left(\frac{1}{n^2+n+1}\right).$$

Find $\tan X$.

Radioactive rods

(1) There are eight rods, identical in appearance, but one of them is radioactive. It is possible to test for radioactivity by placing some number of rods into a super high-tech box. After the test, the box will indicate whether there was any radioactivity in its contents. Since the box is very expensive to operate, what is the minimum number of tests needed to find the radioactive rod?

(2) Now suppose that two out of the eight rods are radioactive. How many tests are needed to find them both?

Solutions to Puzzle Corner 20

The $50 book voucher for the best submission to Puzzle Corner 20 is awarded to Mike Hirschhorn. Congratulations!

Lousy labelling

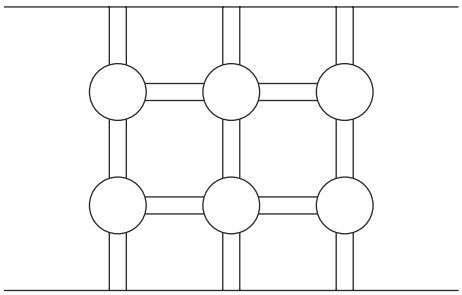
Three boxes are on the table. One has red balls, one has blue balls, and one has balls of both colours. Three labels are made for the boxes, but they are misplaced so that none of the boxes is labelled correctly. How many balls would you need to retrieve from the boxes in order to determine the correct labelling?

Solution by John Miller: Let R, B and M be the three incorrect labels, meaning red, blue and mixed. Draw one ball from the box labelled M. Without the loss of generality, let the ball be red, then the box labelled M must have red balls only since it cannot contain mixed balls. Now the box labelled B cannot have blue balls only, so it must have mixed balls. Finally the box labelled R must contain blue balls only. The argument works similarly if the initial ball was blue.

Thus only one ball is needed to identify the boxes.

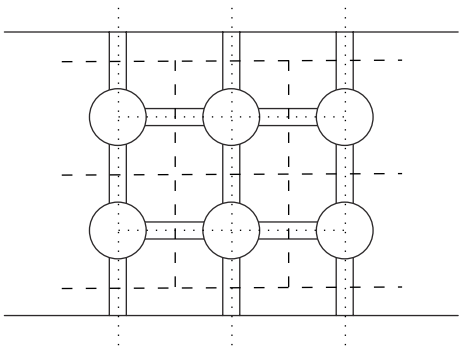
Broken bridges

There are thirteen bridges connecting the banks of River Pluvia and its six piers, as shown in the diagram below:



On an extremely stormy night, each bridge has a 50% *chance of being damaged by the rainfall. What is the probability that the locals can still cross the river using undamaged bridges the next morning?*

Solution by Robert Tang: Many boats frequent River Pluvia. Most of them can safely pass under the thirteen bridges, but have to navigate around the six piers. The following illustration shows boat paths as dashed lines and human paths as dotted lines.



Note the boat paths have the same configuration as the human paths, but rotated by 90°. Also, every boat path joining east and west cuts every human path joining north and south.

Suppose a tall sail boat can pass under a bridge if and only if the bridge is damaged. So for any bridge, the chance of the sail boat being able to pass under it would also be 50%. Since the boat paths and the human paths are symmetric, the chance of the sail boat passing these piers is equal to the chance of a person crossing the river.

However, the sail boat can pass the mess of piers and bridges if and only if people can no longer cross the river. Therefore the answer is 50%.

Trick question

Find all real solutions to the equation

$$\sqrt{x+4\sqrt{x-4}}-\sqrt{x-4\sqrt{x-4}}=4.$$

Solution by Randell Heyman: For the original equation to make sense, we require $x \geq 4$, so write $x = y^2 + 4$ for $y \geq 0$. Simplifying gives

$$\begin{aligned}\sqrt{x+4\sqrt{x-4}}-\sqrt{x-4\sqrt{x-4}} &= \sqrt{y^2+4+4\sqrt{y^2}}-\sqrt{y^2+4-4\sqrt{y^2}}\\ &= \sqrt{y^2+4+4y}-\sqrt{y^2+4-4y}\\ &= \sqrt{(y+2)^2}-\sqrt{(y-2)^2}\\ &= |y+2|-|y-2|.\end{aligned}$$

Certainly $y + 2 > 0$, so

$$y+2-|y-2|=4 \quad\Longleftrightarrow\quad y-2=|y-2| \quad\Longleftrightarrow\quad y\geq 2.$$

Since $x = y^2 + 4$, the required solution would be $x \geq 8$.

Comment. Squaring both sides of the original equation twice can result in $0 = 0$, which may confuse the careless, but certainly not the readers of the Puzzle Corner!

Clock shop

A clock shop has 10 accurate clocks of various sizes on display. Prove that there exists a moment in time when the sum of all pairwise distances between the tips of the minute hands is greater than the sum of all pairwise distances between the centres of the clocks.

Solution by Ross Atkins: Consider a single pair of clocks whose centres are at points C_1 and C_2. Respectively let A_1, A_2 be the tips of their minute hands half an hour ago, and let B_1, B_2 be the tips of their minute hands right now. However, since C_i is the midpoint of A_iB_i, we have the vector identity

$$\overrightarrow{A_1A_2}+\overrightarrow{B_1B_2}=2\overrightarrow{C_1C_2},$$

which by the triangle inequality yields

$$|A_1A_2|+|B_1B_2|\geq 2|C_1C_2|.$$

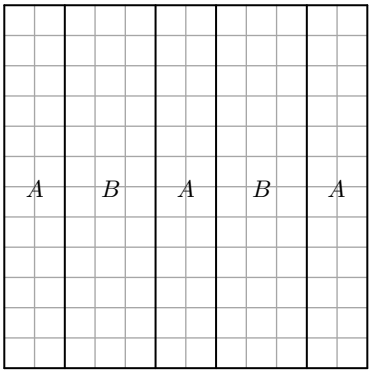
Now if we sum up this expression for all pairs of clocks, we see that the sum of all pairwise distances between the tips of the minute hands, half an hour ago, plus the sum of all pairwise distances between the tips of the minute hands now is greater than twice the sum of the distances between the centres. Therefore one of these minute sums must be larger than the centre sum.

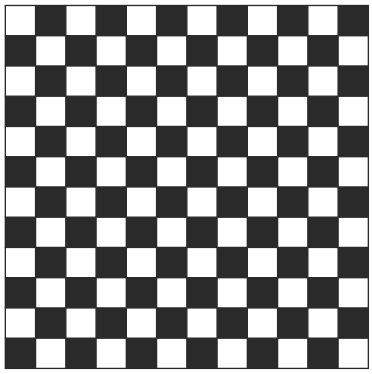
Super knight tour

In a game of super chess, a super knight can move diagonally across a 4×3 *rectangle (as opposed to a standard knight which moves diagonally across a* 3×2

rectangle). Can the super knight perform a knight tour on a 12×12 *super chessboard, i.e., use a sequence of moves to visit every square exactly once?*

Solution by Norman Do: Divide the super chessboard as follows.

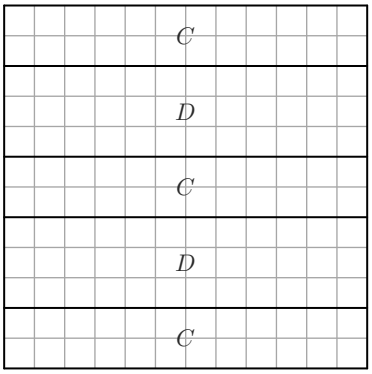




In the first diagram, there are 72 A squares and 72 B squares. A super knight cannot move between two A squares. Now under the usual black-white chessboard colouring, as shown in the second diagram, a super knight has to alternate between black and white squares. Since the A and B regions have an equal number of black squares, any super knight tour must follow the sequence

$$\underbrace{ABAB \cdots ABAB}_{72} \underbrace{BABA \cdots BABA}_{72}.$$

Now apply the same idea but in a different direction.



By similar arguments, the knight tour has to follow

$$\underbrace{CDCD \cdots CDCD}_{72} \underbrace{DCDC \cdots DCDC}_{72}.$$

But that means every C square is also an A square, which is a contradiction. Hence a super knight tour is not possible.

Consecutive sums

(1) *What is the smallest number that can be expressed as a sum of consecutive positive integers in exactly 2010 different ways? Note that a sum must contain at least two summands.*

(2) *Can you find a number which can be expressed as a sum of an even number of consecutive positive integers in exactly 2010 different ways? Can you find one that is smaller than the answer to part (1)?*

Solution by Mike Hirschhorn: We begin with the following theorem [1].

Theorem. The number of partitions of n into an odd number of consecutive positive integers is equal to the number of odd divisors of n less than $\sqrt{2n}$, while the number of partitions into an even number of consecutive positive integers is equal to the number of odd divisors greater than $\sqrt{2n}$. □

Proof. First note that, if n has an odd divisor $d = 2k+1$ and let $d' = n/d$, then

$$d^2 < 2n \iff d < 2d' \iff 2k+1 < 2d' \iff k < d'. \tag{1}$$

Suppose n is the sum of an odd number of consecutive positive integers, then it is possible to write

$$n = (a-b) + \cdots + a + \cdots + (a+b) = (2b+1)a \tag{2}$$

where $b < a$. By (1), setting $d = 2b+1$ and $d' = a$, we must have $d^2 < 2n$. Conversely, suppose $d = 2b+1$ is an odd divisor of n with $d^2 < 2n$ and let $a = n/d$. Again by (1), $b < a$, and it is possible to write n as in (2).

Next, suppose n is the sum of an even number of consecutive positive integers, then

$$n = (a+1-b) + \cdots + a + (a+1) + \cdots + (a+b) = b(2a+1) \tag{3}$$

where $a \geq b$. By the contrapositive of (1), setting $d = 2a+1$ and $d' = b$, we must have $d^2 \geq 2n$. Since d^2 is odd, equality is not possible and $d^2 > 2n$. Conversely, suppose $d = 2a+1$ is an odd divisor of n with $d^2 > 2n$ and let $b = n/d$. Again by the contrapositive of (1), $a \geq b$, and it is possible to write n as in (3). The theorem is proven. □

(1) From the theorem, the number of ways to write n as a sum of consecutive positive integers is equal the number of odd divisors of n. A sum of one term is counted in the theorem, but is not valid for the purpose of the puzzle. Hence we look for numbers with exactly 2011 odd divisors. Since 2011 is prime, the answer is in the form $2^k p^{2010}$ where p is an odd prime. The smallest possibility is $n = 3^{2010}$.

(2) Again from the theorem, we look for n with exactly 2010 odd divisors greater than $n\sqrt{2}$. One example would be $n = 3^{4020}$. It has 4021 divisors, 2010 of which are greater than $3^{2010}\sqrt{2}$.

The following solutions are less than 3^{2010} (which has 960 digits).

n	Approximate value	Number of digits
$2 \times 3^2 \times 5^{1340}$	7.50×10^{937}	938
$2 \times 3^{1340} \times 7^2$	2.16×10^{641}	642
$3^{1340} \times 7^2$	1.08×10^{641}	642
$3^{804} \times 23^4$	1.13×10^{389}	390
$3^{268} \times 79^{14}$	2.72×10^{154}	155

There are many more, but after a *tremendous* effort, the smallest solution is conjectured to be

$$3^6 \times 5^4 \times 7^4 \times 11^2 \times 13 \times 17 \times 769 = 22492916406088125.$$

References

[1] Hirschhorn, M.D. and Hirschhorn, P.M. (2005). Partitions into consecutive parts. *Math. Mag.* **78,** 396–397.

