Singapore Mathematical Society

Events and Activities 2012

1. Singapore Mathematics Projects Festival 2012

Dates:

February 11, 2012 (Preliminary round A)
February 11, 2012 (Preliminary round B)
March 17, 2012 (Festival Congress – Final round)

This year the Project Festival attracted 19 projects from Junior section and 21 projects from Senior section.

The preliminary rounds were held at various locations, including Hwa Chong Institution, Nanyang Girls' High School, Zhenghua Secondary School. Judging panels made up of mathematicians and school teachers were formed to grade the presentation of each team.

5 teams each from the Junior and Senior Sections were invited to the Festival Congress held at NUS High School of Mathematics and Science.
(See the article on Singapore Mathematics Project Festival 2012 on page 50)

The judges for the Festival were

- Junior Section: Dr. Teo Kok Ming (NIE), Dr. Lim Poon Chuan Adrian (NIE), Dr Toh Pee Choon (NIE)
- Senior Section: Dr Wang Fei (NUS), Dr Ku Cheng Yeaw (NUS), Associate Professor Tay Tiong Seng (NUS)

Medals were awarded to the following projects:

Junior section

Silver: "Fit the Squares into a Square!" by Angelin Ang Xue Yin, William
(River Valley High School)

Silver: "Strategy Behind Mastermind" by Hsiao I Ann, Lee Yue Xin
(NUS High School of Mathematics and Science)

Bronze: "Project Traffic Light" by Tan Jing Ling, Lee Bing Qian Ryan, Justin Lo Tian Wen
(Hwa Chong Institution)

Bronze: "Napoleon's Theorem" by Tan Jia Yu, Cheryl Chua Xing Jun, Xu Ming Xin
(Paya Lebar Methodist Girls' School)

Bronze: "Interesting Patterns in the Pascal's Triangle and Pyramid" by Ng Jian Rong, Shashvat Shukla, Glen Goh Wee Zhuan
(NUS High School of Mathematics and Science)

Senior section

Gold (Foo Kean Pew Memorial Prize):
"A General Method of Flattening Convex Prismatoid into Flat Sheet" by Zhou Jingqi, Li Chenglei
(NUS High School of Mathematics and Science)
Gold: "Weak Roman Domination" by Xu Linfeng
(Hwa Chong Institution - High School)
Gold: "Graph Theory: List Assignment Problems" by Lee Kian Wee, Yeo Yao Rui
(NUS High School of Mathematics and Science)
Silver: "Catalan Numbers: An Attempt to Generalize" by Jonathan Ang Yun Hao, Eun Jung Min, Lee Yi Min (NUS High School of Mathematics and Science)
Bronze: "The Extension of Fermat's Last Theorem" by Tong Hien Chi, Le Minh Phuc
(National Junior College)

2. 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 7, 2012

Title: The Foundational Role of Statistics in the Future of Medicine

Speaker: **Associate Professor Teo Yik Ying**

Teo Yik Ying is Associate Professor in the Department of Statistics & Applied Probability (Faculty of Science) and the Department of Epidemiology & Public Health (School of Medicine) at the National University of Singapore (NUS). He also heads the Biostatistics Domain at the Saw Swee Hock School of Public Health (NUS) and is Adjunct Visiting Group Leader at the Genome Institute of Singapore, A*STAR. He graduated from Imperial College in 2000 and obtained his M.Sc. and DPhil. from the University of Oxford in 2001 and 2006 respectively. Among his many accolades, he most recently won the National Research Foundation Research Fellowship (2010), the 2010 Young Scientist Award and the 2011 Singapore Youth Award. Professor Teo is also an excellent teacher, having won several teaching excellence awards from Oxford and NUS.

Abstract: The advent of genomics began the digitization of modern biology, progressing from the observational and empirical nature of medicine and biology to a more deterministic nature of science, where physical traits, disease risks and drug responses are expected to be quantifiable, within realistic boundaries of confidence and uncertainty. The capacity to process genomic information - digitized biology - underpins the next phase in medical advancement, moving clinical medicine towards precision medicine or future medicine. Future medicine foundationally relies on understanding, interpreting and utilizing genomic information for addressing disease risk, drug efficacy and dosage, and appropriate modifications to lifestyle factors for promoting good health and minimizing adverse health outcomes. This ranges from the micro-level of personalized medicine, personalized nutrition and personalized lifestyle management, to the macro-level of social and governmental policies to address public health burdens. The interpretation and application of genomics fundamentally rely on statistics and methodological developments in handling complex genetic datasets. Clinicians, healthcare workers and policy makers need to be trained to understand, interpret and use genomic information in future medicine. In this talk, I will describe the changing landscape for medical practice, and to discuss the importance of mathematics and statistics in future medicine. I will also highlight the role that Singapore has to play in future medicine, with its population demography that is representative of more than half of the world's populations.

