Mathematics Enrichment Camp 2007

Date: Thursday, 6 December 2007

Time: 9.00am to 6.00pm

Venue: Lecture Theatre 33
         Block S17 (SOC 1), Level 2
         Faculty of Science, National University of Singapore

Registration OPEN!

ORGANIZED BY

NUS
National University
of Singapore

DEPARTMENT OF MATHEMATICS

Programme

Time	Activity
9.00am	**Registration**
9.30am	**Welcome Address** Professor Chong Chi Tat, Head, Department of Mathematics
9.40am	**Brief Introduction to the Exciting World of Mathematics** Associate Professor Goh Say Song
10.00am	**Lecture on "On the Bernoulli Numbers"** By Associate Professor Chan Heng Huat
11.00am	Tea Break
11.30am	**Lecture on "Financial Engineering: Traditional Methods and New Challenges"** By Associate Professor Juri Hinz
12.30pm	Lunch Break
1.30pm	**Lecture on "How Can Optimization Help Santa Claus Deliver Christmas Gifts"** By Associate Professor Sun Defeng
2.30pm	**Lecture on "Mathematics in Imaging Science"** By Professor Shen Zuowei
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**

On the Bernoulli Numbers

By Associate Professor Chan Heng Huat

The Bernoulli numbers are defined to be the integers $B_n, n \geq 1$ satisfying the relation

$$\frac{xe^x}{e^x - 1} = \sum_{n=0}^{\infty} \frac{B_n}{n!} x^n.$$

In this talk, we will learn more about these very interesting numbers.

About the Speaker

Associate Professor Chan Heng Huat obtained his B.Sc. degree from National University of Singapore in 1991. He completed his Ph.D. in 1995 under the supervision of Professor B.C. Berndt at the University of Illinois at Urbana Champaign. He spent nine months at the Institute for Advanced Study at Princeton from 1995 to 1996 and a year at the National Chung Cheng University (Taiwan).

In 1997, he returned to Singapore as a lecturer at the National University of Singapore and was promoted to Associate Professor in 2000.

Chan's main research area is Number Theory, with emphasis in the study of results discovered by S. Ramanujan and their relations with modern mathematics. For the past ten years, he has taught many undergraduate courses including Calculus, Algebra, Complex Analysis, Elementary Number Theory, Analytic Number Theory and Algebraic Number Theory.

Financial Engineering: Traditional Methods and New Challenges

By Associate Professor Juri Hinz

In this talk, we elaborate on logical principles and mathematical tools underlying modern approaches in the area of risk management. Starting from a number of typical questions, we show how the need for risk transfer raises the question of fair

contract valuation. Thereby, we illustrate the corresponding mathematical techniques, which range from actuarial to martingale based methods, depending on the availability of related financial instruments. Further, we elaborate on development and adaptation of stochastic models due to their applications in non-financial areas, such as energy, commodity, and environmental risk management.

About the Speaker

Dr. Juri Hinz is Associate Professor at the Department of Mathematics. He recently joined NUS, coming from the Swiss Federal Institute of Technology (ETH Zurich). At ETH, he worked as Senior Scientist, leading award winning research projects (Prize of Excellence in Practice at Euro 2007) at the Institute for Operations Research. His interests focus on applications of financial mathematics to commodities, energy-related and environmental assets. He is an appreciated speaker on diverse workshops for energy industry and consults energy companies in Switzerland, Mexico, and Australia.

How Can Optimization Help Santa Claus Deliver Christmas Gifts

By Associate Professor Sun Defeng

With the forthcoming of Christmas, Santa Claus is busy preparing gifts for children all over the world to be delivered by dawn of Christmas Day. Although he has one year's

the gifts, he has only one day's time to make the delivery with his leer. Therefore, it is critical for him to plot out the shortest route to presents on time. Here, we shall demonstrate how modern of optimization can help Santa to achieve his goal. The mathematical Santa's task is P versus NP, one of the seven Millennium uestions with each solution worth US $1 million.

About the Speaker

Sun Defeng is Associate 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. He currently serves as an associate editor for the Asia-Pacific Journal of Operational Research and Mathematical Programming.

Mathematics in Imaging Science

By Professor Shen Zuowei

From the beginning of sciences, visual observations have played major roles. Advances in computer technology have made it possible to apply some of the most sophisticated developments in mathematics and science for the design and implementation of fast algorithms running on a large number of processors to process image data. As a result, image processing and analysis techniques are now applied to virtually all natural sciences and technical disciplines and digital images has gone into everyone's life.