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.

Australian Academy of Science Fellows

Seventeen of Australia's leading scientists were honoured on 23 March 2011 by election to the Australian Academy of Science (see http://www.science.org.au/news/media/24march11.html). Those honoured included the following mathematical scientists.

Professor Joseph John Monaghan FAA 'distinguished for his work in the development of smoothed particle hydrodynamics with broad applications in astrophysical, geophysical and engineering problems.'

Professor Ian Richard Petersen FAA FIEAust FIEEE 'distinguished for his work on robust control theory with innovative advances enabling the synthesis of robust state feedback controllers using standard software tools'.

Ian Petersen is a Scientia Professor and Federation Fellow in the School of Engineering and Information Technology at the University of New South Wales (Australian Defence Force Academy). He received a Bachelor of Engineering degree in Electrical Engineering from the University of Melbourne in 1979 and a PhD in Electrical Engineering from the University of Rochester in 1984. From 1983 to 1985 he was a Postdoctoral Fellow at the Australian National University. In 1985 he joined the University of New South Wales at the Australian Defence Force Academy. From 2002 to 2003, he was Executive Director in Mathematics, Information and Communications for the Australian Research Council and in 2004 he was Acting Deputy Vice Chancellor (Research) for the University of New South Wales. He has served as an Associate Editor for the *IEEE Transactions on Automatic Control*, *Systems and Control Letters*, *Automatica* and *SIAM Journal on Control and Optimization*. Currently he is an Editor for *Automatica*. He is a Fellow of the IEEE. His main research interests are in robust control theory, quantum control theory and stochastic control theory.

Professor Mathai Varghese FAA FAustMS 'distinguished for his work in geometric analysis involving the topology of manifolds, including the Mathai–Quillen formalism in topological field theory'.

Mathai Varghese obtained his PhD from Massachusetts Institute of Technology (MIT) in 1986 under the supervision of the Fields medallist Professor Daniel Quillen, and was appointed a Dickson Instructor at the University of Chicago. In 1989, he moved to the University of Adelaide, where he has been a Professor since 2006

and is currently an Australian Professorial Fellow of the Australian Research Council, and Director of the Institute for Geometry and its Applications. In 2000 he was awarded the Australian Mathematical Society Medal, in 2000–2001 he was awarded a Clay Research Fellowship and position of Visiting Scientist for a year at MIT, and in 2006 he was appointed a Senior Research Fellow for a semester at Erwin Schrödinger Institute in Vienna. From 2006 to 2009 he was Vice-President (in charge of annual conferences) of the Australian Mathematical Society and has also been a member of several national committees. Much of his research work is concerned with geometric analysis involving the topology of manifolds, and mathematical problems that originate from physics, such as topological field theories, the fractional quantum Hall effect and string theory.

Professor Aibing Yu FAA 'distinguished for his work in particle science and technology, including methods to simulate and model the motion of individual particles within large populations in flowing systems'.

Aibing Yu is a Federation Fellow and Scientia Professor in the School of Materials Science and Engineering at the University of New South Wales (UNSW). He obtained a BEng in 1982 and a MEng in 1985 from Northeastern University, China, a PhD in 1990 from the University of Wollongong and a DSc in 2007 from the University of New South Wales. He is a world-leading scientist in particle and powder technology and process engineering, and is recognised as an authority in particle packing, particulate and multiphase processing, and simulation and modelling. He has authored more than 550 publications in these areas and is currently on the editorial board of more than 10 journals. He developed and directs a world class research facility, Simulation and Modelling of Particulate Systems (SIMPAS), at UNSW. Professor Yu is the recipient of various prestigious fellowships, including a CSIRO Postdoctoral Fellowship (1990–1991), an ARC Queen Elizabeth II Fellowship (1993–1997), an Australian Professorial Fellowship (2005–2009), a Federation Fellowship (2008–2012), and the Royal Academy of Engineering's Distinguished Visiting Fellowship. He has also received the Josef Kapitan Award from the Iron and Steel Society, the Ian Wark Medal and Lecture from the Australian Academy of Science, and the Exxon Mobile Award from the Australian and New Zealand Federation of Chemical Engineers, and was the NSW Scientist of Year 2010 in the category of Engineering, Mathematics and Computer Science. He was elected as a Fellow of the Australian Academy of Technological Sciences and Engineering in 2004.

Winner of the 2011 J.H. Michell Medal

The J.H. Michell Medal is awarded annually by ANZIAM to at most one outstanding new researcher who has carried out distinguished research in applied and/or industrial mathematics within Australia and/or New Zealand. At the recent ANZIAM Annual Meeting, the 2011 J.H. Michell Medal was awarded to Dr Frances Kuo.

Citation for the 2011 J.H. Michell Medal

After careful consideration, the committee is unanimous in recommending that the J.H. Michell Medal be awarded to Dr Frances Y. Kuo from the School of Mathematics and Statistics at the University of New South Wales.

Frances Kuo

Dr Kuo completed both her Bachelor and PhD degrees at the University of Waikato in New Zealand. She then joined the School of Mathematics and Statistics at the University of New South Wales in 2003 as a Research Associate, before obtaining a highly competitive UNSW Vice-Chancellor's Research Fellow position. She followed up this distinction by winning a most prestigious ARC QEII Research Fellowship, which she holds until the end of this year, when she will take up a Senior Lectureship at UNSW.

Dr Kuo's achievements in Applied Maths are manifold, substantial, and sustained. She is a recognised leader in the theory and applications of high-dimensional integration and approximation, quasi-Monte Carlo methods and information-based complexity, interested in applications in finance, statistics and porous media flow. She has published 29 journal articles and 3 articles in highly regarded conference series. These include 11 papers in the leading international journal in her field, the *Journal of Complexity*, one of which was a sole-authored paper for which she received the Information-Based Complexity Young Researcher Award. She has participated as an equal collaborator with many of the giants in her field, from around the globe as well as within Australia and New Zealand. Her significant research achievements have been recognised with plenary talks at major international conferences, and an editorial board position at the *Journal of Complexity*. These are remarkable accolades for so early in a research career, and speak to the quality and impact of Dr Kuo's work. Both are clearly of the highest order.

Dr Kuo has been undertaking research in New Zealand and Australia since 2002, has been a member of ANZIAM since 2007, and has published in the *ANZIAM Journal*.

The Committee strongly recommends Dr Frances Kuo for the 2011 Michell Medal, and is confident that she will prove to be a future leader in Applied Mathematics.

The committee consisted of:

Natashia Boland (Chair)
Carlo Laing
Mark Nelson

MathWest workshop and IMU Meeting at The University of Western Australia

John Bamberg[1] and Michael Giudici[1]

From 27 February to 4 March 2011, we were honoured to have the Executive Committee of the International Mathematical Union (IMU) visiting Perth for their first meeting in Australia. The committee consists of a host of eminent mathematicians, pictured above with the manager of the IMU secretariat. They are, from left to right: Vasudevan Srinivas (India), Marcelo Viana (IMU Vice-President, Brazil), László Lovász (IMU Past President, Hungary), Wendelin Werner (France), Manuel de León (Spain), Cheryl Praeger (Australia), Ingrid Daubechies (IMU President, USA), Christiane Rousseau (IMU Vice-President, Canada), Martin Grötschel (IMU Secretary, Germany), Sylwia Markwardt (manager of the IMU secretariat), Alexander Mielke (IMU Treasurer, Germany), John Toland (UK) and Yiming Long (China).

Following the two-day committee meeting, a workshop was held, with a dazzling line-up of lectures from the IMU Executive Committee. These lectures were accessible to a broad mathematically inclined audience, and were recorded via Lectopia*.
The presenters and titles of the talks were:

- Ingrid Daubechies: 'Comparing surfaces using mass transportation'
- László Lovász: 'General questions about extremal graphs'
- Christiane Rousseau: 'Mathematics of Planet Earth'

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*See http://www.maths.uwa.edu.au/community/year-of-maths/mathwest-workshop-2011.

- John Toland: 'Waves with prescribed distribution of vorticity'
- Marcelo Viana: 'Entropy, old and new'
- Wendelin Werner: 'Random surfaces and fractal carpets'

Additionally, the workshop included a forum consisting of three talks on 'Mathematics: how a nation plans for the future—the Spanish, Indian and Chinese experience', by Manuel de León, Vasudevan Srinivas and Yiming Long. These three members of the IMU each had direct experience in the organisation of the International Congress of Mathematicians in their respective countries.

On the first day of the two-day workshop, an industry breakfast was sponsored by the Dean of the Faculty of Engineering, Mathematics and Computing (Professor John Dell) and the Dean of the Faculty of Education (Professor Helen Wildy). Martin Grötschel (IMU) gave an excellent presentation, 'Production Factor Mathematics', on the application of optimisation methods in industry. Martin pointed out that the mathematics that sped up algorithms had actually contributed more to the solution of these problems than increases in computer speed. His talk was followed by a presentation by UWA's Professor of Zoology and WA Chief Scientist, Professor Lyn Beazley, on the ever-increasing role of mathematics in science and industry.

Following the workshop, most of the IMU Executive made a two-day trip to the south-west of Western Australia, and in particular, to Bunbury Cathedral Grammar School, where some 120 students from local schools were in attendance. Martin Grötschel spoke again about maths in the real world, from the routing of garbage collection to the electro-physiology of the heart. Martin's presentation was followed by an interactive activity given by us (John Bamberg and Michael Giudici) on 'The game of Nim'.

We are extremely grateful and privileged to have had the IMU Executive hold their meeting in Perth, to have been enlightened by their presentations, and to have discussed with them matters mathematical.

Lift-off fellowship report: Mathematical modelling of infectious diseases

Roslyn Hickson[1]

For my Lift-Off Fellowship, I attended an internationally recognised course on 'Mathematical Modelling of Infectious Diseases' at the University of Utrecht, in The Netherlands, from 5 to 16 July 2010. The course was divided into two parts: 'basics of' and 'advanced' modelling of infectious diseases, covering a wide breadth. An important aspect of the course was the opportunity to meet and work with researchers in infectious disease modelling, including leading researchers such as Professors Diekmann and Heesterbeek, and to form connections with other new researchers from around the world.

On return from the course in Utrecht, I worked on modelling dengue fever, focussing on far north Queensland where it is an increasing problem. Dengue 'overwintered' in 2010, which suggests it is now endemic. I explored the effect of seasonality on dengue in Queensland, and presented my preliminary results at the 2010 AustMS conference in Brisbane. In particular, I performed a sensitivity analysis of my model, which showed the lifespan of the mosquito to be significantly less important than the magnitude of the 'seasonality' of the mosquito population.

I am currently working on modelling the dynamics of tuberculosis (TB) transmission from regions of high to low prevalence. This is of particular importance when considering multidrug-resistant (MDR) strains. The work is motivated by tuberculosis in the Papua New Guinea (PNG)–Torres Strait Island region, where 25% of all MDR-TB cases occur in Australia. I presented some initial results at the 2011 ANZIAM conference in Glenelg, where I showed that increasing treatment in PNG will significantly reduce prevalence in the Torres Strait.