3. AME-SMS Conference 2012

This conference for mathematics teachers is the first 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. Three SMS members were invited to deliver lectures for the secondary/junior college teachers.

Theme: Nurturing Reflective Learners

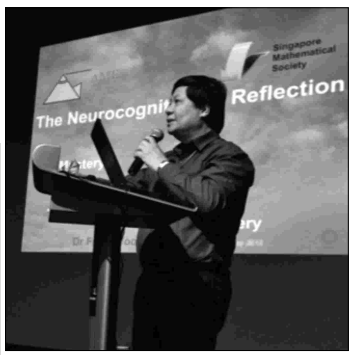
Date: May 30 2012

Venue: NUS High School of Mathematics and Science

Speaker 1: **Associate Professor Yap Von Bing**
Title: Using Summary Statistics to Learn Probability

Abstract: Probability looks simple but is not. Summary statistics look messy but is simple. In the secondary mathematics curriculum, summary statistics are taught before probability. This affords the leveraging of summary statistics in the learning of probability, which can deepen appreciation of both topics. Detailed examples and resources will be demonstrated in this presentation. Related issues in the mathematics syllabus will be discussed.

Speaker 2: **Dr Hang Kim Hoo**
Title: Task Design & Analysis, Problem Posing & Mathematical Metacognition: How can these be integrated to deepen learning in mathematics?



Abstract: The current mathematics curriculum framework used in Singapore schools emphasizes mathematical problem-solving as its core focus. The various components of this framework include developing mathematical conception & skills, mathematical reasoning and thinking skills, problem solving heuristics and processes, and metacognition. This lecture will provide a brief survey of some current development in task design and analysis, mathematical problem solving, and problem posing. Based on the experiences of some high ability students in mathematics, a taxonomy of mathematical metacognitive strategies is proposed. Through some exemplars, an exposition will be made on how task design and analysis can be integrated while making mathematical extensions and problem posing. Preliminary proposals on how metacognitive strategies can be explicated will also be presented.

Speaker 3: **Associate Professor Peter Pang**
Title: Mathematical Modeling in Epidemiology

Abstract: The lecture explores how mathematical modeling in epidemiology can be used in the classroom. After introducing the standard SIR model and its more sophisticated versions, the speaker will discuss how they can inform public health policies. The strong potential for interdisciplinary learning in this approach will also be highlighted.

4. Singapore Mathematical Olympiad 2012

Dates:

May 29 2012 (Junior and Senior section - First round)
May 30 2012 (Open section - First round)
June 23 2012 (Junior and Senior section - Second round)
June 30 2012 (Open section - Second round)

The Society conducted the Singapore Mathematical Olympiad (Junior, Senior and Open Sections) in June 2012. A total of 9742 students from 148 secondary schools and junior colleges participated in the various sections of the Olympiad.

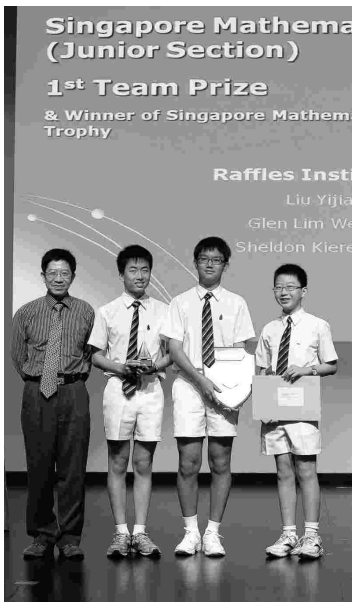
For Junior section, there are 4626 participants from 123 schools. For Senior section, there are 3271 participants from 116 schools. For Open section, there are 1845 participants from 75 schools.

