Combinatorial Mathematics Society of Australasia

Newsletter 72: April 2025

Incorporated 8 July 1996

Introduction

Thanks to all CMSA members who have sent information for this newsletter.

Please send news as soon as you have anything of interest to CMSA members and the combinatorial community, even if no newsletter is imminent. Email items to the Newsletter Editor: kevin.mcavaney@ozemail.com.au. Only in plain text please.

Closing date for Newsletter 73: 30 June 2025.

Old newsletters can be found here.

Workshop and conference announcements

47ACC December 2025

The 47th Australasian Combinatorics Conference (47ACC) will be held at Victoria University of Wellington, New Zealand, 1–5 December 2025.

It will include invited talks, contributed talks in parallel sessions, the conference dinner, a presentation of the CMSA Anne Penfold Street Student Prize for the best student talk at the conference, an excursion, and the CMSA Annual General Meeting. Registration will automatically include a one-year membership of CMSA, if not already a life member.

Researchers in any area of discrete mathematics and its applications are warmly invited to attend and to contribute a talk.

The invited speakers for 46ACC are:

- Johannes Carmesin (Technische Universität Bergakademie Freiberg, Germany)
- Katie Clinch (UNSW, Sydney)
- Jim Geelen (University of Waterloo, Canada)
- Eunjung Kim (KAIST, South Korea, and CNRS, France)
- Karen Meagher (University of Regina, Canada)
- Kerri Morgan (RMIT University, Melbourne)
- Luke Morgan (University of Western Australia)
- Rajko Nenadov (University of Auckland)

Organisers: Nick Brettell and Dillon Mayhew.

Early bird registration deadline: 3 October 2025.
Deadline for submission of abstracts: 14 November 2025.

Contact: 47AustCombCon@gmail.com

Website: https://sms.wgtn.ac.nz/Events/ACC47/

More combinatorics conferences

38th Conference of the European Chapter on Combinatorial Optimization (ECCO'2025),
Marrakech, Morocco, 8–10 May 2025

8th Workshop on Design Theory, Hadamard Matrices and Applications (Hadamard 2025),
Universidad de Sevilla, Seville, Spain, 26–30 May 2025

Canadian Discrete and Algorithmic Mathematics Conference (CanaDAM2025),
Ottawa, Canada, 20–23 May 2025

21st Annual Conference of the Academy of Discrete Mathematics and Its Applications and International Conference on Discrete Mathematics (ADMA-ICDM 2025),
Cochin, India, 7–10 June 2025

14th International Conference on Algorithms and Complexity (CIAC 2025),
LUISS University, Rome, Italy, 10–12 June 2025

15th Nordic Combinatorial Conference (NORCOM 2025),
Reykjavik University, Iceland, 16–18 June 2025

Rzeszów Workshop on Graph Theory (RWGT2025),
Rzeszow University of Technology, Poland, 23–27 June 2025

20th Workshop on Modelling and Mining Networks (WAW 2025),
Vilnius University, Vilnius, Lithuania, 30 June–3 July 2025

International Conference on Permutation Patterns 2025,
University of St Andrews, Scotland, 7–11 July 2025

Algebraic Combinatorics, Special Functions, and Representation Theory,
University of Queensland, Brisbane, 14–18 July 2025

37th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC 2025),
Hokkaido University, Japan, 21–25 July 2025

31st International Computing and Combinatorics Conference (COCOON 2025),
Chengdu, China, 15–17 August 2025

European Conference on Combinatorics, Graph Theory and Applications (EUROCOMB'25),
Hungarian Academy of Sciences, Budapest, 25–29 August 2025

10th Cracow Conference on Graph Theory (10CCGT),
Pieniny Mountains, Poland, 21–26 September 2025

International Congress of Mathematicians 2026,
Philadelphia, USA, 23–30 July 2026. The Congress is a quadrennial event organised by the International Mathematical Union. There are 20 sections across mathematics including Section 13 Combinatorics, which lists the following topics. Combinatorial structures. Enumeration: exact and asymptotic. Graph theory. Probabilistic and extremal combinatorics. Designs and finite geometries. Algebraic combinatorics. Topological and analytical techniques in combinatorics. Combinatorial geometry. Combinatorial number theory. Additive combinatorics. Polyhedral combinatorics and combinatorial optimization.

The 48th Australasian Combinatorics Conference (48ACC) will be held at Monash University, Melbourne, December 2026, dates TBA.