My attendance at the Utrecht course has significantly fast-tracked my learning in a field that is quite different to my PhD and undergraduate background, and has hence 'jump-started' my post-PhD career. It has provided the opportunity to bring international knowledge and new insights to my department, which will prove crucial as my colleagues and I intend to develop a similar course based at the National Centre for Epidemiology and Population Health at the ANU.

Roslyn graduated with a Bachelor of electrical engineering from UNSW@ADFA in 2006. She was awarded a PhD in applied mathematical modelling from UNSW@ADFA in 2010. Her PhD addressed heat and mass transfer through multilayered materials. Roslyn is currently working at the National Centre for Epidemiology and Population Health (NCEPH) at the Australian National University, where her focus is on the control of infectious diseases.

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Using the finite simple groups

Cheryl E. Praeger[1]

The finite simple group classification, announced by Daniel Gorenstein in February 1981, was one of the greatest triumphs of late twentieth century mathematics, and to this day its ramifications continue to drive cutting-edge developments across many areas of mathematics. The list of finite simple groups is surprisingly short: for each prime p, the cyclic group C_p of order p is simple; for each integer n at least 5, the group of all even permutations of a set of size n forms the simple alternating group A_n; there are finitely many additional infinite families of simple groups called *finite simple groups of Lie type*; and there are precisely 26 further examples, called the *sporadic simple groups*, of which the largest is the Monster*.

Already in 1981, some consequences of the classification were 'waiting expectantly in the wings'. For example, we immediately could list all the finite groups of permutations under which all point-pairs were equivalent (the 2-transitive permutation groups) [3].

1. Simple groups and algebraic graph theory

For other problems it was unclear for a number of years whether the simple group classification could be applied successfully in their solution. One of the most famous of these was a 1965 conjecture of Charles Sims at the interface between permutation group theory and graph theory. It was a question about finite primitive permutation groups. The primitive groups form the building blocks for permutation groups in a somewhat similar way to the role of the finite simple groups as building blocks (composition factors) for finite groups. Sims conjectured that there is a function f on the positive integers such that, for a finite primitive permutation group in which a point stabiliser H has an orbit of size d, the cardinality of H is at most $f(d)$. In graph theoretic language: for a vertex-primitive graph or directed graph of valency d (each vertex is joined to d other vertices), there are at most $f(d)$ automorphisms (edge-preserving permutations) fixing any given vertex. Proof of the Sims conjecture [5] in 1983 required detailed information about the

Invited technical paper, communicated by Jon Borwein.

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*containing 808 017 424 794 512 875 886 459 904 961 710 757 005 754 368 000 000 000 elements!

subgroup structure of the Lie-type simple groups, and was one of the first non-trivial applications of the finite simple group classification in Algebraic Graph Theory, see [6, Section 4.8C]. The new approach in [5] was later developed into a standard framework for applying the simple group classification to many problems about primitive permutation groups and vertex-primitive graphs.

Stunning new applications of the simple group classification in Algebraic Graph Theory continue to appear, and many new applications are accompanied by deep new results on the structure and properties of the simple groups. The most recent exciting developments relate to expander graphs. These are graphs or networks which are simultaneously sparse and highly connected. They have important applications for design and analysis of robust communication networks, for the theory of error-correcting codes, the theory of pseudo-randomness, and many other uses, beautifully surveyed in [11]. A family of finite graphs, all of the same valency but containing graphs of arbitrarily large size, is an *expander family* if there is a constant c such that the ratio $|\partial A|/|A|$ is at least c for every subset A of vertices of any of the graphs Γ in the family, where A contains at most half of the vertices of Γ and ∂A is the set of vertices of Γ at distance 1 from A. The new results confirm that many families of Cayley graphs for simple Lie-type groups of bounded rank are expander families. This flurry of activity began with a spectacular breakthrough by Helfgott [9] in 2008 for the two-dimensional projective groups $\mathrm{PSL}(2,p)$ over fields of prime order p. The strongest current results for bounded rank Lie type groups are consequences of new results for 'growth in groups' by Pyber and Szabo [19], and independently by Breuillard, Green and Tao [2] for the finite Chevalley groups.

2. Simple groups, primes and permutations

Several results about permutation groups have 'simple' statements making no mention of simple groups, but their only known proofs rely on the simple group classification, often on simple group theory developed long after the classification was announced. In fact many recent results in this area demand a deep and subtle understanding of the finite simple groups, especially their subgroup structure, element statistics, and their representations.

A surprising link between the number of primes and the finite simple groups was discovered soon after the announcement of the simple group classification. It is a result due to Cameron, Neumann and Teague [4] in 1982. Each positive integer $n \geq 5$ occurs as the index of a maximal subgroup of a simple group, namely the simple alternating group A_n has a maximal subgroup A_{n-1} of index $|A_n|/|A_{n-1}| = n$. Let's call n a *maximal index* if $n = |G|/|H|$ for some non-abelian simple group G and maximal subgroup H with $(G,H) \neq (A_n, A_{n-1})$. It was proved in [4] that

$$\max(x)/\pi(x) \to 1 \quad \text{as} \quad x \to \infty,$$

where $\max(x)$ is the number of maximal indices at most x and $\pi(x)$ is the number of primes at most x. The limiting density of the set of maximal indices is 'explained' by the fact that, for each prime p, the projective group $\mathrm{PSL}(2,p)$ acts primitively on the projective line $\mathrm{PG}(1,p)$ of size $p+1$, and so has a maximal subgroup of

index $p+1$. The major motivation that led to this result was its consequence for primitive permutation groups, also proved in [4]: the number $D_{\mathrm{prim}}(x)$ of integers $n \leq x$ for which there exists a primitive permutation group on n points (that is, of *degree* n), other than S_n and A_n, satisfies $D_{\mathrm{prim}}(x)/\pi(x) \to 2$ as $x \to \infty$. Beside the primitive actions of $\mathrm{PSL}(2,p)$ of degree $p+1$, the cyclic group C_p acts primitively of degree p, thus accounting for the limiting density ratio 2.

Two decades later I extended this result with Heath-Brown and Shalev in [8] as part of our investigation of quasiprimitive permutation groups, a strictly larger family of permutation groups than the primitive groups and important in combinatorial applications**. The crucial quantity we needed, in order to determine the behaviour of the degrees of quasiprimitive permutation groups, turned out to be the number $\mathrm{sim}(x)$ of *simple indices* at most x, where by a simple index we mean an index $|G|/|H|$ of an arbitrary subgroup H of a non-abelian simple group G such that $(G,H) \neq (A_n, A_{n-1})$. We proved that $\mathrm{sim}(x)/\pi(x)$ also approaches a limit as $x \to \infty$, and we proved that this limit is the number

$$h = \sum_{n=1}^{\infty} \frac{1}{n\phi(2n)} = 1.763085\ldots,$$

where $\phi(m)$ is the Euler phi-function, the number of positive integers at most m and coprime to m. The analogous consequence (which had been our principal motivation for studying $\mathrm{sim}(x)$) was that the ratio $D_{\mathrm{qprim}}(x)/\pi(x)$ of the number $D_{\mathrm{qprim}}(x)$ of degrees $n \leq x$ of quasiprimitive permutation groups, apart from S_n and A_n, to $\pi(x)$ approaches $h+1$ as $x \to \infty$. In this case also, these ratios are accounted for by various subgroups of the simple groups $\mathrm{PSL}(2,p)$.

My 'all-time favourite' example of a deep result with a deceptively uncomplicated statement is due to Isaacs, Kantor and Spaltenstein [12] in 1995: let G be *any group of permutations* of a set of size n and let p be any prime dividing the order $|G|$ of G (that is, the cardinality of G). Then there is at least one chance in n that a uniformly distributed random element of G has a cycle of a length that is a multiple of p. The hypotheses of this result are completely general, giving no hint that the assertion has anything at all to do with simple groups. However the only known proof of this result relies on the finite simple group classification, and in particular uses subtle information about maximal tori and Weyl groups of simple Lie-type groups. These techniques were the same as those introduced in 1992 by Lehrer [13] to study the representations of finite Lie-type groups. I recently worked with Alice Niemeyer and others to understand the precise conditions needed for this approach to be effective. We developed an estimation method in [16] and used it to underpin several Monte Carlo algorithms for computing with Lie-type simple groups (in [14], [15]). It produces sharper estimates for the proportions of various kinds of elements of Lie-type simple groups than alternative geometric approaches.

**A permutation group is quasiprimitive if each of its nontrivial normal subgroups is transitive. Each primitive permutation group has this property, and so do many other permutation groups.

3. Simple groups and involutions

One of the first hints that understanding the finite simple groups might be a tractable problem was the seminal 'Odd order paper' of Feit and Thompson [7] in 1963 in which they proved that every finite group of odd order is soluble, or equivalently, that every non-abelian finite simple group contains a non-identity element x such that $x^2 = 1$. Such an element is called an *involution*, and the Feit–Thompson result, that each non-abelian finite simple group contains involutions, had been conjectured more than 50 years earlier by Burnside in 1911. The centraliser of an involution x consists of all the group elements g that centralise x in the sense that $xg = gx$. The involution centralisers in finite simple groups are subgroups that often involve smaller simple groups. Several crucial steps in the simple group classification involved systematic analyses of the possible involution centralisers in simple groups, resulting in a series of long, deep and difficult papers characterising the simple groups containing various kinds of involution centralisers.

Some important information about the simple groups can be found computationally, and key for this are efficient methods for constructing their involution centralisers. To construct an involution, one typically finds by random selection an element of even order that powers up to an involution, then uses Bray's ingenious algorithm [1] to construct its centraliser. This worked extremely well in practice for computing with the sporadic simple groups. A more general development of Bray's method into proven Monte Carlo algorithms for Lie-type simple groups over fields of odd order required delicate estimates of various element proportions in simple groups — first given in a seminal paper of Parker and Wilson [17] (available as a preprint for several years before its publication), and then in full detail in [10]. The estimates and complexity analysis give a lower bound on the algorithm performance, but do not match the actual (excellent) practical performance. A major program is in train to find a realistic analysis and the first parts have been completed [14], [18].

The classification of the finite simple groups was a watershed for research in algebra, combinatorics, and many other areas of mathematics. It changed almost completely the problems studied and the methods used. To realise further the power of the classification for future applications, new detailed information is needed about the simple groups — and this will be gained both as new theory and through new computational advances.

References

[1] Bray, J.N. (2000). An improved method for generating the centralizer of an involution. *Arch. Math. (Basel)* **74,** 241–245.

[2] Breuillard, E., Green, B. and Tao, T. (2010). Approximate subgroups of linear groups. *Geom. Funct. Anal.* (To appear.) arXiv:1005.1881v1.

[3] Cameron, P.J. (1981). Finite permutation groups and finite simple groups. *Bull. London Math. Soc.* **13,** 1–22.

[4] Cameron, P.J., Neumann, P.M. and Teague, D.N. (1982). On the degrees of primitive permutation groups. *Math. Zeit.* **180,** 141–149.

[5] Cameron, P.J., Praeger, C.E., Seitz, G.M. and Saxl, J. (1983). On the Sims' conjecture and distance transitive graphs. *Bull. Lond. Math. Soc.* **15,** 499–506.

