

Mathematics Enrichment Camp 2009

Date: Saturday, 15 August 2009

Time: 9.00am to 6.00pm

Venue: Lecture Theatre 23
Faculty of Science, National University of Singapore



Department of Mathematics

Programme

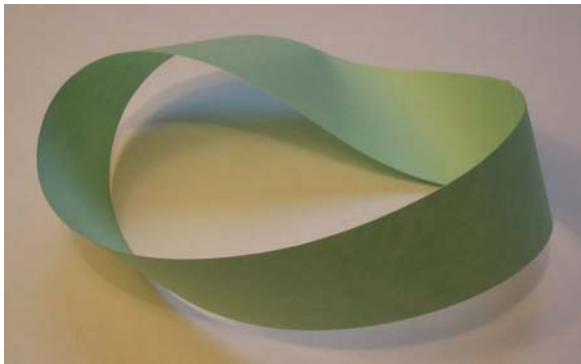
Time	Activity
9.00am	Registration
9.30am	Welcome Address By Professor Chong Chi Tat Head, Department of Mathematics
9.40am	Brief Introduction to the Exciting World of Mathematics By Associate Professor Goh Say Song
10.00am	Lecture on "Paper, Scissors and Glue" By Associate Professor Denny Leung
11.00am	Tea Break
11.30am	Lecture on "Circle Packings" By Professor Tan Ser Peow
12.30pm	Lunch Break
1.30pm	Lecture on "P vs NP" By Professor Sun Defeng
2.30pm	Lecture on "Applied Partial Differential Equations: A Visual Approach" By Professor Bao Weizhu
3.30pm	Tea Break
4.00pm	Lecture on "The Mathematics of Sudoku" By Associate Professor Helmer Aslaksen
5.00pm	Sudoku Competition By Associate Professor Helmer Aslaksen
6.00pm	End of Programme

Abstracts

Paper, Scissors and Glue

By Associate Professor Denny Leung

Take a strip of paper, give it a twist and glue the two ends together. The result is a well-known object called a Möbius band. It has many interesting properties. For instance, it has only one side and one edge. In fact, its edge forms a loop (circle). Now take a plain disk, whose edge is also a circle. Can you imagine what would happen if we glue the disk to the Möbius band along their edges (that is, glue the circular edge of the Möbius band to the circular edge of the disk)? In this talk, we will discuss how to perform this and similar tasks without tying ourselves into knots. Along the way, we meet up with fun and



interesting objects such as the torus, the Klein bottle, the projective plane, the handle and the crosscap. We will try to understand them by doing some cutting and pasting, but more so by playing with some (flat, two-dimensional) pictures. At the end, we hope to find out how to build all possible two-dimensional surfaces. The explorations in this talk, about the study of the shapes of objects, allowing for stretching and squeezing without

tearing, belongs to a branch of mathematics that goes by the name of “topology”.

About the Speaker

Denny Leung is Associate Professor of Mathematics at the National University of Singapore. He received his Bachelor’s degree from Illinois State University and his PhD from the University of Illinois at Urbana-Champaign. His mathematical interest is in functional analysis, where algebra, mathematical analysis and topology intersect. He was the recipient of the NUS Faculty of Sciences’ teaching award on several occasions.

Circle Packings

By Professor Tan Ser Peow

We give a brief introduction to the study of circle packings, and show how this is related to various branches of mathematics like complex analysis, algebra, geometry, combinatorics and number theory.

About the Speaker

Tan Ser Peow has been with the department of mathematics, NUS since 1990, after obtaining his Ph.D from UCLA. He works mainly in the fields of geometry and topology.

P vs NP

By Professor Sun Defeng

Each year at Christmas Day children all over the world wait early to receive gifts from Santa Claus. Although Santa has one year's time to prepare the gifts, he has only one day's time to make the delivery with his sleigh and reindeer. It is thus critical for Santa to plot out the shortest route to deliver all the presents on time. Here, we shall demonstrate how modern methodologies of optimization can help Santa to achieve his goal. The mathematical challenge behind Santa's task is P versus NP, one of the seven Millennium mathematical questions with each solution worth US \$1 million.

About the Speaker

Sun Defeng is Professor at Department of Mathematics, National University of Singapore. He received his PhD in Operations Research and Control Theory from the Institute of Applied Mathematics, Chinese Academy of Sciences, China in 1995. He completed his post-doctoral training at the University of New South Wales, Australia. His research interests are mainly on Optimization, a subject of studying best decision-making with limited resources, with side interest in computational finance. He currently serves as an associate editor to journals of The Asia-Pacific Journal of Operational Research and Mathematical Programming.

