Singapore Mathematical Society
Events and Activities 2014

1. SMS Lecture Series

- This annual lecture series, which is traditionally organized in conjunction with the Annual General Meeting of the Singapore Mathematical Society, features eminent local mathematicians or mathematics educators to share with the public some of their interests and ideas.
- Date: March 11 2014
- Venue: LT31, National University of Singapore
- Title: **Mathematics of Money**
- Speaker: **Steven Kou**

Professor Steven Kou is currently a Provost's Chair Professor of Mathematics and the Director of the Centre for Quantitative Finance at National University of Singapore. Previously, he taught at Columbia University, University of Michigan, and Rutgers University. He teaches courses in quantitative finance, stochastic models, and statistics. His research results have been widely used on Wall Street, and have been incorporated into standard M.B.A. textbooks

- Abstract: We will discuss three aspects of the application of mathematics in finance: (1) Investment (2) Derivatives (3) Risk Management. Although more advanced mathematics, such as stochastic differential equations, statistical inference, optimization, and functional analysis may be needed to study these topics, only high school mathematics will be used in the talk. We aim at giving some concrete examples in these topics, to inspire interests among the general public. In particular, we will focus on three examples: (1) Optimal portfolio choices, e.g. Kelly and Merton criteria. (2) The binomial model for option pricing. (3) Axioms for risk measures.

2. AME-SMS Conference 2014

- This Conference for mathematics teachers is the second joint collaboration between the Association of Mathematics Educators (AME) and the Singapore Mathematical Society (SMS). The one-day programme comprised of lectures delivered by mathematicians and mathematics educators. Four SMS members were invited to deliver lectures for the secondary/junior college teachers.

- Theme: Assessment in Mathematics
- Date: June 5 2014
- Venue: NUS High School of Mathematics and Sciences

- Speaker 1: **Professor Ling San**
  Title: **Assessment & Undergraduate Mathematics**
  Abstract: In any course or programme, what we assess students on and how we assess them can be expected to drive the learning behaviour. It is therefore important for assessments to be designed in a fashion aligned to the objectives of the course or programme. In this talk, we shall discuss the desired learning outcomes for an undergraduate education in mathematics and how they should influence the way assessment is conducted. However, in what way would this topic (of undergraduate mathematics) be of relevance and concern to the mathematics educators in the schools? The speaker will attempt to explain the connections, drawing on his experience both as an educator of undergraduate mathematics and a consultant for mathematics textbooks for secondary schools.

- Speaker 2: **Associate Professor Yap Von Bing**
  Title: **How to teach basic skills in statistics using exam-type problems?**

  Abstract: If a student has difficulty with examination-type problems, he should practise on more similar problems. This seems obvious, and presumably works for students who have already learnt the basics. For strugglers, who probably form the bulk, this advice may even be harmful. Such students are likely better off improving their basic skills. This interactive workshop will present concrete steps for doing so, using various problems, including examination-type ones, as raw material. The topics are from statistics, though the idea is obviously generally applicable.

- Speaker 3: **Dr Hang Kim Hoo**
  Title: **Assessment for Learning in Mathematics – Strategies and Approaches**

  Abstract: There has been much focus and discussion on assessment for learning in the classrooms in Singapore in recent years. Many educational research studies, both international and local, have put forward many proposals and suggestions on how to integrate assessment into the teaching and learning processes. This workshop attempts to help participants come up with some practical strategies and approaches to design and integrate a range of assessment tasks that can potentially enhance students' engagement in their learning of Mathematics in the classroom. The contexts and exemplars used will be relevant to upper primary as well as secondary levels.

- Speaker 4: **Associate Professor Toh Tin Lam**
  Title: **Designing assessment items for paper-and-pencil tests for higher order thinking skills (HOTS)**

  Abstract: It is generally believed that paper-and-pencil tests are not suitable to test students' Higher Order Thinking Skills (HOTS). In this workshop, participants will be led to explore how suitable test items testing HOTS can be designed. The participants will also be engaged to use identify the assessment objectives of selected traditional test items, and guided to modify these questions into forms that are suitable to assess students HOTS and formulate the new assessment objectives of these items.

