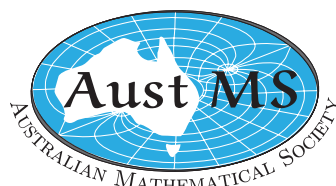




2012/13

AMSI Summer School

The University of Melbourne
7 January - 1 February 2013





INTRODUCTION

Strengthening education in the mathematical sciences

The 11th annual AMSI Summer School was held at the University of Melbourne in January of 2013. The importance of the AMSI Summer School to the mathematical sciences in Australia was evident from the start with strong enrolments and Deputy Australian Statistician, Professor Ian Ewing, officially opening the event on Monday January 7th 2013.

Eight honours level courses covering a range of specialised and core topics in the mathematical sciences were offered. A total of 131 students (up from 105 in 2012) came from 22 AMSI member institutions and six AMSI institutions were represented by summer school lecturers. Many students took courses that will count towards an honours or postgraduate degree at their home institution while others attended simply to improve their mathematical knowledge and skills. All, however, benefited from interaction with a lively mathematical community that many had not previously experienced. While most time at the summer school was spent on the courses, the social activities, general interest lectures and careers afternoon were a very valuable

component of the summer school experience.

The AMSI Summer School was the result of much hard work and valuable input from several individuals. The foundation of a successful summer school is an appealing program delivered by talented lecturers and the program committee deserves thanks for their work in providing this. Guidance and support from previous director, Jonathan Kress, as well as from Geoff Prince, Simi Henderson and other AMSI staff was invaluable. Office staff of the Department of Mathematics and Statistics, in particular Lee Shia Chan, spent many hours helping with the organisation and day to day running of the event. Finally, all of this combined with the enthusiasm and commitment shown by the students ensured the summer school was a great success.

*A/Prof Jan De Gier
AMSI Summer School 2013 Director*



COMMITTEES

The 2012 AMSI School wishes to acknowledge the generous donation of time and scientific advice of the following committees, without their contribution this event would not be a success.

Program Committee

Jan De Gier (Director), University of Melbourne
Aurore Delaigle, University of Melbourne
Markus Hegland, Australian National University
Jonathan Kress, University of New South Wales
Michael Murray, University of Adelaide
Geoff Prince, AMSI Director
Ole Warnaar, University of Queensland

Organising Committee

Jan De Gier (Director), University of Melbourne
Lee Shia Chan (Office), University of Melbourne
Simi Henderson, AMSI Program Manager
Sandy Clarke, University of Melbourne
Caley Finn, University of Melbourne
Federico Frascoli, University of Melbourne

A great deal of help was also provided by the Department's office staff, in particular Charlotte Mcloughlin.

PARTICIPANTS

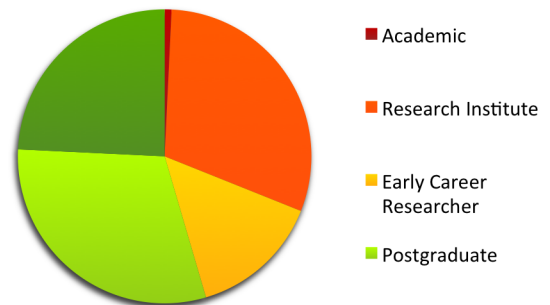
A total of 132 students enrolled in the 2013 AMSI Summer School, 61 students took courses for credit.

Students were encouraged to enroll in two courses, taking one for credit and auditing a second. They were expected to finalise their choice in week 2. A number of students changed their initial enrolment after they sat in on an extra course in week one. Some students took two courses for credit, but this was generally experienced as too much work.

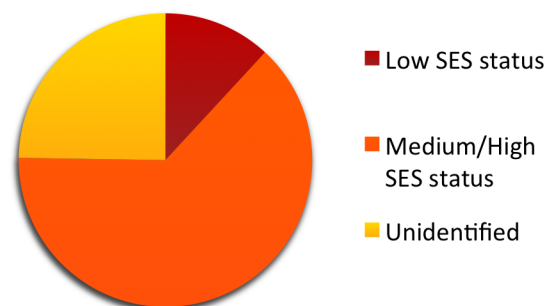
Enrolment numbers by university

University of Adelaide	4
Australian National University	8
University of Ballarat	1
Curtin University	3
Flinders University	3
LaTrobe University	8
University of Melbourne	49
Monash University	9
Macquarie University	1
University of Newcastle	3
Queensland University of Technology	1
RMIT	11
Swinburne University	3
University of Sydney	4
University of New England	1
University of New South Wales	9
University of Queensland	5
University of Southern Queensland	1
University of Technology Sydney	1
University of Western Australia	2
University of Western Sydney	1
University of Wollongong	4
Total	132