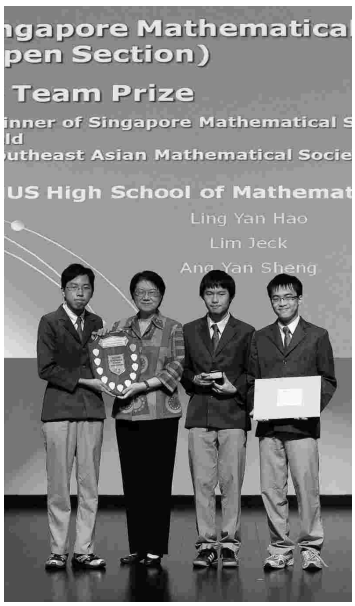
There were some changes in the rules and regulations to the competition this year:

- The duration of senior section second round increases from 3.5 hours to 4 hours.
- The duration of open section second round decreases from 4.5 hours to 4 hours.
- Team ranking computation:
  First round results (top 3 scores) will be used to identify the top 20 teams (junior and senior sections) and top 10 teams (open section).
  The final team ranking will then be decided based on the first round and second round results (top 3 combined scores).

The SMO Subcommittee 2012 consisted of

- Associate Professor Victor Tan (Chairman)
- Dr Hang Kim Hoo (Deputy Chairman/Administration)
- Dr Wang Fei (Junior Section Coordinator)
- Dr Toh Pee Choon (Senior section Coordinator)
- Associate Professor Toh Tin Lam (Open Section Coordinator)
- Associate Professor Tay Tiong Seng (Second Rounds Coordinator)





The top 10 winners for the various sections is given below:

Junior Section (Team)

1	Raffles Institution
2	NUS High School of Mathematics and Science
3	Hwa Chong Institution
4	Raffles Girls' School (Secondary)
5	Anglo-Chinese School (Indep.)
6	Nanyang Girls' High School
7	River Valley High School
8	Victoria School
9	Catholic High School
9	Xinmin Secondary School

Junior Section (Individual)

1	Sheldon Kieren Tan (RI)
2	Liu Yijia (RI)
3	Clarence Chew Xuan Da (NUSHS)
4	Glen Lim Wei An (RI)
5	Lee Yu Tse (RI)
6	Yang Gan (RI)
7	Tan Likai (RI)
8	Cong Feng (RI)
9	Nicholas Steven Husada (Indep)
10	Siew Kheng Hun (RI)

Senior Section (Team)

1	Raffles Institution
2	NUS High School of Mathematics and Science
3	Hwa Chong Institution
4	Anglo-Chinese School (Indep.)
5	Raffles Girls' School (Secondary)
6	Singapore Chinese Girls' School
6	St Joseph's Institution
8	Nanyang Girls' High School
9	Victoria School
9	Zhonghua Secondary School

Senior Section (Individual)

1	Way Tan (RI)
2	David Lin Kewei (RI)
3	Tan Siah Yong (RI)
4	Ling Yan Hao (NUSHS)
5	Sean Lo (RI)
6	Lim Xiao Zheng Xavier (RI)
6	Teh Jiun Harn (RI)
8	Jansen Jarret Sta Maria (RI)
9	Zhang Boyu (RGS)
10	Cho Ming En (HCI)

Open Section (Team)

1	NUS High School of Mathematics and Science
2	Raffles Institution
3	Hwa Chong Institution
4	Anglo-Chinese School (Indep.)
5	National Junior College
5	Raffles Girls' School (Secondary)
7	Maris Stella High School
8	River Valley High School
9	Catholic Junior College
10	St Joseph's Institution

Open Section (Individual)

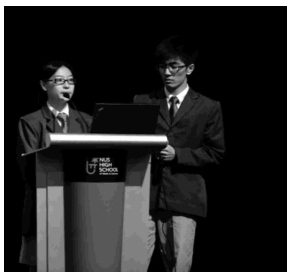
1	Lim Jeck (NUSHS)
2	Ang Yan Sheng (NUSHS)
3	Lee You Jun (RI)
4	Ding Yue (RI)
5	Kor Cong Luck Ryan (RI)
5	Yan Kaidi (HCI)
7	Joseph Kuan Jun Jie (RI)
8	Zhang Aidi (RI)
9	Ling Yan Hao (NUSHS)
10	Chan Jau Tung (RI)
10	Tan Pin Lin (NUSHS)