3. AME-SMS Conference 2014

- This is the fourth year the Singapore Mathematical Society organized the Singapore Mathematics Symposium, which is an initiative to promote interaction within this community and to showcase some of the exciting developments originating from Singapore. This year, four prominent mathematicians from NUS and NTU were invited to speak. A poster exhibition and competition for graduate students was also held during the symposium.
- Date: September 26, 2014
- Venue: National University of Singapore, Lecture Theatre 34

- Speaker 1: **Professor Chong Chi Tat**
  Affiliation: Department of Mathematics, NUS
  Title: **Logical analysis of Ramsey's theorem**
  Abstract: Ramsey's theorem (proved in 1931) concerns the existence of infinite homogeneous sets for finite colouring of n-tuples of natural numbers. This theorem has evolved into a combinatorial principle studied extensively by logicians. This talk will present the historical and mathematical development of the principle, from the logical perspective.

- Speaker 2: **Associate Professor Nicolas Privault**
  Affiliation: School of Physical and Mathematical Sciences, NTU
  Title: **From continuous to discrete infinite-dimensional analysis**
  Abstract: This talk will start with a review of analysis on Gaussian space, motivated by connections with stochastic calculus and PDEs. The Gaussian model will then be transferred to the discrete setting of random point processes by a natural isomorphism. This transfer will allow us to consider a differential structure on discrete spaces and applications to the stochastic geometry of Poisson point processes.

- Speaker 3: **Associate Professor Ren Weiqing**
  Affiliation: Department of Mathematics, NUS
  Title: **The mathematics and the physics of the moving contact line problem**

  Abstract: The moving contact line problem is a classical problem in fluid mechanics. The difficulty stems from the fact that the classical Navier-Stokes equation with no-slip boundary condition predicts a non-physical singularity at the contact line with infinite rate of energy dissipation. Partly for this reason, mathematical and numerical studies of free boundary problems in fluids have so far avoided dealing with realistic solid boundaries. Many modified continuum models have been proposed to overcome this difficulty. They all succeed in removing the singularity, but they leave behind the question: which one of these models is faithful to the microscopic physics near the contact line region? This and related questions can be answered by using continuum theory, molecular dynamics and the more recently developed multiscale techniques.

- Speaker 4: **Associate Professor David John-Nott**
  Affiliation: Department of Statistics and Applied Probability, NUS
  Title: **Approximate Bayesian computation and Bayesian model criticism**

  Abstract: In the Bayesian framework a standard approach to model criticism is to compare some function of the observed data to a reference predictive distribution. The result of the comparison can be summarized in the form of a p-value, and it's well known that computation of some kinds of Bayesian predictive p-values can be challenging. The use of regression adjustment approximate Bayesian computation (ABC) methods will be explored for this task. Two problems are considered. The first is the calibration of posterior predictive p-values so that they are uniformly distributed under some reference distribution for the data. Computation is difficult because the calibration process requires repeated approximation of the posterior for different data sets under the reference distribution. The second problem considered is approximation of distributions of prior predictive p-values for the purpose of choosing weak informative priors in the case where the model checking statistic is expensive to compute. Here the computation is difficult because of the need to repeatedly sample from a prior predictive distribution for different values of a prior hyperparameter.

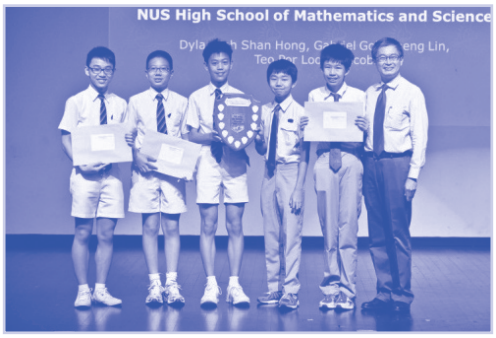
- Poster competition
- Winner 1: **Le Thi Khanh Hien** (SPMS, NTU)
  Title of Project: **A globally linear and locally superlinear (quadratic) inexact non-interior continuation method for variational inequalities over general closed convex sets**
  Abstract: Using barrier-based smoothing approximation proposed by Chua and Li, we extend the non-interior continuation method introduced by Chen and Xiu for NCP to an inexact non-interior continuation method for solving VIs over general closed convex sets. While many of known algorithms solving VIs achieve locally superlinear (quadratic) convergence in company with global convergence only, our proposed algorithm converges globally linearly as well as locally superlinearly (quadratically). Furthermore, Newton equations in our method are solved inexactly to handle large scale problems.

- Winner 2: **Wang Yan** (Math, NUS)
  Title of Project: **Sharp interface model for solid-state dewetting problems with weakly anisotropic surface energy**
  Abstract: Based on an energy variational approach, we propose a sharp interface model for simulating solid-state dewetting of thin films with weakly anisotropic surface energies. The morphology evolution of thin films is governed by surface diffusion and contact line migration. For the contact line migration, we introduce a relaxation kinetics with a finite contact line mobility by energy gradient flow method. We implement the mathematical model in an explicit finite difference scheme with cubic spline interpolation for evolving marker points. Following validation of the mathematical and numerical approaches, we present a series of two dimensional simulation results.