[6] Dixon, J.D. and Mortimer, B. (1996). *Permutation Groups*. Springer, New York.
[7] Feit, W. and Thompson, J.G. (1963). Solvability of groups of odd order. *Pacific J. Math.* **13,** 775–1029.
[8] Heath-Brown, D.R., Praeger, C.E. and Shalev, A. (2005). Permutation groups, simple groups and sieve methods. *Israel J. Math.* **148,** 347–375.
[9] Helfgott, H.A. (2008). Growth and generation in $\mathrm{SL}_2(Z/pZ)$. *Annals of Math.* **167,** 601–623.
[10] Holmes, P.E., Linton, S.A., O'Brien, E.A., Ryba, A.J.E. and Wilson, R.A. (2008). Constructive membership in black-box groups. *J. Group Theory* **11,** 747–763.
[11] Hoory, S., Linial, N. and Widgerson, A. (2006). Expander graphs and their applications. *Bull. Amer. Math. Soc.* **43,** 439–561.
[12] Isaacs, I.M., Kantor, W.M. and Spaltenstein, N. (1995). On the probability that a group element is p-singular. *J. Algebra* **176,** 139–181.
[13] Lehrer, G.I. (1992). Rational tori, semisimple orbits and the topology of hyperplane complements. *Comment. Math. Helv.* **67,** 226–251.
[14] Lübeck, F., Niemeyer, A.C. and Praeger, C.E. (2009). Finding involutions in finite Lie type groups of odd characteristic. *J. Algebra* **321,** 3397–3417.
[15] Niemeyer, A.C., Popiel, T. and Praeger, C.E. (2010). Finding involutions with eigenspaces of given dimensions in finite classical groups. *J. Algebra* **324,** 1016–1043.
[16] Niemeyer, A.C. and Praeger, C.E. (2010). Estimating proportions of elements in finite simple groups of Lie type. *J. Algebra* **324,** 122–145.
[17] Parker, C.W. and Wilson, R.A. (2010). Recognising simplicity of black-box groups by constructing involutions and their centralisers. *J. Algebra* **324,** 885–915.
[18] Praeger, C.E. and Seress, Á. Probabilistic generation of finite classical groups in odd characteristic by involutions. *J. Group Theory*. In press. doi: 10.1515/JGT.2010.061
[19] Pyber, L. and Szabó, E. Growth in finite simple groups of Lie type of bounded rank. (Submitted.) arXiv:1005.1858.

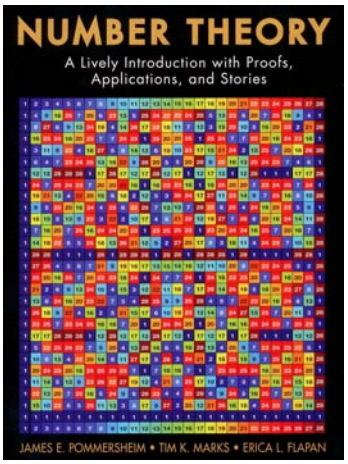
Cheryl Praeger is Winthrop Professor of Mathematics at the University of Western Australia, and in 2007 she became the first pure mathematician to be awarded an Australian Research Council Federation Fellowship. For her achievements and service to mathematics, she was elected a Fellow of the Australian Academy of Science, and appointed a Member of the Order of Australia (AM). She was President of the Australian Mathematical Society from 1992 to 1994, and is currently on the Executive Committee of the International Mathematical Union.

Book reviews

Number Theory

J.E. Pommersheim, T.K. Marks and E.L. Flapan
John Wiley, 2010, ISBN: 978-0-470-42413-1

This is a most unusual textbook on elementary number theory, aptly subtitled *A lively introduction with proofs, applications, and stories*. While it covers roughly the same ground as the classical texts of Niven and Zuckerman's *Introduction to the Theory of Numbers* and LeVeque's *Fundamentals of Number Theory*, as well as more recent results, it is unique in being squarely aimed at the 21st-century student.



By this I mean that the serious bits are covered at a leisurely pace, interspersed with jokes, anecdotes and asides addressed to the student. There are three recurrent cartoon characters: Naomi, a computer wiz, who likes to test theorems numerically; Paul, who restates theorems in plain English after they have been presented in formal mathematical terms; and Phil Lovett (get it?) who makes sometimes plausible but often outlandish conjectures which are later shot down by crucial counter-examples.

Each chapter begins with a short biography of a relevant mathematician, together with a sample of his or her work. Then follows what the authors call a MathMyth, a fantastic story that serves to introduce the main topic in a student-friendly manner. After a systematic presentation of the topic comes a host of exercises, firstly numerical problems and then those requiring reasoning and proofs. Finally there are a number of explorations extending the chapter topic.

I illustrate the approach by considering in detail Chapter 4 on Euclid's algorithm for the greatest common divisor. This begins on p. 148 of a 750-page book, whereas Niven and Zuckerman present it on p. 7 of their 270-page book. Euclid's biography places him in the context of Greek Alexandria and describes his relationship with the emperor Ptolemy, including the usual apocryphal legends. The biography describes his results on right triangles, both real and integral, as well as ruler-and-compass constructions.

The MathMyth introducing the Euclidean algorithm concerns a baker called Euclid in 3rd century BC Alexandria. He is asked to bake a rectangular cake of dimensions 175×65. But Euclid only has square pans, so he fills up the rectangle with the largest possible square cakes, using the greedy algorithm. He manages to do this with two 65×65, one 45×45, two 20×20 and four 5×5 squares. Draw the picture

and you will see a 'Proof without Words' that the Euclidian algorithm always terminates with the greatest common divisor of any two given integers.

The actual proof of the Euclidean algorithm is the standard one, but the authors are careful at each step to explain which of the previously defined properties of the integers are used. Naomi explains the precise connection between the geometrical MathMyth and the numerical proof, and Paul puts the calculation of the gcd into prose with a short English sentence.

The Exploration section studies the complexity of the Euclidean algorithm. It contains a proof that the number of steps to compute $\gcd(a, b)$ is less than $\log_2(ab)$ and describes the connection with Fibonacci numbers. This is all nicely illustrated by a table showing each of the 49 steps used to compute the greatest common divisor of two 25-digit integers. Finally, the method is extended to real numbers to illustrate the method of anthyphairesis which will later be employed in the chapter on continued fractions.

The first three chapters cover what I would describe as 'High school number theory', such as the number systems, prime decomposition, induction, modular arithmetic and divisibility. Then comes 'University number theory', starting with the Euclidean algorithm as described above, followed by chapters on Linear Diophantine Equations and the Fundamental Theorem of Arithmetic (i.e. a proof of the uniqueness of prime decomposition). Other topics include Congruence with applications to check-digit schemes and the Gregorian and Mayan calendars, Modular Number Systems, Fermat's Little Theorem and Euler's Theorem with applications to RSA encryption, Primitive Roots, Quadratic Residues, with proofs of quadratic reciprocity, Primality Testing, including both probabilistic and deterministic tests, Gaussian Integers, Continued Fractions and finally Nonlinear Diophantine Equations, including Pell's Equation and some of the more elementary advances towards a proof of Fermat's Last Theorem.

On the whole, I recommend this book enthusiastically as a Number Theory text that students will actually read and enjoy. Unfortunately, it is marred by several typographical errors which may be puzzling to students. Other indications of overhasty production include an intriguing picture on the cover of a 28×28 matrix whose entries are colour-coded integers between 1 and 28. There is no indication in the Preface or Contents pages of the meaning of this picture. A careful examination reveals that it is a table of powers of elements of Z_{29}. Sure enough, one finds an explanation on p. 390 that it is an encryption table for an exponentiation cipher modulo 29. A less forgivable lapse is repeated references to an online Appendix, Student Companion Site and Instructor Companion Site. There is no indication of how these resources can be accessed, nor how the Instructor Site, presumably containing solutions, is made unavailable to students.

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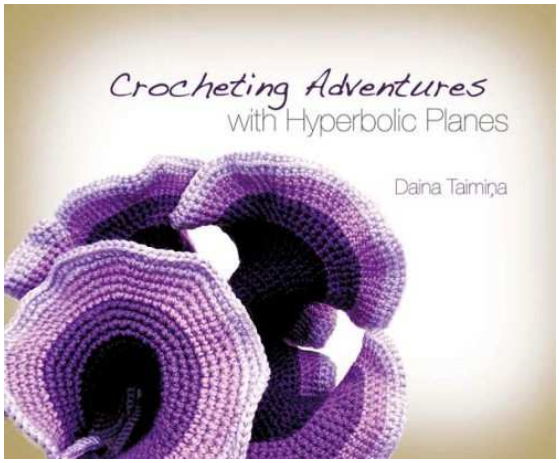
Crocheting Adventures with Hyperbolic Planes

Daina Taimiņa
A K Peters Ltd, 2009, ISBN: 978-1-56881-452-0

The links between mathematics and art have been explored in many works (e.g. [1], [2], [3]). These days, there is a periodical dedicated to these connections, namely the *Journal of Mathematics and the Arts*. In this tradition, *Crocheting Adventures with Hyperbolic Planes* explores the relationship between the art of crocheting and the geometry of surfaces.

How are mathematics and crochet related? Looking back over many years of dressmaking, knitting and crocheting, I find that I am constantly surprised by how many sophisticated mathematical concepts I have used, quite unconsciously. For example, many years ago I used the ideas discussed in this book to construct a costume for a Spanish dancer, when it was important to have very full ruffles on the skirt, but even more important to reduce bulk at the dancer's waistline.



We will describe some chapters in detail in order to convey a sense of the text.

In the Preface to *Geometry and the Imagination* [4], Hilbert states that the aim of the authors is to demonstrate that mathematics is much more than arithmetic by 'offering, instead of formulas, figures that may be looked at and that may be easily supplemented by models which the reader can construct' [4, p. iv]. Similarly, in the introduction to *Crocheting Adventures with Hyperbolic Planes*, Taimiņa states that she is 'sharing a tactile way of exploring mathematical ideas'. Taimiņa is an artist, who has participated in numerous art exhibits, as well as a mathematician. Her work shown in Figure 1 was created for an art exhibit *From Baltic Sea to Coral Reefs*.

Chapter 3 is entitled 'Four strands in the history of geometry'. The author argues that geometry has evolved from (i) art and patterns, (ii) buildings and structures, (iii) navigation, and (iv) motion or machines. The influence of each of these strands is considered in detail and accompanied by many fine illustrations. The author puts Euclid's *Elements* into the second strand. This chapter encourages us to see geometric patterns in unlikely places, and hence, broaden our appreciation of the scope for applying mathematics. Chapter 5 contains a nice introduction to the history of non-Euclidean geometry.

Chapter 4, which is entitled 'Tidbits from the History of Crochet' is just that, tidbits. The author includes much speculation from many sources concerning the origins of crochet, but makes no mention of the extreme popularity of crochet as a means of creating decorative garments during the nineteenth and twentieth centuries. It seems to me that it would be impossible to pinpoint an origin for crochet, because I have seen so many children discover the basic technique simply by playing with a piece of yarn and looping it over their fingers to create a basic crochet chain without a hook. It was called 'finger knitting' when I discovered it, many years ago. I also find it a little odd that images of knitted garments (mittens) are used to illustrate a book on crochet as they do not explore the possibilities of crochet itself.

Figure 1. *The Land and The Sea*, mixed yarn, D. Taimiņa (2009).
Photo: Courtesy of the artist.