While most people are impressed by the pictures generated by digital cameras, few realize the depth and extent of mathematics and computational mathematics that went into the design of the algorithms that led to the images seen in digital cameras.

This talk will give a glimpse of the exciting new field of imaging science, the technical knowledge and training in mathematics, science and computer science that are needed to do state-of-the art research and development in the area.
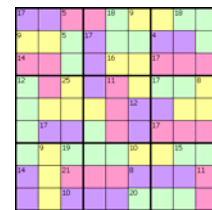
About the Speaker

Shen Zuowei is Professor of Mathematics at the National University where he has been on the faculty since 1993. He is best known for his fundamental work on wavelet frames and Gabor frames. More recently his research has focused on the emerging field of mathematical imaging which aims to restore images by using wavelet and Gabor frames. He has been invited to speak at over fifty international conferences and workshops. He is an editor of nine journals in his fields. He won the University Research Award in 1997 and the National Science Award in 1998.

The Mathematics of Sudoku

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. Cross the road and proceed to Block S17 (SOC 1), LT 33, Level 2.

5. For an interactive map of NUS, please visit http://www.nus.edu.sg/campusmap/
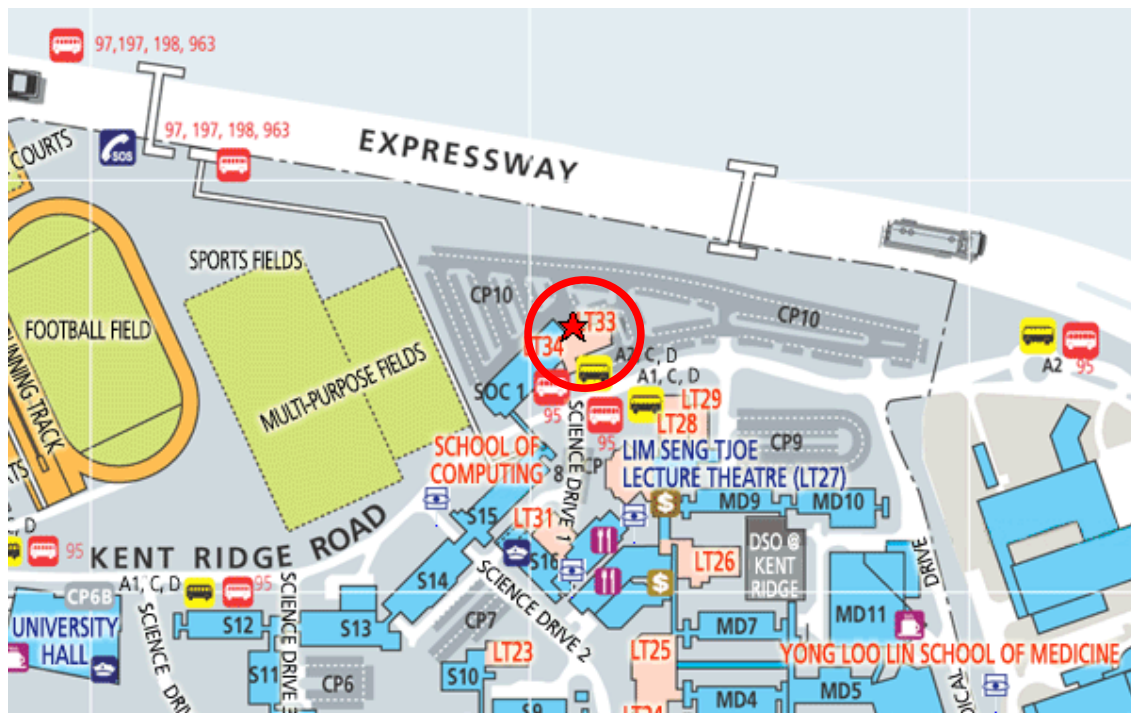
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REGISTRATION INSTRUCTIONS

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 <u>together with your payment</u> **by <u>Thursday 1 November,</u>** **to:**

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

5. For further information, please contact Lai Chee (6516 2762 or <u>matclc@nus.edu.sg</u>) or Lynette (6516 8322 or <u>matwongl@nus.edu.sg</u>)

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REGISTRATION FORM

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Individual Registration

Name: _____

Institution: _____

Email: _____

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Bank & cheque number: _____

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Block Registration - Please also complete BLOCK REGISTRATION LIST on page 8

Institution: _____

No. of students: _____

Name of teacher-in-charge: _____

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Phone: _____

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BLOCK REGISTRATION LIST

Complete and return this page together with the registration form (page 7) and payment. Enter the particulars on a new page if necessary.

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