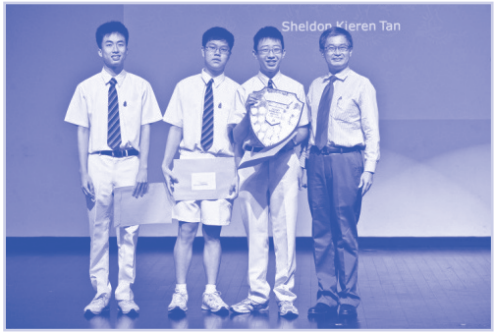
4. Singapore Mathematical Olympiad 2014

- Dates:
  June 3 2014
  (Junior and Senior section - First round)
  June 4 2014
  (Open section - First round)
  June 28 2014
  (Junior and Senior section - Second round)
  July 5 2014
  (Open section - Second round)

- The Society conducted the Singapore Mathematical Olympiad (Junior, Senior and Open Sections) in June 2014. A total of 9231 students from 132 secondary schools and junior colleges participated in the various sections of the Olympiad.
- For Junior section, there are 4571 participants from 116 schools. For Senior section, there are 2856 participants from 101 schools. For Open section, there are 1804 participants from 71 schools.
- The SMO Subcommittee 2014 consists of
  - Associate Professor Victor Tan (Chairman)
  - Dr Hang Kim Hoo (Deputy Chairman/Administration)
  - Dr Toh Pee Choon (Junior Section Coordinator)
  - Dr Ku Cheng Yeaw (Senior Section Coordinator)
  - Associate Professor Toh Tin Lam (Open Section Coordinator)
  - Associate Professor Tay Tiong Seng (Second Round Coordinator)



SMO 2014 Junior Section Challenge Trophy Joint- Winner (Raffles Institution & NUS High School)



SMO 2014 Senior Section (left) and Open Section (right) Challenge Trophy Winners (Raffles Institution)

- The top 10 ranking for the SMO individual awards is given below:

	Junior section	Senior section	Open section
1	Dylan Toh Shan Hong (NUSHS)	Clarence Chew Xuan Da (NUSHS)	Sheldon Kieren Tan (RI)
2	Wang Jianzhi (RI)	Sheldon Kieren Tan (RI)	Way Tan (NUSHS)
3	Seah Fengyu (RI)	Ma Zhao Yu (RI)	David Lin Kewei (RI)
4	Teo Por Loong, Jacob (NUSHS)	Glen Lim Wei An (RI)	Eugene Lee Hua Jun (RI)
5	Gabriel Goh Kheng Lin (NUSHS)	Bryan Wang Peng Jun (HCI)	Liu Yi Jia (RI)
6	Lee Estelle (RGS)	Lyu Liang (Dunman Secondary)	Dylan Toh Shan Hong (NUSHS)
7	Cheng Puhua (RI)	Lee Yuan (RI)	Clarence Chew Xuan Da (NUSHS)
8	Joel Tan Junyao (NUSHS)	Yang Gan (RI)	Tan Siah Yong (RI)
9	Caleb Leow Yong Quan (RI)	Liu Tianyi (RI)	Ling Yan Hao (NUSHS)
10	Li Anqi (RGS)	Tan Likai (RI)	Jansen Jarret Sta Maria (RI)

- The SMO School Awards for Category 1 and 2 are given below:

Category 1	
Gold Award	**Silver Award**
Anglo-Chinese School (Independent)	Cedar Girls' Secondary School
Hwa Chong Institution	Maris Stella High School
Nanyang Girls' High School	Nan Hua High School
NUS High School of Mathematics and Science	River Valley High School
Raffles Girls' School (Secondary)	St Joseph's Institution
Raffles Institution	Victoria School
Bronze Award	
Anderson Secondary School	Methodist Girls' School
Bukit Panjang Govt High School	Nan Chiau High School
Catholic High School	National Junior College
CHIJ St Nicholas Girls' School	Ngee Ann Secondary School
Chung Cheng High School (Main)	Swiss Cottage Secondary School
Dunman High School	Tanjong Katong Secondary School

Category 2	
Gold Award	**Silver Award**
Anglo-Chinese School (Independent)	Dunman High School
Hwa Chong Institution	National Junior College
NUS High School of Mathematics and Science	River Valley High School
Raffles Institution	Temasek Junior College
	Victoria Junior College
Honorable Mention	
Anderson Junior College	Meridian Junior College

