



NeMeSiS News

2018

Newsletter of the ANU-AAMT National Mathematics Summer School



NMSS 2018 students enjoying the view from Black Mountain, Canberra

EDITOR'S WELCOME

Welcome to the 20th edition of NMSS News! While 2018 has been a year of conflicting emotions for NMSS, the National Mathematics Summer School celebrated its 50th year, recognising half a century of inspiring, challenging and fostering a genuine love of learning in students across the country.

For pragmatic reasons (and to minimise waste) this year we have decided to change to an e-Newsletter. If your contact details have changed, you can email us your new details, or update them at <http://nmss.edu.au/contact-us/>. We are always looking for feedback, submissions or ideas to keep our annual newsletter something that all generations of NMSS students and staff can enjoy, so please don't hesitate to get in touch.

Wishing you a lovely remainder of 2018!

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FROM THE DIRECTOR

This year NMSS welcomed its newest Director, Professor Benjamin Burton. Ben is a professor at the School of Mathematics and Physics at The University of Queensland, specialising in Computational Geometry and Topology. He first attended NMSS as a student in 1992 and 1993, returning as a tutor from 1995 to 1997 before becoming a regular lecturer for the School, delivering courses at 17 Schools between 1998 and 2018. Past students of Ben's Knot Theory and Topology courses have fond regard for his energetic presentation and mind-bending content. We look forward to NMSS continuing under Ben's leadership from 2019 and beyond.

Written by Sean Gardiner

VALE LEON POLIADAN // Written by Leanne Rylands



21 March 1964 – 13 February 2018

This year, on February 13th we lost Leon to brain cancer. Leon had a long history with NMSS. Leon attended NMSS in 1981 as a student when he was 16, at the end of his year 11 at Fort Street Boys High School and again in 1982. No one will be surprised to hear that he was an outstanding student. Ten years later, Leon was back at NMSS, this time as staff. He had completed a BSc with first class honours in physics and a PhD in theoretical physics at the University of Sydney. He was an incredibly talented mathematician and physicist. Leon was a part of NMSS every year from 1992, except for this year. In all, for 28 of his Januarys (almost 52%) he was in Canberra for NMSS.

As a NMSS staff member, Leon was a tutor several times and 22 times he lectured week-long courses that he had developed, often about chaos theory. Leon also designed and taught courses on game theory and geometric construction. In 2001 and 2002 he lectured one week of the number theory course.

At NMSS Leon twice gave lectures on his career, which included his work on optical fibres and iridescence in butterflies. From 2013-2017 Leon was director. He had planned to be director until long after he retired from university. Leon clearly loved mathematics, he loved sharing it with others, including both students and staff at NMSS. Leon's teaching was inspiring.

Leon cared about education beyond NMSS. He published at least 16 papers about tertiary mathematics education including "Thinking deeply of simple things: 45 years of the National Mathematics Summer School" and was involved in several funded projects.

Leon was hugely positive, enthusiastic and energetic about many things, including all aspects of NMSS. Some of his non-mathematical interests appeared in his NMSS biography: "Leon Poladian ... has a special interest in foreign languages and linguistics and can be misunderstood in several languages. He is addicted to euro-style board games, created his first iPad game recently and hopes to design a game that will win Spiel des Jahres."

Each year for the last few years Leon invited Nobel Prize winner and ANU vice chancellor Professor Brian Schmidt to be the NMSS academy of science lecturer. Professor Schmidt finally said yes for January 2018. It was also the 50th NMSS. It would have been wonderful to have Leon there for our first Nobel Prize winning speaker and for the 50th NMSS, but it was not possible. In fact, many thought that Leon would not be able to attend NMSS in 2017 as in the weeks up to NMSS he was having chemotherapy and radiotherapy. He insisted that he would be able to attend and run NMSS and said that any staff member could have something at the last minute that could stop them attending, so why worry just about him? In the few days before NMSS a tutor did have to drop out, and Leon made it to Canberra and gave his lectures, just as he said he would.

In July last year Leon received a AAMT Distinguished Service Award, the first such award since 2008. The citation noted that Leon "has been an important part of the fabric of NMSS for half of its life". Actually, at that time Leon had attended just over 57% (28 of 49) NMSSs.