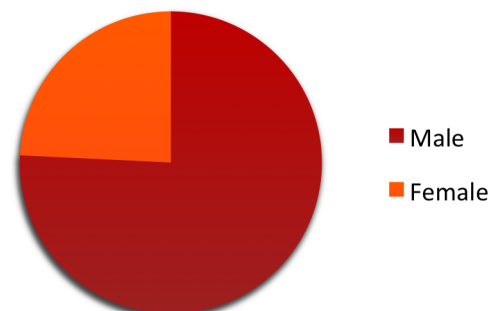
ENROLMENT BY TYPE



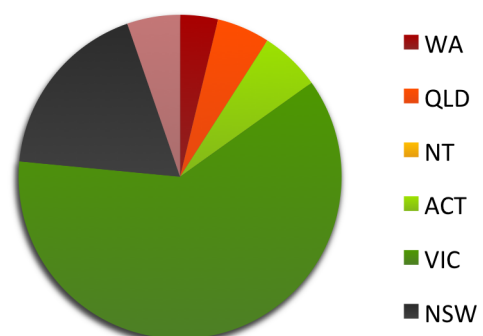
ENROLMENT BY SES STATUS



ENROLMENT BY GENDER



ENROLMENT BY STATE



FEEDBACK

"Summer School is really fun and very challenging; I have enjoyed taking a class I wouldn't normally encounter!"

- Noon Silk

"I found the AMSI Summer School to be a motivating, interesting and enjoyable experience. Meeting the challenge of the course material was assisted by the serene environment away from the usual stresses a everyday life"

- Dean Taylor

"AMSI Summer School is an exceptional opportunity for post-graduate students to learn interesting courses while meeting many students along the way and developing strong networks for the future"

- Eddie Toth

"worthwhile for anyone with a serious interest in mathematics and its role in the real world"

- Cameron Road

"Mathematics is a global human endeavour so any chance to begin to engage with peers from further afield is a great introduction to the social aspect of a mathematical career"

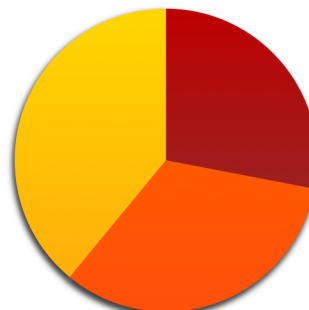
"Worthwhile for anyone with a serious interest in mathematics and its role in the real world"

- Cameron Road

"An excellent experience"

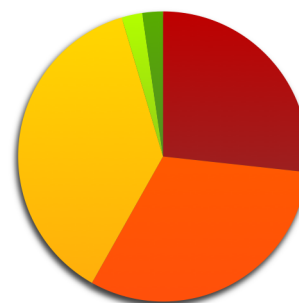
- Luke Gandolfo

THE SUBJECTS I TOOK WERE OF A HIGH STANDARD



- Strongly Agree
- Agree
- Neutral

I MADE USEFUL CONTACTS AT THE SUMMER SCHOOL



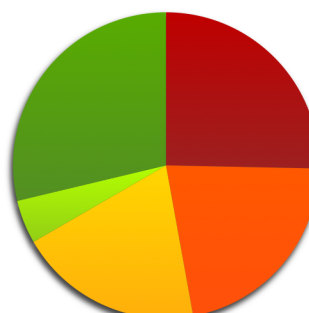
- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

SUMMER SCHOOL HAS STRENGTHENED MY RESOLVE TO DO A PHD



- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- N/A

THE CAREERS AFTERNOON WAS HELPFUL



- Strongly Agree
- Agree
- Neutral
- Disagree
- N/A

SOCIAL EVENTS

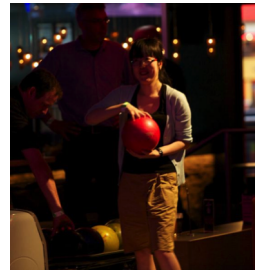
A number of social events run through out the Summer School, students and lecturers come together to relax and socialise and have a break from studying.

ICEBREAKER BOWLING

There was much hilarity on the first Wednesday of the school when students and lecturers showed off their bowling skills. Bowling proved to be an excellent way for students and lecturers to break the ice and start to form friendships.

“I would love to
come again.
Fantastic
environment,
I learnt a lot”

- *Sangeeta Bhatia*



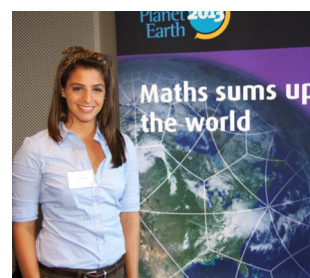
FRIDAY BBQS

Friday BBQs are run throughout the school, giving students the opportunity to relax after a hard weeks work and make plans for the weekend.

LETTERS AND NUMBERS QUIZ NIGHT

Lily Serna, mathematician and previously SBS’s Letters and Numbers presenter hosted a Letters and Numbers style quiz night on Thursday 24 January.

Team trials were held at the beginning of the week to select the teams with Summer School Lecturers and students competing to win the title!



CAREERS AFTERNOON

The Careers Session is a popular feature of the AMSI Summer School, students have the opportunity to hear about career opportunities from employers specifically seeking mathematics and statistic graduates and network with employers over drinks.