5. Singapore Mathematics Projects Festival 2014

- Dates:
  February 15 2014 (Preliminary round A)
  February 22 2014 (Preliminary round B)
  March 22 2014 (Festival Congress – Final round)

- This year the Project Festival attracted 21 projects from Junior section and 23 projects from Senior section.
- The preliminary rounds were held at various locations, including NUS, Hwa Chong Institution, NUS High School, Paya Lebar Methodist Girls' School, Zhonghua Secondary School. Judging panels made up of Mathematicians and school teachers were formed to grade the presentation of each team.
- 5 teams from the Junior section and 5 teams from Senior Section were invited to the Festival Congress held at Nanyang Girl High School
- The judges for the Festival were
  - Junior Section: Dr Teo Kok Ming (NIE), Assoc Prof Zhao Dong Sheng (NIE), Dr Toh Pee Choon (NIE)
  - Senior Section: Dr Ku Cheng Yeaw (NUS), Assoc Prof Tay Tiong Seng (NUS), Prof Yang Yue (NUS),

- Medals were awarded to the following projects:
  Junior section
  - Gold (Foo Kean Pew Memorial Prize): **Conway's Game of Life**, by Wang An Aloysius, Koh Shang Hui (Hwa Chong Institution - High School)
    (See featured article on page 11)
  - Gold: **Optimal Strategy Usage via Geometric Figures**, by Clarence Chew Xuan Da (NUS High School of Mathematics and Science)
  - Silver: **Winning Strategy of Game of Criss-Cross**, by See Xiaomin, Kwak Yoon Joo, Chen Qi Jia, Geraldine Zhang Fang (Singapore Chinese Girls' School)
  - Silver: **Josephus Problem: History, Extensions**, Generalizations, by Chan Wayde, Chen Pang Yen Byron, Quek Sze Long (NUS High School of Mathematics and Science)
  - Bronze: **The Chicken McNugget Theorem**, by Matthew Fan Xin Yu (NUS High School of Mathematics and Science)

- Senior section
    - Gold (Foo Kean Pew Memorial Prize): **Tromino Covering**, by Liu Hang, Surya Mathialagan, Pek Yu-Xuan Sean (NUS High School of Mathematics and Science)
    - Silver: **Generalization for Computing Bishop's Polynomial Derived From the Conventional Rook's Polynomial**, by Sim Ming Hui Melodies, Qu Siyang (Raffles Girls' School - Secondary)
    - Bronze: **The Car Park Problem**, by Chen Yankang, Sun Lu, Hu Jingjie, Huang Shimeng (National Junior College)
    - Bronze: **Projectile Motion: The Math behind Angry Birds**, by Charmaine Kho Ling Wei, Chen Mei Zhu, Jere Low Wenn, Nicole Ong Wen Pei (Nanyang Girls' High School)
    - Bronze: **PIN: The More, The Better?**, by Xin Jiawen, Wang Zhenghao, Qian Hongyu (Hwa Chong Institution -High School)
    - Bronze: **Why Ternary?**, by Ang Jun Ming, Song Zhiyuan, Yang Fan (Clementi Town Secondary School)
    - Bronze: **The Confused Knight**, by Kuan Yu Jie, Goh Wei Shern, Lim Zhe Hui (Hwa Chong Institution -High School)
    - Bronze: **Adaptation of Nonlinear-Programming Algorithms to find the Geometric Median of Five Points**, by Dave Kaiman, Toh Jia Qi Andrea, Yeo Jen Khai (National Junior College)
    - Bronze: **Angel Problem in a Hexagon**, by Ren Yuhua, Choi Yun Young, Lin Shao Yun (NUS High School of Mathematics and Science)

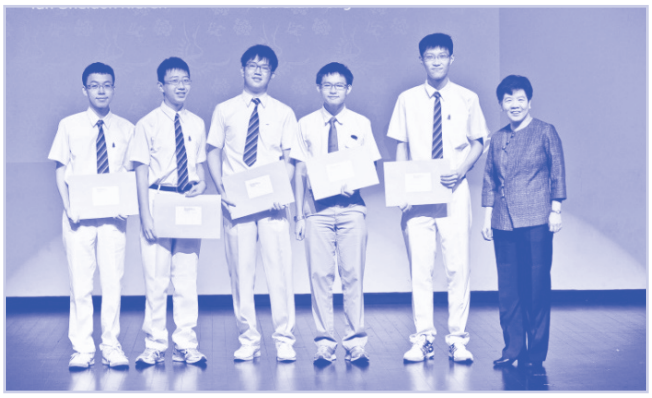
Gold Award (Junior section) from Hwa Chong Institution (left) and NUS High School (middle), and Gold Award (Senior section) from NUS High School (right).