Chapter 7 is entitled 'Metamorphoses of the hyperbolic plane'. In this chapter the author endeavours to bring together her interests in mathematics and the art of crocheting. To write about mathematics for a general audience — and to write about crocheting for mathematicians — are two challenging tasks. The chapter opens with the author wondering about where mathematicians find their inspiration. Daina Taimiņa finds her inspiration through the interaction between mathematics and her crocheted models. In this chapter, as elsewhere in the book, there are ideas for people with many interests. Primary school teachers will find interesting exercises with paper and cardboard about drawing on surfaces. The photos may suggest that teachers ask students to reflect on the shapes of things around them. Would a mathematics class benefit from visiting the local art gallery? University students may turn to the work of Hilbert and Cohn-Vossen [4] for clarification on aspects of hyperbolic geometry.

The author concentrates exclusively on one crochet stitch, the double crochet stitch (or, in America, the single crochet). It is, of course, the most suitable for her purpose as this stitch forms the basic building block in the crochet repertoire. It enables the construction, not only of these fantastic curves, but also of solid fabrics, very complex lace patterns and elaborate beading, which is one of the most widespread uses for the Tambour technique mentioned on page 64 and one which does not discard the background fabric. The beauty of crochet lies in the range of possible uses for something that is so essentially simple.

This book has had a variety of impacts and connections. It won the 2009 Diagram Prize, awarded by *The Bookseller* magazine, to that year's book with the oddest title. In 2009, the Powerhouse Museum in Sydney was host to *The Sydney Hyperbolic Crochet Coral Reef*, which was part of the the world-wide *Hyperbolic Crochet Coral Reef* project being conducted by *The Institute of Figuring*. The Sydney exhibition brought together mathematics and crochet to raise awareness about the plight of the Great Barrier Reef. At a personal level, the book has drawn our attention to a branch of mathematical activity of which we were previously unaware.

Crocheting Adventures with Hyperbolic Planes demonstrates that abstract mathematical ideas can be sources of inspiration for artists, and that art can be used to demonstrate geometric ideas. The book is richly illustrated with photographs and coloured illustrations and it has been produced on high-quality paper. It would be a useful addition to the library of a school or university. Indeed, this high level of interest shown by artists in geometry may encourage schools and universities to devote more space to geometry in the curriculum.

References

[1] Belcastro, S.-M. and Yackel, C. (eds) (2008). *Making Mathematics with Needlework*. A K Peters Ltd, Wellesley, MA.

[2] Escher, M.C. (c1992). *M.C. Escher, the graphic work : Introduced and explained by the artist*. Germany : Benedikt Taschen.

[3] Gerd Fischer (ed.) (1986). *Mathematical Models from the Collections of Universities and Museums*, Two volumes. Fried. Vieweg & Sohn, Braunschweig.

[4] Hilbert, D. and Cohn-Vossen, S. (1952). *Geometry and the Imagination*. Chelsea, New York.

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AMSI 2011

Graduate Winter School in Mathematical Sciences

AMSI
AUSTRALIAN MATHEMATICAL SCIENCES INSTITUTE

Graduate Winter School is hosted by:
THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Where

The University of Queensland
St Lucia Campus, Brisbane QLD

When

26 June–8 July 2011
(no lectures scheduled for the weekend of 2–3 July)

Contact

Andree Phillips on
07 3365 2308 or email
a.phillips@maths.uq.edu.au

Two advanced courses are being offered on the theme—Global Optimization: theory and applications

- **Moments, Positive Polynomials and their Applications**
  Presented by Dr Jean Lasserre
  French National Centre for Scientific Research
- **Competitive Markov Decision Processes**
  Presented by Prof. Jerzy Filar
  The University of South Australia

In addition to attending both courses, each participant will have the opportunity to present a seminar of 20 minutes on a topic related to their research.

Target audience

Primarily postgraduate students in Mathematics, Statistics and cognate disciplines from Australian Universities.

Applications close **16 May 2011**—for further information and the application form, go to **www.maths.uq.edu.au/AMSI-AGTP/**

AMSI news

Geoff Prince[1]

AMSI's advocacy role is often applauded even by those using indefinite metrics to gauge our successes. Over the last month we've led engagement with government on a couple of major issues.

Research Workforce Strategy (RWS). This is a particularly important exercise by the federal Department of Innovation, Industry, Science and Research involving a study of the effectiveness of the quality and volume of research training. The mathematical sciences were chosen as a case study after our early engagement with the project. The result is, for the first time, a definitive statement by government that our discipline is simultaneously experiencing galloping demand and at best zero growth. At a recent forum on the RWS I presented a synopsis of our contradictory state to Australia's DVC(R)s, research managers and bureaucrats and I'm pleased to say that I captured their attention. You can see the case study at http://www.innovation.gov.au/Research/ResearchWorkforceIssues/Documents/DisciplineSpecificCaseStudies.pdf. Much to my disappointment, however, the extensive research performance data contained in drafts of the case study were dropped in the last version and replaced by a one paragraph summary of the ERA results. The ERA outcomes say nothing about our performance or resourcing relative to other Australian disciplines. Previously there was a clear statement that the discipline is one of Australia's best performing by international impact and yet one of the most poorly funded.

Base Level Funding submission. By far the largest component of Commonwealth university funding is based on student enrolments. This so-called cluster funding model contains weightings for various disciplines which results in the relative funding of students according to their subject enrolments. This model has a rather long and organic history and is currently being comprehensively reviewed. AMSI was invited to be part of this process and so I convened a working party comprising Peter Taylor (AustMS), Kerrie Mengerson (Statistical Society of Australia Inc.), Nalini Joshi (National Committee for Mathematical Sciences) and Hyam Rubinstein (2006 Strategic Review) to put together a submission. We asked Heads from around the country for input and came up with a comprehensive document that can be found at http://www.amsi.org.au/index.php/publications.

We particularly stressed our role as a service discipline without peer, the burden of remediation that comes with decreasing Year 12 enrolments in intermediate and advanced mathematics, the need to treat honours (and equivalent) enrolments

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separately and the strategic virtues of a national scholarship scheme to boost mathematics and statistics enrolments.

Jan Thomas retires. Jan has made an extraordinary contribution to the mathematical sciences in Australia. She is a past president of the Australian Mathematical Sciences Council, and has been involved with mathematics curriculum and policy development with the education departments. Jan was a senior lecturer in mathematics education at Victoria University before she became involved with the establishment and operation of AMSI. She held an executive position with the AustMS for many years and more recently has been executive officer of the Australian Council of Heads of Mathematical Sciences. We wish her all the very best for her retirement. You can find an in-depth interview with Jan in the latest AMSI Bulletin at http://www.amsi.org.au/index.php/publications/amsi-ice-em-bulletin.

AMSI events. This year's AMSI Industry Event was hosted by Greenhouse 2011 in Cairns. Scott Power of the Bureau of Meteorology was the AMSI (plenary) Lecturer and AMSI's one-day session on Risk and Uncertainty was very popular with keynote talks by Peter Hayman (SARDI) and Kevin Hennessy (CSIRO). We also sponsored the attendance of a number of prospective AMSI interns on the lookout for challenges in the environmental sector. Thanks to our events manager, Simi Henderson, for handling the whole show. A full report will be available soon on our website.

The AMSI Graduate School will be held at the University of Queensland again this July with the working title of Global Optimisation: Theory and Applications. See our ad elsewhere in this issue.

The 2012 AMSI Summer School will return to UNSW, where a very successful event was held back in 2004. Details will be available later in the year.

Following last year's very successful revival, BioInfoSummer will be held again this year at the Walter and Eliza Hall Institute in Melbourne from 5 to 9 December. See http://www.amsi.org.au/index.php/events/652-bioinfosummer-2011.

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

News

General News

AMSI Graduate Winter School

Postgraduate students from mathematics and cognate disciplines, particularly from Australian universities, are invited to apply for a place in the AMSI Graduate Winter School in the Mathematical Sciences.

The website link is www.maths.uq.edu.au/AMSI-AGTP/.

The Graduate Theme Program will take place at the University of Queensland from 26 June to 8 July 2011.

This year, two advanced courses are being offered on the theme of 'Global Optimization: Theory and Applications'.

'Moments, Positive Polynomials and Their Applications' will be presented by Dr Jean Lasserre from The French National Centre for Scientific Research.

'Competitive Markov Decision Processes' will be presented by Professor Jerzy Filar from the University of South Australia.

Places are strictly limited to 25 and acceptance will be based on academic merit. Generous subsidies, covering up to 100% of travel and accommodation costs, are available to students living outside the Brisbane metropolitan area from institutions affiliated with AMSI.

Closing date for applications is 16 May 2011 and registration forms are now available on the website.

For further information contact Andree Phillips (a.phillips@maths.uq.edu.au).

G.S. Watson Annual Lecture

The 13th G.S. Watson Annual Lecture will be given by Professor Peter Hall (University of Melbourne) on 9 August at the Department of Mathematics and Statistics, La Trobe University (Bendigo Campus). The title of the talk is 'Contemporary Frontiers in Statistics'. See www.latrobe.edu.au/maths/watson/ for further details.

Maths in the Media

- Professor John Lattanzio (Monash University) http://www.sbs.com.au/news/article/1428936/Ball-lights-may-explain-%27UFOs%27.
- Dr Aidan Sudbury (Monash University) http://www.abc.net.au/unleashed/41540.html.

Math Planet

Math Planet (www.mathplanet.com) is an online community with free resources for high school maths with a focus on pre-algebra, algebra and geometry. It contains over 350 maths lessons on video as well as forums. Math Planet was developed by a Swedish non-profit organisation called Mattecentrum.

Completed PhDs

Australian National University

- Dr Rishni Ratnam, *A dimensionally reduced Gysin sequence for the equivariant Brauer group*, supervisor: Peter Bouwknegt.
- Dr Janice Scealy, *Modelling techniques for compositional data using distribution defined on the hyper sphere*, supervisor: Alan Carey.
- Dr John Jakeman, *Numerical methods for the qualification of uncertainty in discontinuous function of high dimension*, supervisor: Stephen Roberts.

University of Melbourne

- Dr Allan Motyer, *Quasi-birth-and-death processes with an infinite phase space*, supervisor: Peter Taylor.
- Dr Ofer Manor, *Bubbles, drops and the physics of their collisions*, supervisors: Derek Chan and Steven Carnie.
- Dr Michael Wheeler, *Free fermions in classical and quantum integrable models*, supervisor: Omar Foda.
- Dr Loretta Bartolini, *One-sided Heegaard splittings of 3-manifolds*, supervisor: Professor Hyam Rubinstein

University of Newcastle

- Dr Francisco Eduardo Castillo Santos, *Connections between geometrical and fixed point properties*, supervisor: Brailey Sims.

University of Sydney

- Dr Anna Ougrinovskaia, *Mathematical models of atherosclerosis*, supervisor: Rose Thompson.
- Dr Xiang Fu, *Root systems and reflection representations of Coxeter groups*, supervisor: Bob Howlett.

University of Western Australia

- Dr Hassan Alavi, *On triple factorisations of finite groups*, supervisors: John Bamberg and Cheryl Praeger.

Awards and other achievements

Australian National University

- Mr Lashi Bandara has been awarded a Fulbright Scholarship enabling him to spend a year at Stanford and the University of Missouri where he will study more differential geometry and harmonic analysis.

La Trobe University

- Thi Dinh Tran has been awarded the inaugural Professor Edgar Smith Scholarship. The scholarship, in the form of a travel grant, is awarded annually to a full-time PhD student of outstanding merit from the Department of Mathematics and Statistics at La Trobe University.