Applied Partial Differential Equations: A Visual Approach

By Professor Bao Weizhu

The lecture illustrates topics of science/engineering, which occur in nature and/or are part of our daily lives. The described natural/engineering phenomena are modeled by partial differential equations, which relate physical variables like mass, velocity, energy etc. to their spatial and temporal variations. Typically these equations are highly nonlinear, in many cases they are also vectorial systems, and they represent a challenge even for the most modern and sophisticated mathematical-analytical and mathematical-numerical techniques. The chosen topics include flows of fluids and gases, granular material flows, biological processes like pattern formation on animal skins, kinetics of rarified gases and semiconductor devices. Each topic is briefly presented in its scientific or engineering context, followed by an introduction of the mathematical models in the form of partial differential equations with a discussion of the most basic mathematical properties, and then highlighted by a series of high quality photographs. The lecture is based on a book with the same title, authored by Professor Peter A. Markowich from University of Cambridge and published by Springer Verlag Heidelberg in 2006.

About the Speaker

Professor Bao received his Ph.D from Tsinghua University in 1995. He had postdoc experience at Imperial College in UK and Georgia Institute of Technology in USA. He joined NUS in 2000 and currently is a Professor at Department of Mathematics, NUS. His research interests include numerical methods for partial differential equations; scientific computing/numerical analysis; analysis and computation for problems from physics, chemistry, biology and engineering sciences.

The Mathematics of Sudoku

By Associate Professor Helmer Aslaksen

Sudoku is a logic puzzle where you are given a 9×9 grid made up of nine 3×3 blocks. The goal is to place the numbers 1 through 9 into the cells in such a way that each row, column and box contains each number exactly once. Some of the cells are given, and this is done in such a way that there is a unique way to fill in the remaining cells. The puzzles can be of varying levels of difficulty. They can be easy enough to appeal to anybody, while a mathematician will immediately be fascinated by the more fiendish puzzles and start thinking about algorithms. I will describe some of the techniques for solving this puzzle and we will solve some puzzles together.



About the Speaker

Associate Professor Helmer Aslaksen was born in Oslo, Norway, and did his undergraduate at the University of Oslo. After receiving his Ph.D. at the University of

California, Berkeley, he joined the Department of Mathematics at the National University of Singapore in 1989.

His interests include geometry, Lie groups, and the relationship between mathematics and astronomy and art. He has been academic advisor for the exhibition Art Figures: Mathematics in Art at the Singapore Art Museum and The Dating Game: Calendars and Time in Asia at the Asian Civilization Museum and for the TV series Ancient Chinese Inventions on the Discovery Channel. He was also on the Program Committee and a judge for National Science Challenge, a TV science quiz for secondary school students. In 2001 he won the fourth prize in the Boeing Writing Contest. He was on the organizing committee of a topic study group at the International Congress on Mathematical Education in 2004. He has been invited to be a plenary speaker for the Mathematical Association of America.

He has an extensive web site, including a highly ranked page on The Mathematics of the Chinese Calendar.

At the NUS he has introduced two General Education Modules, Heavenly Mathematics: Cultural Astronomy and Mathematics in Art and Architecture.

In 2004 he was awarded the University's Outstanding Educator Award.

Sudoku Competition!



Rules of competition

1. The competition will last up to 45 minutes.
2. The first 10 people who manage to finish the puzzle will receive prizes.
3. If at the end of 45 minutes there are less than 10 people who have finished the puzzle, we will grade incomplete puzzles, giving one point for each correct entry.

Getting to the Camp

1. Take the MRT and alight at Buona Vista MRT Station.
2. Transfer to SBS Bus Service 95 at the bus-stop opposite the station (across the North Buona Vista Road, in front of the Ministry of Education building).
3. Alight at the bus-stop in front of the Lim Seng Tjoe Lecture Theatre 27 in NUS.
4. Follow the map and walk to Lecture Theatre 23.
5. For an interactive map of NUS, please visit <http://www.nus.edu.sg/campusmap/>



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Registration Instructions

1. The Registration Fee per person is **S\$30 (GST inclusive)** and this includes 2 tea breaks and lunch.
2. Payment is by **cheque only**. Please make cheque payable to **National University of Singapore**.
3. Cancellations are **not refundable** although participants can be substituted.
4. Please send the completed registration form together with the cheque **by Friday 24 July 2009 to:**

Ms Chan Lai Chee
Department of Mathematics
National University of Singapore
2 Science Drive 2
Singapore 117543

5. For further information, please contact Ms Lynette Wong (6516 8322, matwongl@nus.edu.sg), or Ms Chan Lai Chee (6516 2762, matclc@nus.edu.sg)

Mathematics Enrichment Camp 2009

Registration Form

Individual Registration

Name: _____

Institution: _____

Email: _____

Phone: _____

Bank & cheque number: _____

Block Registration - Please also complete BLOCK REGISTRATION LIST on page 9

Institution: _____

No. of students: _____

Name of teacher-in-charge: _____

Email: _____

Phone: _____

Bank & cheque number: _____

Mathematics Enrichment Camp 2009

Block Registration List

Complete and return this page together with the registration form (page 8) and payment.
Enter the particulars on a new page if necessary.

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