6. Annual Prize Presentation Ceremony

- Date: September 06 2014
- Venue: NUS High School of Mathematics and Sciences
- Guest of Honour: **Ms Chan Lai Fung** (Permanent Secretary (Education), Ministry of Education)

Guest of Honour Ms Chan with SMS President Prof Ling San

- The following prizes were given out at the ceremony:
    - o 9 prizes for the Singapore Mathematics Project Festival (Junior Section)
    - o 14 prizes for the Singapore Mathematics Project Festival (Senior Section)
    - o 30 individual prizes for the Singapore Mathematical Olympiad (Junior section)
    - o 30 individual prizes for the Singapore Mathematical Olympiad (Senior section)
    - o 31 individual prizes for the Singapore Mathematical Olympiad (Open section)
    - o 44 School Awards for the Singapore Mathematical Olympiad (Category 1)
    - o 19 School Awards for the Singapore Mathematical Olympiad (Category 2)
    - o Awards to the Singapore Team to the 55th International Mathematical Olympiad



- Winner of the Gold award for the junior section of the Singapore Mathematics Project Festival also presented their winning projects: **Conway's Game of Life** by Wang An Aloysius, Koh Shang Hui from Hwa Chong Institution (High School).
(See featured article on page 11)

7. Singapore Mathematical Society Masterclasses

- This programme is jointly organized by SMS, MOE and the Singapore Science Center. It is a one to two day program targetting at mathematically talented students. It is designed to encourage, inspire and engage young people in the art and practice of mathematics by introducing them to aspects, including applications, which may not usually be covered in the school curriculum. Within each class, students are given the opportunity to explore the subject for themselves, either individually or in small groups, with help being on hand if needed.

- Date: July 22-25, 2014
- Venue: Singapore Science Centre

- Speaker 1: **Associate Professor Chua Chek Beng** (Division of Mathematical Sciences, Nanyang Technological University)
  Topic: **The Mathematics of Transportation**
  Abstract: The efficient allocation of resources is essential in the sustainability of a global metropolis such as Singapore. At the core of this lies Transportation Theory, which is the study of optimal transportation and allocation of resources such as material, goods and energy. In this workshop, you will explore two fundamental mathematical problems, the shortest path problem and the transportation problem. You will discover the various algorithms designed by mathematicians over the years to solve these problems, and learn the mathematical techniques involved in proving the correctness of these algorithms. This foundational knowledge will open your door to an exciting branch of Mathematics known as Operations Research.

- Speaker 2: **Dr Frédérique Oggier** (Division of Mathematical Sciences, Nanyang Technological University)
  Topic: **An Introduction to Coding Theory and Cryptography**
  Abstract: This class will be an introduction to coding theory and cryptography. No particular prerequisite will be required. Some background on modular arithmetic will be given, after which erasure codes will be introduced, as well as RSA, one example of cryptosystem.

8. SMS - Talent Outreach Programme Launch

- In September, a special talent outreach programme (TOP) was launched to reach out to all primary pupils. TOP is organised by the Singapore Mathematical Society (SMS) and run on a zonal basis. TOP seeks to provide equal opportunities to benefit pupils and teachers in all primary schools.

- This is a 45 hour enrichment programme intended for mathematically talented pupils in Primary 3, 4 and 5 who have a strong interest in mathematics. The main objective of the programme is to stimulate and develop pupils' creative thinking and problem-solving abilities. The programme consists of 5 modules and each module will be conducted in six 1.5-hour sessions.
  (Refer to http://www.add-venture.com.sg/sms_talent/ for more details.)

- Date: September 10, 2014
- Venue: NUS High School of Mathematics and Sciences
- Speaker 1: **Dr Hang Kim Hoo**
  Title: **Mathematical Problem Solving for Primary School Pupils**

  Speaker 2: **Dr Lee Peng Yee**
  Title: **Paper folding Activities - An Experience in Chongqing**

  Speaker 3: **Dr Lim Suat Khoh**
  Title: **Primary Mathematical Olympiad Programme Questions**

Clockwise from top left: Dr Hang Kim Hoo, Dr Lee Peng Yee, Dr Lim Suat Khoh, Dr Rosalind Phang & Dr Tang Wee Kee (co-founders of Add-venture Learning)