Macquarie University

- Professor Ross Street has been appointed to the 'Chaire de la Vallée Poussin 2011' at the Université catholique de Louvain (see www.uclouvain.be/35646.html for the history of this Chair). Ross will give a series of lectures at the UCL during the last week of May (23–28). The title of the 'Leçon inaugurale' will be: 'From linear algebra to knot theory via categories' (www.uclouvain.be/15551.html). Ross is also an invited speaker at the Category Theory, Algebra and Geometry conference (27–28 May). See http://perso.uclouvain.be/tim.vanderlinden/ctag.html for more details.

Monash University

- Professor Joe Monaghan has been elected Fellow of the Australian Academy of Sciences.
- Dr Chris Hough has won the Monash Enhancement Studies Program's Teaching Award for 2010.
- Jie Yen Fan (PhD student in Statistics) has been awarded a Victorian International Research Scholarship from the Victorian Government as a stipend as well as an Endeavour International Postgraduate Research Scholarship (IPRS) which provides cover for the cost of international tuition fees.

University of Adelaide

- Professor Mathai Varghese has been elected Fellow of the Australian Academy of Sciences.
- Sam Cohen has been selected as the Postgraduate Alumni University Medallist for 2011. His PhD thesis is entitled *Problems in backward stochastic differential equations; with applications to nonlinear evaluations and risk measures*. Supervisors: Robert Elliott and Charles Pearce.
- AMSI vacation scholar Vincent Schlegel (supervisor: Michael Murray) was awarded the Cambridge University Press prize for his talk on his vacation project 'Quantum structures of Yang–Mills fields' at the CSIRO Big Day In.

University of Melbourne

- Congratulations to Gus Schrader (Department of Mathematics and Statistics) who has just been awarded the Fulbright Scholarship. This international award is offered yearly to about 40 people worldwide and will enable Gus to study in the US for three years.

University of New South Wales

- Professor Aibing Yu has been elected Fellow of the Australian Academy of Sciences.

University of New South Wales (at ADFA)

- Professor Ian Petersen has been elected Fellow of the Australian Academy of Sciences.

University of Technology, Sydney

- Professor Peter Green of the University of Bristol has been given a fractional appointment in the School of Mathematical Sciences as part of the Dean's Initiative for recruitment of high-profile researchers. Professor Green will spend 6–8 weeks at UTS.

  Peter Green has made important contributions in several fields of statistics including Bayesian modelling and inference, nonparametric regression, image analysis, spatial statistics and Monte Carlo methods and statistical bioinformatics. His 1995 *Biometrika* paper that introduced reversible jump Markov chain Monte Carlo methods has been cited more than 1400 times and contributed to him being listed as one of the top 15 highly cited mathematicians for the 1990s.

  In 2003 he became a Fellow of the Royal Society, an honour held by only about ten living British statisticians.

University of Wollongong

- The Australian Bureau of Statistics has renewed its commitment to fund Professor Ray Chambers as Professor of Statistical Methodology at the University for a further three years.

Appointments, departures and promotions

Charles Sturt University

- Kylie Thomas has resigned from the University.

Macquarie University

- Dr Richard Garner has joined the Department of Computing as an Australian Research Fellow.
- Dr Mark Weber has joined the Department of Mathematics as a research fellow.

Monash University

- Dr Maria Jadamec resigned effective 28 February 2011 and has now been appointed as Adjunct Research Fellow.
- Dr Simon Campbell (Research Fellow) commenced on 5 January 2011. He is a postdoc of Professor John Lattanzio in Astrophysics.
- Dr Sarah Boyd (Research Fellow) commenced on 3 February 2011. She is a postdoc of Dr Jonathan Keith in Statistics and Stochastic Processes.
- Dr Dianne Atkinson, Mr Simon Teague, Mr Alan Couchman and Mr John McCloughan have all been successfully reclassified in Level A Education Focused Academic Roles.
- Dr Burkard Polster has been successfully reclassified in a Level C Education Focused Academic Role.
- Associate Professor Cristina Varsavsky has been successfully reclassified in an Associate Professor (Education Focused) Academic Role.
- Dr Murray Rudman (alumnus and adjunct member of the school) has left CSIRO to become Associate Dean (Research) in the Faculty of Engineering at Monash.

University of Melbourne

- Dr Kevin Tatur has been appointed as Research Fellow.
- Liz Bailey has been appointed as Transition Specialist at the Mathematics and Statistics Learning Centre.
- Dr Tomasz Kowalski has been appointed as Future Fellow.
- Miriam Sved has been appointed as Project and Publicity Officer at MASCOS.
- Dr Anthony Fernando (Research Fellow) has left the university.
- Associate Professor Bill Blyth (AMSI) has left the university.
- Bianca Rigoni (Project and Publicity Officer/MASCOS) has left the university.
- Dr John Groves (Associate Professor) has left the university.

University of Newcastle

- Irene Hudson has been appointed as Professor of Statistics.
- Professor John Rayner has retired.

University of New South Wales

- We welcome Dr Leung Lung Chan who has joined the School as Lecturer in Statistics in February 2011.

University of South Australia

- Dr Amie Albrecht has been appointed as Lecturer in Operations Research.

University of Sydney

- Dr Sheehan Olver has been appointed as a lecturer in Applied Mathematics.
- Dr Peter Kim has been appointed as a lecturer in Applied Mathematics.
- Dr Stephan Tillmann has been appointed as a lecturer in Pure Mathematics.

University of Western Australia

- Assistant Professor Mike Alder has left the School.
- Alice Devillers has been promoted from Research Associate to Research Assistant Professor.

University of Western Sydney

- Dr James East has joined the School as a lecturer in Pure Mathematics.

University of Wollongong

- Dr Nathan Brownlowe has been appointed as a lecturer in Pure Mathematics for four years. Nathan was previously a postdoctoral fellow in the school.

Conferences and Courses

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

The Magma computer algebra group one-day number theory event

Date: 12 May 2011
Venue: University of Sydney
Web: http://magma.maths.usyd.edu.au/conferences/ntd2011

The Magma computer algebra group in the School of Mathematics at the University of Sydney is hosting a one-day number theory event on Thursday 12 May. The schedule will consist of approximately seven talks from a spectrum of number theory speakers, running from about 9:30am until 6:00pm.

The preliminary list of speakers includes: Frank Calegari, Northwestern University; Brendan Creutz, Magma; Daniel Delbourgo, Monash University; Claus Fieker, Magma; Eric Mortenson, The University of Queensland; Frederick Vercauteren, Katholieke Universiteit Leuven; Jared Weinstein, Boston University.

The talks will take place in the Drawing Office (Room 361) of the Civil Engineering Building, essentially the first building on the approach from Redfern Station.

Computational and Analytical Mathematics

Date: 16–20 May 2011
Venue: Simon Fraser University, Canada
Web: http://conferences.irmacs.sfu.ca/jonfest2011/

A workshop on Computational and Analytical Mathematics in honour of Jonathan Borwein's 60th birthday will be held from 16 May to 20 May 2011.

The workshop will be held at Simon Fraser University, Canada but remote participation from Australia will be possible via Access Grid Rooms.

Full details of the workshop are available at the website, and brief details of talks available in Australia are also listed below.

Everyone planning to attend the remote talks should register by 9 May at http://conferences.irmacs.sfu.ca/jonfest2011/registration.

Remote participant registration payment will be covered by AMSI. Remote participants will receive the conference proceedings on a memory stick, the official conference t-shirt and their name will be listed as a conference participant.

Questions should be directed to jonfest2011@irmacs.sfu.ca.

Talks available in Australia (times in AEST):

- Tuesday 17 May, 9.00–10.00, Patrick Combettes, 'Monotone+skew decomposition of inclusion problems'
- Wednesday 18 May, 9.00–9.30, Wadim Zudulin, 'Mahler measures and modular funs'
- Wednesday 18 May, 9.30–10.00, Richard Brent, 'Computing Bernoulli and tangent numbers'
- Wednesday 18 May, 10.00–10.30, Jonathan Borwein, 'What I am doing in Australia'
- Wednesday 18 May, 10.30–11.30, Tony Guttman, 'The susceptibility of the two-dimensional Ising model'
- Thursday 19 May, 9.00–10.00, Peter Borwein, 'The Once and Future Jon'
- Friday 20 May, 9.00–10.00, Richard Crandall, 'On the Fractal Distribution of Brain Synapses'.

Australian Mathematical Sciences Students' Conference

Date: 9–10 June 2011
Venue: Monash University Clayton campus
Web: www.maths.monash.edu.au/conferences/amssc11/

Our pure mathematics students are organising a postgraduate conference. The talks will be split into separate streams running simultaneously and will have several tea and lunch breaks to socialise with other students. Some talks will be aimed at a general maths audience.

AMSI workshop: Symplectic and CR-methods in Complex Analytic Geometry

Date: 28–30 June 2011
Venue: University of New England, Armidale
Web: turing.une.edu.au/~gerd/SCV2011.html
Organisers: Adam Harris, Gerd Schmalz

Integer Programming Down Under: Theory, Algorithms and Applications

Date: 6–8 July 2011
Venue: University of Newcastle
Web: carma.newcastle.edu.au/nuor/ipdu/

The IPDU (Integer Programming Down Under) workshop is designed to bring together researchers with an interest in the theory, algorithms and applications of integer programming so as to facilitate an exchange on the latest ideas and developments in the area, and to provide a venue and environment for informal interaction and collaborative engagements. The workshop program is composed of a limited number of invited talks which are organised in a single track and scheduled so as to leave ample time for discussion and interaction among the participants.

Further details including the list of invited speakers are available at the website.

9th EUROPT Workshop on Advances in Continuous Optimization

Date: 8–9 July 2011
Venue: University of Ballarat
Web: www.ballarat.edu.au/ard/itms/CIAO/Workshops/EUROPT2011

Geometry & Topology Down Under — A Conference in Honour of Hyam Rubinstein

Date: 11–22 July 2011
Venue: University of Melbourne
Web: www.ms.unimelb.edu.au/~hyamfest/
Contact: hyamfest@ms.unimelb.edu.au

Scientific program. 11–15 July 2011: Short courses by Danny Calegari, Walter Neumann and Leonid Polterovich.

18–22 July 2011: Conference with confirmed speakers: Mohammed Abouzaid (MIT/Clay); Ian Agol (Berkeley); Michel Boileau (Toulouse); Danny Calegari (California Institute of Technology); Marc Culler (UI Chicago); Nathan Dunfield (UI Urbana-Champaign); David Gabai (Princeton); Cameron Gordon (UT Austin); Kazuo Habiro (Kyoto); Joel Hass (UC Davis); Craig Hodgson (Melbourne); William Jaco (Oklahoma State); Thang Le (Georgia Institute of Technology); Feng Luo (Rutgers); Darryl McCullough (Oklahoma); Yoav Moriah (Technion); Walter Neumann (Columbia University, Barnard College); Yi Ni (California Institute of Technology); Leonid Polterovich (Chicago/Tel Aviv); Martin Scharlemann (UC

Santa Barbara); Abigail Thompson (UC Davis); Gang Tian (Princeton); Shicheng Wang (Peking University).

Registration. Registration for Geometry & Topology Down Under is via the online registration form, which can be found on the conference website. For planning purposes, we ask all who plan to attend to register in advance.

Support. Travel support is available primarily for graduate students and early career researchers based in Australia or the United States. Please refer to the website for full eligibility criteria and the application process. Note the deadline for US funding applications is Monday 18 April 2011. Later applications will also be considered.