Leon loved games of all kinds. As with mathematics, his enthusiasm was particularly contagious at NMSS. "The staff often stayed up into the early hours with some of the most complex board games we had ever encountered - I still don't understand what the point of the Battle Star Galactica game was, but it was always filled with fun and laughter" (a tutor). Leon developed a game app; he intended to sell it and use the income for NMSS. The aim was to get a martian to its spaceship.

In April 2017, NMSS staff presented Leon with a board-game-inspired plaque. It listed some of his attributes: chaotic (referring to his lectures on chaos), creative, compassionate, inspirational, mentor, fun, devoted and educator. The plaque read "A simple thank you for a deeply thoughtful director".

Leon worked on NMSS 2018 for much of 2017 with the same care and enthusiasm as usual, knowing that someone else would take over and knowing that he might not get there in 2018. Leon's work with, and contribution to, NMSS over so many years will not be forgotten.

PAST STUDENT PROFILE // RACHEL WONG

Hey everyone! I'm Rachel and I attended NMSS in 2013, and 2014 as an EG. This is a bit about what I've been doing since then!

My interest in maths started early, so I was really excited when I got to go to NMSS, which also ended up being even better than I'd expected it to be! It was the first time I'd been pushed to explore open-ended maths questions, and it was quite novel to be looking further than just the answers to a given problem. I also found the community at NMSS awesome and loved the focus on social activities as well as a very positive attitude towards learning. Needless to say, the second-time around was just as delightful as the first.

After high school I went to study maths at Cambridge in the UK, which was a huge adventure. There was the thrill of being in a new country with lots of nearby places to visit, as well as the challenge of adapting to the environment and keeping in touch with Aussies who were now so far away. There was also a phenomenal amount of new mathematical ideas to digest, facilitated by Cambridge's wide range of lecture courses and one-on-two tutorials.

The first year gave us a broad introduction into the various areas of maths, with the subjects becoming more specialised over time. I ended up mostly studying pure maths, and particularly liked algebra and topology. My first taste of topology was actually at NMSS, where we were given enough tools during the week to discover the classification

of two-dimensional surfaces. I really loved that result, and it seems that a similar interest in topology carried over into my university studies. It also became clear that even the whole undergraduate course in mathematics barely scratched the surface of things that could be discovered, and it's amazing how much theory has been developed that is available for learning and to be expanded upon.

My time at university finished a few months ago and I've now moved back to Sydney, which still feels very much like home. I've spent most of the time since then travelling, catching up with old friends, and playing video games. It's been very nice having some downtime after a few intense years, before it all starts up again. During this time, I decided that the lifestyle of academia wasn't what I wanted right now, so next year I'll be starting work as a software engineer. Programming has been a long-time hobby of mine, and I'd love to keep tackling logical puzzles. I'm very excited to see what's in store!



PUZZLE??

Each line describes two words/phrases - one being an anagram of the other after adding the letters in NMSS.

For example, "Buccaneer Altoids (6,10)" describes "PIRATE SPEARMINTS", while "Simplifies studio (11,7)" describes "STREAMLINES ATELIER".

This puzzle was kindly created by our in-house cryptic crossword extraordinaire, Sean Gardiner – his solutions can be found at the end of the newsletter should you wish!

1. Kidnaps paddler (7,3)
2. Glaswegian-Mexican snack (8,4)
3. Ripped beasts (4,8)
4. Beloved rays (4,8)
5. Juliet's Johns? (5,4-5)
6. Spin selection (6,10)
7. Asian herbs aplenty (10,6)
8. I scale? (6,10)
9. March & march & march & march? (10,6)
10. What a forgetful student's dog is blamed for (6,10)
11. Invite back geniuses (7,11)
12. Stranger strings? (7,11)
13. Absurd ancestry (11,7)
14. Benign anagrams (7,11)
15. Scat? (7,11)
16. Protests perverts (8,12)
17. Skier/shooter organisations (9,13)
18. Make drunk annihilation (10,4-10)

NMSS REFLECTIONS

Before coming to NMSS I already knew what everyone was going to be like: self-residing, nerd stereotypes who wanted to do maths all day and not talk to anyone. How wrong I was! The group was better than anything I could have ever dreamed of, from tutors to the lecturers, the IG's to the EG's, everyone had such great enthusiasm for the subject, each bringing their own unique take creating something that was truly remarkable.