Recent news

New PhDs

Congratulations to the following students who recently completed their PhD in the Discrete Maths group at Monash University:

Amber Gentle, Covering problems on permutations, 2024. Supervised by Ian Wanless and Daniel Horsley.

Robert Hickingbotham, Exploring sparse and hereditary graph classes via products and tree-decompositions, 2024. Supervised by David Wood and Tony Huynh.

CMSA Seminars

Recent seminars in this online series were by:

- Jeroen Schillewaert, University of Auckland, 12 March 2025, *Quasi-polar spaces*
- Nick Brettel, Victoria University of Wellington, 9 April 2025, *Generalisations of Brooks' Theorem for graphs with connectivity constraints*

For abstracts and forthcoming seminars visit http://combinatorics-australasia.org/seminars.html

Research Fellow Position

The School of Mathematics and Statistics at The University of Melbourne is seeking a full-time Research Fellow to work on an ARC funded project in algebraic graph theory. The position is for two years, with the possibility of extension for up to one additional year. The expected starting date is 1 July 2025, but an earlier or slightly later commencement date is possible.

This postdoctoral position is associated with an ARC Discovery Project led by Sanming Zhou and Binzhou Xia. The goal of the project is to study perfect codes in selected classes of Cayley graphs, with a focus on their existence, construction and connection with underlying groups.

The candidate should have a PhD in mathematics with strong expertise in one or more of the following areas: symmetry of graphs (in particular, vertex-transitive graphs, Cayley graphs and their applications); group theory (in particular, actions of finite groups on combinatorial structures, representations and characters of groups); combinatorics (in particular, designs, codes, and their links to graphs and algebraic structures).

The full job advertisement, including a position description and a link to the online application system, can be found at https://jobs.unimelb.edu.au/en/job/919448/research-fellow-in-algebraic-graph-theory. The closing date for applications is 21 April 2025.

For more information, please contact Sanming Zhou and/or Binzhou Xia.

Report on 46ACC

The 46th Australasian Combinatorics Conference (46ACC) was held at The University of Queensland, 2-6 December 2024. The conference was organised by Sara Davies, Barbara Maenhaut, and Darryn Bryant. It was supported financially by the Institute of Combinatorics and its Applications.

There were 70 registered participants, 48 contributed talks, and the following 8 plenary talks:

- Alice Devillers (University of Western Australia) *On partial linear spaces and rank 3 groups*
- Melissa Lee (Monash University) *Graphs on finite groups*
- Florian Lehner (University of Auckland) *Groups acting on trees and tree-like graphs*
- Anita Liebenau (UNSW Sydney) *Ramsey with purple edges*
- Jie Ma (University of Science and Technology of China) *A hypergraph bipartite Turan problem*

- Sam Mattheus (Vrije Universiteit Brussel) *Forbidden subgraphs: past, present and future*
- Anita Pasotti (Università degli Studi di Brescia) *Heffter Spaces*
- David Wood (Monash University) *The global structure of planar graphs*

In Anita Pasotti's talk, the audience was given a challenge: to be the first to find a Heffter linear space (or prove its non existence). The reward: a typical Italian dinner to be kindly offered by Marco Buratti!

As is tradition for the Australasian Combinatorics Conference, an excursion was held on the Wednesday of the conference week. We had 41 participants on an excursion to Lone Pine Koala Sanctuary, enjoying the koalas, kangaroos, and bird life. The photo shows a shy koala with several conferees.

The conference dinner was held on the Thursday evening of the conference, at the Transcontinental Hotel in Brisbane. The CMSA Anne Penfold Street Student Prize for the best presentation by a student at 46ACC was awarded to Tara Kemp (University of Queensland) for her talk *Latin squares with disjoint subsquares.* The photo shows Tara receiving the prize from Mikhail Isaev (one of the judges) at the dinner.

CMSA Council

At the CMSA AGM on 3 December 2024, the following people were elected to Council for 2025:
Ian Wanless (President), John Bamberg (Vice-President), Sara Davies (Secretary), Daniel Horsley (Treasurer), Thomas Britz, Jeanette McLeod, Rajko Nenadov, Nick Brettell, Florian Lehner, Brendan McKay, Anita Liebenau, Paul Leopardi, Kevin Hendrey.

Book Review

Parabolic Problems: 60 Years of Mathematical Puzzles in Parabola by David Angell and Thomas Britz.

If some day you decide to send me to a desert island, please, please let me take a copy of *Parabolic Problems* with me. The magazine *Parabola* began in 1964 at the UNSW under the parentage of Charles Cox and George Szekeres. Its aim was, and still is, a magazine for secondary school students. Its first editor, Charles Cox, aimed "... to provide problems and puzzles that will test your insight, ingenuity and determination to the limit."