This funding is available courtesy of generous grants kindly provided by the Australian Mathematical Sciences Institute (AMSI) and the National Science Foundation (NSF).

Acknowledgement. The conference is funded by the National Science Foundation, the Clay Mathematics Institute, the Australian Mathematical Sciences Institute, the Australian Mathematical Society and the Department of Mathematics and Statistics at the University of Melbourne.

Organising Committee. Loretta Bartolini (Oklahoma State), Danny Calegari (CalTech), Craig Hodgson (Melbourne), William Jaco (Oklahoma State), Amnon Neeman (ANU), Paul Norbury (Melbourne), Arun Ram (Melbourne), Stephan Tillmann (Queensland) and Nick Wormald (Waterloo).

7th International Congress on Industrial and Applied Mathematics (ICIAM 2011)

Date: 18–22 July 2011
Venue: Vancouver, British Columbia, Canada
Web: www.iciam2011.com
Email: info@iciam2011.com

12th International Pure Mathematics Conference 2011

Date: 29–31 July 2011
Venue: Islamabad, Pakistan
Web: www.pmc.org.pk

55th Annual AustMS Meeting

Date: 26–29 September 2011
Venue: University of Wollongong, NSW
Web: www.uow.edu.au/informatics/maths/austms/index.html

The meeting will be preceded by the third Early Career Researcher Workshop on 24–25 September, and followed by the ALTC Funded Workshop on 29–30 September.

Please note that the date for early bird registration is 17 June.

International Workshop on Hadamard Matrices and their Applications

Date: 27–30 November 2011
Venue: RMIT University, Melbourne
Web: www.rmit.edu.au/mathsgeo/iwhma

A workshop on Hadamard Matrices and their Applications will be held in honour of Kathy Horadam's 60th birthday.

It is almost five years since the publication of Professor Horadam's book *Hadamard Matrices and their Applications* by Princeton University Press. To celebrate the resurgence of interest in Hadamard matrices, we encourage students and researchers to join us in Melbourne for this premier event.

Accepted key note speakers: Professor Jennie Seberry, Dr Dane Flannery, Associate Professor Robert Craigen, Dr John Dillon (NSA).

Volcanic Delta 2011

Date: 27 November – 2 December 2011
Venue: Rotorua, NZ
Web: www.delta2011.co.nz

The 35th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing (ACCMCC)

Date: 5–9 December 2011
Venue: Monash University, Melbourne
Web: users.monash.edu.au/~accmcc/

12th Asian Logic Conference

Date: 15–20 December 2011
Venue: Victoria University of Wellington
Web: msor.victoria.ac.nz/Events/ALC2011

MCQMC 2012: Tenth International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing

Date: 13–17 February 2012
Venue: Sydney
Web: www.mcqmc2012.unsw.edu.au
Contact: Ian H. Sloan, Frances Y. Kuo, Josef Dick, Gareth Peters
(mcqmc2012@unsw.edu.au)

Vale

The University of Wollongong

We regret to advise of the passing away of Dr Grant Cox, senior lecturer in applied mathematics.

Visiting mathematicians

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

A/Prof Pramod Achar; Louisana State University; 19 May to 12 June 2011; algebra; USN; A. Henderson

Ms Natalie Aisbett; The University of Melbourne; 1 February to 29 July 2011; cohomology of real and complex varieties associated with hyperplane arrangements; USN; A. Henderson

Pierre-Olivier Amblard; CNRS, France; 1 August 2010 to 28 February 2013; –; UMB; Owen Jones

Ms Suci Astutik; Institut Teknologi Sepuluh Nopember, Indonesia; 3 October to 30 December 2011; –; UWA; Gopal Nair

Dr Ben Ayliffe; University of Exeter, UK; September 2010 to July 2011; problems related to the formation of planets; UMN; Guillaume Liabe

Prof Matthew Bate; University of Exeter, UK; September 2010 to July 2011; problems relating to the role of magnetic fields and radiation in star formation; UMB; Daniel Price

Andrei Bejan; University of Cambridge; 30 May to 17 June 2011; stochastic modelling and statistical inference; UAD; Joshua Ross

Prof John Bland; University of Toronto, Canada; 28 June to 1 July 2011; several complex variables, CR geometry; UNE; Gerd Schmalz

Prof John Bland; University of Toronto; 16 July 2010 to 31 August 2011; analysis and geometry; ANU; Michael Eastwood

Prof Jon Brundan; University of Oregon; 20 March to 13 June 2011; Hecke algebras and W-algebras; USN; A.P. Mathas

Prof Tim Burness; University of Southampton, UK; 4–18 September 2011; groups and combinatorics; UWA; Michael Giudici

Prof Frank Calegari; Northwestern University; 30 April to 4 June 2011; Galois representations; USN; N.C. Weber

Dr Ebrima Ceesay; Booz Allen Hamilton, USA; during 2011; –; UBR; Paul Watters

Prof Stephen Chapman; Oxford University; 1 August 2010 to 1 August 2011; mathematical modelling, methods of asymptotics; USN; N. Joshi

Jing Chen; Central South University, China; January 2011 to January 2012; –; UWA; Cai Heng Li

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

A/Prof Pallavi Dani; Louisiana State University; 19 May to 12 June 2011; geometric group theory; USN; A. Thomas

Phillip Edwards; Monash University; May 2011; –; UWA; Nazim Khan

Eugene Feinberg; Stony Brook University, New York; 17–20 July 2011; –; USA; Vladimir Ejov

Prof Albert Ferrer; Polytechnic University of Catalonia, Spain; mid-2011; –; UBR; Adil Bagirov

Prof Jorge Garcia-Mellian; University de La Laguna, Spain; 2–21 May 2011; nonlinear partial differential equations; UNE; Yihong Du

Dr Shane Henderson; Cornell University; 1 January to 30 June 2011; computational science; ANU; Steve Roberts

Mr David Howden; University of Warwick; 13 April to 18 May 2011; MAGMA; USN; J.J. Cannon

Prof Naihong Hu; East China Normal University; 1–31 May 2011; Lie superalgebras; USN; R. Zhang

Prof Sergey Ivashkovitch; University of Lille, France; 28 June to 1 July 2011; complex and symplectic geometry; UNE; Gerd Schmalz

Feida Jiang; –; 1 April to 30 September 2011; –; ANU; Neil Trudinger

James Keesling; –; 1 May to 18 June 2011; –; ANU; Michael Barnsley

Prof Juan Enrique Martinez Legaz; University of Barcelona, Spain; mid-2011; –; UBR; Adil Bagirov

Prof C.C. Lindner; Auburn University, USA; 11–25 May 2011; combinatorics; UQL; E.J. Billington

Prof Marco Antonio Lopez; University of Alicante, Spain; mid-2011; –; UBR; Adil Bagirov

Andy Lynch; University of Cambridge; 18 March to 18 May 2011; –; ANU; Conrad Burden

Joel Moitsheki; University of the Witwatersrand; early October 2011; –; USA; Bronwyn Hajek

Dr Dave Morris; University of Lethbridge, Canada; 27 January to 30 May 2011; groups and combinatorics; UWA; Cheryl Praeger/Michael Giudici

Dr Joy Morris; University of Lethbridge, Canada; 27 January to 30 May 2011; –; UWA; –

Benjamin Moyon; University of Bordeaux, France; 1 March to 1 September 2011; –; UWA; Andrew Bassom

Mark Nelson; University of Wollongong; second half 2011; –; USA; Bronwyn Hajek

Max Neunhoeffer; University of St Andrews, UK; 18 August to 16 September 2011; –; UWA; Cheryl Praeger

Miss Thuntida Ngamkhan; Thailand; 15 March to 30 June 2011; –; UWA; Andre Volodin

Dr Burak Ordin; Ege University, Izmir, Turkey; March to October 2011; –; UBR; Adil Bagirov

Adam Piggott; Bucknell University, USA; January to May 2011; geometric group theory; UNC; Murray Elder

Prof Peter Polacik; University of Minnesota, USA; 29 May to 3 June 2011; nonlinear partial differential equations; UNE; Yihong Du

Dr Natalia Rojkovskaia; Kansas State University; 17 May to 17 June 2011; quantum algebras; USN; A.I. Molev

Katja Sagershnig; University of Vienna; 1 May 2011 to 31 December 2012; –; ANU; Michael Eastwood

Prof Leonidas Sakalauskas; Lithuania; mid-2011; –; UBR; Adil Bagirov

Tony Samuel; University of St Andrews; 9 April to 17 May 2011; – ANU; Adam Rennie

Jens Schmidt; Freie University, Berlin; 21 April to 20 May 2011; –; UOM; David Wood

Marie Snipes; Kenyon College, Ohio; 15 June to 27 July 2011; complex analysis; USA; Lesley Ward

Prof Oliver Stein; University of Karlsruhe, Germany; mid-2011; –; UBR; Adil Bagirov

Miss Sujitta Suraphee; Thammasat University, Thailand; 5 May to 25 June 2011; –; UWA; Andre Volodin

Mr Hakan Tor; Turkey; May to November 2011; –; UBR; Adil Bagirov

Dr Frederick Vercauteren; Research Foundation Flanders; 9–26 May 2011; MAGMA; USN; J.J. Cannon

Dr Jerome Vetois; University of Nice; 1–13 May 2011; Nonlinear equations; USN; F.C. Cirstea

Andrew Vince; –; 1–31 May 2011; –; ANU; Michael Barnsley

Ms Anna Vinnitskaya; Saint Petersburg State University, Russia; March to May 2011; –; UBR; Nadezda Sukhorukova

Prof Wei Wang; Nanjing Normal University, China; during 2011; –; UBR; Paul Watters

Dr Jared Weinstein; Institute for Advanced Study; 2–13 May 2011; MAGMA; USN; J.J. Cannon

Dr Geordie Williamson; Oxford; 23–28 May 2011; algebra; USN; A. Henderson

Joseph Wolf; University of California; 13 April to 11 May 2011; –; ANU; Michael Eastwood

Dr Sukru Yalcinkaya; –; 1 May to 1 August 2011; –; UWA; Cheryl Praeger

Dr Ilia Zharkov; Kansas State University 17 May to 17 June 2011; quantum group theory; USN; A.I. Molev

Nominations sought for the 2011 Alf van der Poorten Travelling Fellowship

As a result of a generous donation from the van der Poorten family, applications for the 2011 Alf van der Poorten Travelling Fellowship are now invited, subject to the following rules. Prospective applicants should visit the Society's website at www.austms.org.au/Alf+van+der+Poorten+Travelling+Fellowship for an application template before submitting an application electronically to the selection committee at van.der.poorten@austms.org.au by 16 May 2011.

The members of the selection committee are: Professor Andrew Mathas (Chair), Associate Professor Peter Stacey and Professor Peter Taylor.