One particular individual who I am honoured to call a friend, is Ezra Hui, well deserved recipient of the Hanna Neumann scholarship. We first met when he was in the middle of discussing how to convert knots into raw data. This was directly following our first knot theory lecture. I was instantly struck by how raw and unadulterated his excitement for the subject was. In an instant I was hooked and decided I had to take part. In the following hour and a half, and days thereafter, I learnt much more than just the solution to this intriguing problem (which Ezra did implement in code). What I learnt was the power of sharing ideas, questions, concerns, and most importantly passion. We and several others worked through, day after day abstracting deep questions from problem sets and discussing ideas, ranging from getting finite projective planes out of a binary sudoku puzzles, to solving knot invariants in code and even discussing how to bring education into the 21st century. These deep discussions, I believe, stimulated all of us beyond the new horizons that had been reached in lectures and tutorials adding a new dimension to this remarkable experience.

It also brings me great joy that the appreciation of this environment is so mutual. As Ezra so eloquently stated, 'I adored the enthusiasm and curiosity in so many of you... sparking lots of free time problem solving sessions... you don't know how much it means to me to be told that I've been an inspiration to people who I massively respect.'

Jesse Wright, Student 2018



I first heard the quote "Be the first to look down the volcanic crater" in Terry Gagen's introduction to the first number theory lecture, between the marvelous biographies of Arnold Ross (1906-2002) and Larry Blakers (1916-1995), the marvelous tale of how William Crookes (1832-1919) discovered thallium a recount of how Wilhem Roentgen (1845-1923), in his hometown of Giessen, uncovered the existence of x-rays! The phrase is attributed to Alan Marshall's *I can jump puddles* – a marvelous read that – and serves as a motif for independent exploration and discovery at NMSS. As intended, these words along with the special relationships and memories that I formed, came to define my NMSS 2018 experience.

In terms of my academic discoveries, I was like an ant at a primary school science fair; there were volcanic craters everywhere! Each problem set required me to extend the premises that were provided in the previous lecture to come to conclusions by my own accord. Gauss's article 108 from *Disquisitiones Arithmeticae*, Archimedes derivation of a sphere's volume and the Jones polynomial in knot theory were particular favourites. After attending NMSS, I feel as though I have been properly acquainted with the scope and discipline of mathematics as well as the giants – the likes of Gauss, Archimedes and Hilbert – who've profoundly contributed to its advancement. Perhaps more importantly, NMSS has helped me develop skills – particularly a fortitude in the unknown – that will enable me to further my mathematical ability and its application in other areas of my life.

I think all readers can agree that NMSS is a very special experience and one which I am extremely humbled to be a part of this year. I'd like to thank the faculty for their support/lectures and fun, thoughtful presence, the EGs for inducing a special culture of laughter, positivity and mentorship, the John XXIII residence staff and finally my fellow IGs; I have never met such an amicable, talented group of people who inspire me to be a better person/mathematician and of whom I'm honored to call friends!

Joshua Amoils, Student 2018

ANSWERS TO PUZZLE:

1. RANSOMS OAR, 2. SCOTSMAN TACO, 3. TORE MONSTERS, 4. BEAU SUNBEAMS, 5. ROMEO MEN'S-ROOMS, 6. ROTATE ASSORTMENT, 7. LEMONGRASS GALORE, 8. IODINE DIMENSIONS, 9. AMPERSANDS PARADE, 10. EATING ASSIGNMENT, 11. READMIT MASTERMINDS, 12. NUTTIER INSTRUMENTS, 13. MEANINGLESS LINEAGE, 14. CURABLE UNSCRAMBLES, 15. RAGTIME STAMMERINGS, 16. OUTCRIES MISCONSTRUES, 17. BIATHLETE ESTABLISHMENTS, 18. INTOXICATE MASS-EXTINCTION