David Angell and Thomas Britz are both mathematical academic staff members at UNSW. The former is the current problem editor of Parabola and is strongly committed to extension activities for secondary students. The latter is chief editor and spends great effort to support and care for students and their education. Together they have produced a book to stir the brains not just those of secondary students.

Parabolic Problems has three sections: 1. Problems; 2. Solutions; 3. Some Useful Problem-Solving Techniques.

So first I want to give you some idea about the kind of problems that *Parabola* produces. I'll do this by looking at four of the 329 which the authors have chosen out of the 1740 or so that were available to them.

Q11. Show how to dissect a regular hexagon into five pieces which can be arranged to make a square.

This seems a problem that you can approach by cutting regular hexagons and trying to reassemble again into a square. So most of us have an easy entry to get started on this one.

Q33. Find all solutions to the simultaneous equations

$$y = x + \sqrt{x + \sqrt{x + \cdots + \sqrt{x + \sqrt{y}}}} \quad \text{and} \quad x + y = 6,$$

where there are 1975 square roots in the first equation.

The 1975 was almost certainly not chosen randomly. Many of the problems contain the number of the year that they appeared in Parabola. The solution here starts by saying that "An obvious solution is x = 'this' and y = 'that'. This is the only solution." I won't say any more. I'm not here to give you solutions but to show the kind of problems that might tickle your fancy.

Q83. In this array, the entries in the nth row are successive multiples of n.

$$\begin{array}{ccccccc} 1 & 2 & 3 & 4 & 5 & \cdots \\ 2 & 4 & 6 & 8 & 10 & \cdots \\ 3 & 6 & 9 & 12 & 15 & \cdots \\ 4 & 8 & 12 & 16 & 20 & \cdots \\ 5 & 10 & 15 & 20 & 25 & \cdots \\ \vdots & \vdots & \vdots & \vdots & \vdots & \ddots \end{array}$$

Find a formula for S_n, the sum of the numbers in the nth diagonal. For example, $S_5 = 5 + 8 + 9 + 8 + 5 = 35$.

This is something I'll happily play with: numbers. I hope on my desert island I can get this out in a week. There is a certain symmetry that I find attractive. Does that look like other arrays I have seen?

Q304.
(a) Show how to arrange the numbers 1, 2, 3, 4, 5, 6, 7, 8, 9 around a circle in such a way that the sum of the neighbouring numbers is never a multiple of 3 or 5 or 7. In how many ways can this be done?
(b) Given any 9 consecutive integers, is the same task always possible?

I played with graph theory for a lot of my research life. How can I use graph theory to get a start on this though?

The third chapter is a very valuable one. The Useful Problem-Solving Techniques that are considered are greatest common divisors; solving linear Diophantine equations; modular arithmetic; graph theory; basic combinatorics; the binomial theorem; some trigonometric formulae; proof by mathematical induction; Pick's theorem; roots and coefficients of polynomials; and inequalities. I've given you one method hint above. You might think to use one of the others in one of the questions above. But those techniques are certainly valuable for secondary students to get to know if they like solving problems.

Parabola is still functioning and can be seen on the web at www.parabola.unsw.edu.au. Among other things, a recent issue has eight articles, (including 'Can the chicken cross the road' and '(Yet another) way to prove Pythagoras' Theorem'), and problems 1741 to 1750. I would encourage you to read it regularly and learn to cope with fun and frustration. Perhaps work with a friend. But I encourage you to get a copy of *Parabolic Problems* for yourself, or for the nearest school, or for the secondary school students who would love to have it as a present.

And I would encourage Angell and Britz to produce another book, based this time perhaps, on the best *articles* of Parabola. Derek Holton

The Australasian Journal of Combinatorics

AJC is a 'diamond open access' journal: online and free for readers and authors. There are three volumes per year, closing in about February, June and October. Each volume has three parts. Volume 91, Parts 1, 2, 3 is now available, as are all volumes back to Volume 1.

Visit here to register for email notices whenever new papers are published.

Submissions to the Australasian Journal of Combinatorics may be sent to ajc@maths.uq.edu.au. Only pdf files are required at submission stage.

The Journal is now indexed by Scopus from Volume 13 (1996) onwards, and by Clarivate Analytics 'Emerging Sources Citation Index' from 2015 on.

ISSN: 2202-3518 (online only, after 2013); 1034-4942 (paper, before 2014).