Rules for Alf van der Poorten Travelling Fellowships

1. The Alf van der Poorten Travelling Fellowship is offered annually to researchers who have obtained their PhD in pure mathematics from an Australian university.
2. To be eligible to apply, a candidate must have qualified for their PhD within two years of the closing date and they must not have previously been awarded the Alf van der Poorten Fellowship. Applicants must have been members of the Society for at least twelve months at the time of application. (Backdating of membership to the previous year is not sufficient.)
3. One Fellowship will be awarded each year, unless no one of sufficient merit is found, in which case no Fellowship shall be awarded.
4. The Society will establish a selection committee to make recommendations to Council on the award of the fellowship.
5. Applications for the Fellowship should include the completed application form, with a travel and research plan, a budget (at most one page), a full CV and a letter from the awarding institution confirming when the applicant qualified for the award of their PhD. Applications should be sent to van.der.poorten@austms.org.au by 16 May in the year of the award.
6. The applicant should arrange for letters of support from two experts in their field to be sent to the committee care of van.der.poorten@austms.org.au.
7. The selection committee will recommend the amount to be granted, to a maximum of $5000, to a successful applicant, taking account of the proposed research and travel activities, the need for support and the research track record of the applicant relative to opportunity.
8. The Selection Committee reserves the right to consult with appropriate assessors.

9. In applying for a van der Poorten Fellowship, applicants agree that if they are successful, then their names, a citation and photograph can be published on the web pages and in journals of the Society.
10. The fellowships will be awarded, in the first instance, every year from 2011 to 2030. The amount of the award may be increased in consultation with the family of Alf van der Poorten.

The 2011 Australian Mathematical Society Medal

The Medal Committee for the 2011 Australian Mathematical Society Medal is now seeking nominations and recommendations for possible candidates for this Medal. 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 2011 Medal Committee, Associate Professor B.H. Andrews, Centre for Mathematics and its Applications, ANU, ACT 0200 (email: ben.andrews@maths.anu.edu.au).

Nominations should be received by 1 June 2011.

See www.austms.org.au/The+Australian+Mathematical+Society+Medal for the Medal rules and a list of past winners.

Nominations sought for the 2011 AustMS Best Paper Prize

The 2011 AustMS Best Paper Prize Selection Committee is now seeking nominations and recommendations for possible candidates for this prize. This is a newly established prize, and this year the award will be for a publication in Pure Mathematics. In 2012 it will be for a publication in Applied Mathematics and in 2013 for one in Statistics. Thereafter the prize will rotate between these three areas in a three-year cycle.

Each award will be for a single article, monograph or book consisting of original research, and published in the six calendar years preceding the year of the award.

To be eligible for the award of the Best Paper Prize, a publication must have at least one author who meets the following conditions:

(i) he/she must be a member of the Society, and must have been a member of the Society for the calendar year at the time of publication of the paper (back-dating of membership is not allowed);

(ii) he/she must be normally resident in Australia, and must have been normally resident in Australia at the time when the research was carried out.

In the case of publications with multiple authors, the prize will be shared by all authors. The existence of authors who do not meet the conditions above will not preclude this award, although the Selection Committee may take it into account in assessing the achievement of the author(s) who do meet those conditions.

The Selection Committee may deem a publication ineligible if an author has previously received an award from the Australian Mathematical Society for a body of research which included the publication in question.

A publication may be nominated for the award by any member of the Society who is not an author of that publication.

Nominators should provide a brief (1–2 pages) summary of what makes the nominated publication important and original, with appropriate references to prior or subsequent work in the field. These should be sent by email to the Chair of the selection committee, and all nominations should be received via email by 30 June 2011.

The Selection Committee may consult with appropriate external assessors.

For further information, please email the Chair of the 2011 AustMS Best Paper Prize Selection Committee, Professor Mathai Varghese, School of Mathematical Sciences, University of Adelaide, Adelaide 5005 (mathai.varghese@adelaide.edu.au).

The Prize will be announced at the 55th AustMS annual meeting held at University of Wollongong, NSW, Australia, 26–29 September 2011.

The other members of the 2011 AustMS Best Paper Prize Selection Committee are:

Incoming Chair: Professor Andrew Bassom
Pre-incoming Chair: Professor Peter Hall
One-year member: Dr Anthony Henderson
One-year member: Professor John Hutchinson.

Election of Officers and Ordinary Members of Council

Officers of Council

Nominations are invited for the following Officers for the Session commencing after the Annual General Meeting to be held in September 2011.

One Vice-President and one President-Elect. Note: According to Paragraph 34 (i) of the AustMS Constitution, after the AGM in September 2011, Professor P.G. Taylor will continue in office as the President, and Professor N. Joshi steps down as Immediate-Past-President, and is not eligible for immediate re-election as a Vice-President.

According to Paragraph 34 (ii), Professor A.P. Mathas steps down as Elected Vice-President, and is not eligible for immediate re-election to that office.

According to Paragraph 34 (iii), the positions of Secretary and Treasurer will be appointed by Council at its September 2011 meeting.

The present Officers of the Society are:
President: P.G. Taylor
Immediate-Past-President: N. Joshi
Vice-President: A.P. Mathas
Secretary: P.J. Stacey
Treasurer: A. Howe.

Ordinary Members of Council

The present elected Ordinary Members of Council are:

(1) Members whose term of office expires after the AGM in September 2011
- M. Giudici
- A. Henderson
- J. Ramagge.

(2) Members whose term of office expires after the AGM in September 2012
- J.M. Borwein
- B.M. Maenhaut
- A. Ram

(3) Members whose term of office expires after the AGM in September 2013
- F. Larusson
- M. O'Reilly

Accordingly, nominations are invited for three positions as Ordinary Members of Council, who shall be elected for a term of three consecutive sessions. Note that according to Paragraph 34(iv) of the Constitution, M. Giudici, A. Henderson and J. Ramagge are not eligible for re-election at this time as Ordinary Members. Paragraph 35 of the Constitution requires that the elected Officers and elected members of Council shall include residents from all the States and the ACT. Accordingly, nominations for the two Officers and three Ordinary Members must include a member from Western Australia to satisfy this.

To comply with the Constitution (see Paragraphs 61 and 64), all nominations should be signed by two members of the Society and by the nominee who shall also be a Member of the Society.

Nominations should reach the Secretary (whose name and address appear inside the back cover of the Gazette) no later than Friday 24 June 2011.

Alternatively, members are encouraged to send informal suggestions to the Nominations and Publications Committee, by emailing the Secretary at Secretary@austms.org.au.

For the information of members, the following persons are presently ex-officio members of Council for the Session 2010–2011.

Vice President (Chair of ANZIAM):	T.R. Marchant
Vice President (Annual Conferences):	R. Zhang
Representative of ANZIAM:	P. Broadbridge
Public Officer of AustMS and AMPAI:	P.J. Cossey
Chair, Standing Committee on Mathematics Education:	L. Wood
AustMS member elected to Steering Committee:	J.H. Rubinstein

Editors: A.R. Albrecht and K. White (Gazette)
D.E. Taylor (Bulletin)
R. Moore (Electronic Site)
M.G. Cowling (Journal of AustMS)
C.E. Praeger (Lecture Series)
A.P. Bassom and G. Hocking (ANZIAM Journal)
A.J. Roberts (ANZIAM Journal Supplement)

The Constitution is available from the Society's web pages, at http://www.austms.org.au/Constitution.

The 2012 ANZIAM Medal: call for nominations

Nominations are now sought for the ANZIAM medal, which is the premier award of ANZIAM, a division of the Australian Mathematical Society. Closing date: 31 October 2011.

Nominations for the Award can be made by any member of ANZIAM other than the nominee. A nomination should consist of a brief CV of the nominee, together with the nominee's list of publications and a one-page resumé of the significance of the nominee's work. Nominations should be forwarded, in confidence, to the Chair of the Selection Panel, Professor Jim Hill, University of Adelaide, email: jim.hill@adelaide.edu.au.

Further details of the application process and the award criteria are on the ANZIAM website: www.anziam.org.au.

The 2012 J.H. Michell Medal: call for nominations

Nominations are now sought for the J.H. Michell Medal, an award given in honour of John Henry Michell, by ANZIAM, a division of the Australian Mathematical Society. The award is for outstanding new researchers in applied and/or industrial mathematics. Closing date: 31 October 2011.

Nominations for the Award can be made by any member of ANZIAM other than the nominee. A nomination should consist of a brief CV of the nominee together with the nominee's list of publications and a one-page resumé of the significance of the nominee's work. Nominations should be forwarded, in confidence, to the Chair of the Selection Panel, Dr Carlo Laing, Massey University (Albany Campus), email: c.r.laing@massey.ac.nz.

Further details of the application process and the award criteria are on the ANZIAM website: www.anziam.org.au.

AustMS accreditation

The secretary announces the accreditation of Dr Stephen J. Keith of Macquarie Group as an Accredited Fellow (FAustMS).

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 P.G. Taylor	Department of Mathematics and Statistics University of Melbourne Vic 3010, Australia. P.Taylor@ms.unimelb.edu.au
Secretary:	Dr P. Stacey	Department of Mathematics and Statistics 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: www.austms.org.au.

Local Correspondents

ANU:	K. Wicks	Swinburne Univ. Techn.:	J. Sampson
Aust. Catholic Univ.:	B. Franzsen	Univ. Adelaide:	T. Mattner
Aust. Defence Force:	H. Sidhu	Univ. Ballarat:	A. Kruger
Bond Univ.:	N. de Mestre	Univ. Canberra:	P. Vassiliou
Central Queensland Univ.:	R. Stonier	Univ. Melbourne:	B. Hughes
Charles Darwin Univ.:	I. Roberts	Univ. Newcastle:	J. Turner
Charles Sturt Univ.:	P. Charlton	Univ. New England:	G. Schmalz
CSIRO:	C. Bengston	Univ. New South Wales:	C. Tisdell
Curtin Univ.:	J. Simpson	Univ. Queensland:	H.B. Thompson
Deakin Univ.:	L. Batten	Univ. South Australia:	K. White
Edith Cowan Univ.:	U. Mueller	Univ. Southern Queensland:	T. Langlands
Flinders Univ.:	R.S. Booth	Univ. Sunshine Coast:	P. Dunn
Griffith Univ.:	A. Tularam	Univ. Sydney:	J. Parkinson
James Cook Univ.:	S. Belward	Univ. Tasmania:	B. Gardner
La Trobe Univ.:	B. Davey	Univ. Technology Sydney:	E. Lidums
Macquarie Univ.:	R. Street	Univ. Western Australia:	T. Blackwell
Monash Univ.:	B. Polster	Univ. Western Sydney:	R. Ollerton
Murdoch Univ.:	M. Lukas	Univ. Wollongong:	J. McCoy
Queensland Univ. Techn.:	G. Pettet	Victoria Univ.:	P. Cerone
RMIT Univ.:	Y. Ding		

Publications

The Journal of the Australian Mathematical Society

Editor: Professor M. Cowling
School of Mathematics and Statistics
University of New South Wales, NSW 2052, Australia

The ANZIAM Journal

Editor: Professor A.P. Bassom
School of Mathematics and Statistics
The University of Western Australia, WA 6009, Australia

Editor: Associate Professor G.C. Hocking
Mathematics and Statistics
Murdoch University, WA 6150, Australia

Bulletin of the Australian Mathematical Society

Editor: Associate Professor D. Taylor
Bulletin of the Australian Mathematical Society
School of Mathematics and Statistics
The University of Sydney, NSW 2006, Australia

The *Bulletin of the Australian Mathematical Society* aims at quick publication of original research in all branches of mathematics. Two volumes of three numbers are published annually.

The Australian Mathematical Society Lecture Series

Editor: Professor C. Praeger
School of Mathematics and Statistics
The University of Western Australia, WA 6009, Australia

The lecture series is a series of books, published by Cambridge University Press, containing both research monographs and textbooks suitable for graduate and undergraduate students.

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