This year the careers afternoon was attended by: PWC, Westpac Group, Systems Biology Institute, The Boston Consulting Group and many more. The event begins with employer and early career researcher presentations, which talk students through their personal career pathways and pathways within their organizations. The presentations open the door for lively discussion in the networking sessions, by highlighting opportunities that students are often unaware.

“I was impressed by the number and depth of the questions I was asked.”

- Richard Wardle, Bureau of Meteorology



“Very useful. It showed me a few different careers that I had never linked to a maths degree”

2013 Summer School Student

SUMMER SCHOOL DINNER

The Summer School dinner is held in the last week of the Summer School and is an opportunity for students and lecturers to celebrate the end of the school and cement new friendships.

Prof Keith Devlin from Stanford University, known as National Public Radio's "Math Guy" and author of a number of mathematics communication books gave an entertaining dinner talk on the life and enduring legacy of Leonardo of Pisa, better known today as Fibonacci, a brilliant yet often overlooked mathematician.

Leonardo of Pisa was the first Westerner to recognize the power of the Hindu-Arabic number system (featuring the numerals 0 through 9), which offered a much simpler method of calculation than the finger reckoning and cumbersome Roman numerals used at the time. His book *Liber Abaci* (The book of Calculation) remade the West as the dominant force in science, technology, and large-scale international commerce. He is best known today for discovering the Fibonacci sequence of numbers appearing in biological structures throughout nature, but despite the ubiquity of his discoveries, he has largely slipped from the pages of history.



SUBJECTS

AUSTMS SS2013 SUBJECT: MODULAR FORMS

Wadim Zudilin (University of Newcastle)

The lectures serve as an introduction to the classical theory of modular forms and their applications. An impact of the theory on Fermat's Last Theorem will be discussed at the end of the course.

MEASURE THEORY

Marty Ross

Measure theory is the modern theory of integration, the method of assigning a "size" to subsets of a universal set. It is more general, more powerful and more beautiful (though also more technical) than the classical theory of Riemann integration.

SOLITONS, INSTANTONS, LAX PAIRS AND TWISTORS

Omar Foda (University of Melbourne)

This is a series of introductory lectures on nonlinear partial differential equations that can be solved without approximation, and that play a central role in recent studies of non-perturbative phenomena in string and gauge theories.

NUMERICAL SOLUTION OF CONSERVATION LAWS AND HYPERBOLIC LINEAR SYSTEMS

Markus Hegland and Stephen Roberts (Australian National University)

This course covers advection equations such as the Euler equations, the shallow water equations and the time-dependent Maxwell equations among others. It includes a hands-on computational lab in addition to a discussion of theoretical topics like convergence (Lax equivalence theorem), characteristics, shocks and rarefaction waves and several numerical schemes like Lax-Wendroff and Crank-Nicholson in addition to Godunov schemes.

STRUCTURED MARKOV MODELS AND CONTROL THEORY. A UNIFIED APPROACH VIA LINEAR ALGEBRA

Yoni Nazarathy (University of Queensland)

Performance analysis and control of natural and engineered systems evolving over time is a central theme in applied mathematics, operations research and engineering. Many such systems can be modelled as stochastic by means of structured Markov chains, while others are well described by deterministic linear models with feedback control. In both cases the underlying linear algebra is very similar. This course aims to teach the students both types of methodologies, stochastic modelling and control theory via a unified linear algebraic approach.

COMPLEX NETWORKS

Stephen Davis (RMIT)

The world around us is brimming with structure that consists of discrete entities and relationship between those entities. These structures can be represented as a set of vertices and a set of links that formally define a graph, and a complex network is nothing more than a very large graph where the links are neither predictable nor completely random. This course will touch on the analysis of real, complex networks that arise in ecology and epidemiology, such as food webs and wildlife contact networks, but will emphasise the mathematical and statistical techniques used to classify and characterise networks.

ANZIAM SS2013 SUBJECT: MATHEMATICAL EPIDEMIOLOGY: STOCHASTIC MODELS AND THEIR STATISTICAL CALIBRATION

Joshua Ross (University of Adelaide)

Mathematical models are increasingly used to inform governmental policy-makers on issues that threaten human health or which have an adverse impact on the economy. It is this real-world success combined with the wide variety of interesting mathematical problems which arise that makes mathematical epidemiology, stochastic models and their statistical calibration one of the most exciting topics in applied mathematics.

METHODOLOGY AND THEORY FOR THE BOOTSTRAP; INTRODUCTION TO NONPARAMETRIC REGRESSION AND FUNCTIONAL DATA

Aurore Delaigle and Peter Hall (University of Melbourne)

The course began by discussing the motivation and intuition behind bootstrap methods, and treat a variety of different approaches, including the double bootstrap. In the second part of the course we will introduce techniques for analysing data that are in the form of curves, such as, for example, yearly rainfall or temperature curves, growth curves, etc.

Australian Mathematical Sciences Institute

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