5. Annual Prize Presentation Ceremony

Date: September 01 2012
Venue: NUS High School of Mathematics and Sciences
Guest of Honour: Ms Ho Peng (Director - General of Education)
(See page 48 for the speech by GOH)

The following prizes were given out at the ceremony:

- 8 prizes for the Singapore Mathematics Project Festival (Junior Section)
- 6 prizes for the Singapore Mathematics Project Festival (Senior Section)
- 30 individual prizes and 21 team prizes for the Singapore Mathematical Olympiad (Junior section)
- 30 individual prizes and 20 team prizes for the Singapore Mathematical Olympiad (Senior section)
- 30 individual prizes and 10 team prizes for the Singapore Mathematical Olympiad (Open section)
- Awards to the Singapore Team to the 53rd International Mathematical Olympiad



Winners of the two Gold awards for the senior sections of the Singapore Mathematics Project Festival also presented their wining projects:

"Weak Roman Domination" by Xu Linfeng from Hwa Chong Institution (High School)
"A General Method of Flattening Convex Prismatoid into Flat Sheet" by Zhou Jingqi, Li Chenglei from NUS High School of Mathematics and Science

6. Singapore Mathematics Symposium

Date: September 28 2012
Venue: National University of Singapore, Department of Mathematics

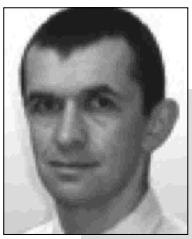
This is the third year the Singapore Mathematical Society organized the Singapore Mathematics Symposium, which is an initiative to promote interaction within this community and to showcase some of the exciting developments originating from Singapore. This year, four prominent mathematicians from NUS and NTU were invited to speak. A poster exhibition and competition for graduate students was also held during the symposium.

Speaker 1: **Professor Shen Zuowei (NUS)**
Title: Image Restoration: Wavelet Frame Approach, Total Variation and Beyond

Abstract: This talk is about the wavelet frame based image and video restorations. Main ideas of wavelet frame based models and corresponding algorithms for image restorations will be reviewed. Some of applications of wavelet frame based models image analysis and restorations will be shown. Examples of such applications include image and video inpainting, denoising, decomposition, image deblurring and blind deblurring, segmentation, CT image reconstruction and etc. In all of these applications, spline wavelet frames derived from the unitary extension principle are used. This allows us to establish a connection between wavelet frame base method and the total variation based method. In fact, we will show that when spline wavelet frames are used, a special model of a wavelet frame method can be viewed as a discrete approximation at a given resolution to the total variation based method. A convergence analysis in terms of objective functionals and their approximate minimizers a resolution increases will be discussed.

Speaker 2: **Professor Xing Chaoping (NTU)**
Title: List Decoding of Algebraic Geometry Codes

Abstract: We give a new construction of algebraic geometry codes which are efficiently list decodable up to the Singleton bound. The worst case list size output by the algorithm matches the existential bound for random codes up to constant factors.



Speaker 3: **Dr Dmitrii Pasechnik (NTU)**
Title: Rational generating functions for moments and non-convex polytopes

Abstract: We show that the non-convex polytopes, i.e. finite unions of convexpolytopes, can be parametrized by multivariate rational generating functions with denominators controlled by their vertices. The starting point for this is a Fantappie transformation of the uniform measure supported on such a polytope. We will also discuss applications of this approach to multidimensional inverse moment problems and inverse harmonic potential problems.

Speaker 4: **Professor Zhu Chengbo (NUS)**
Title: Classical groups and invariant distributions

Abstract: Invariant Theory is the study of invariant polynomial functions of a group action on a vector space. It was first developed in the 19th century by mathematicians such as Cayley and Hilbert. It was later reinvigorated by Weyl, who laid its representation - theoretic foundation in his famous book "The Classical Groups" (1946). Since then it has been incorporated into a subject, and has played an important role in the development, of representation theory (of compact Lie or linear algebraic groups).
For non-compact Lie groups, almost always one only finds representations in N-dimensional (often function) spaces, therefore demanding tools from functional analysis and in particular theory of invariant distributions (as opposed to invariant polynomial functions). In this talk, I will explain two results (joint with Binyong Sun) on representations of classical groups: multiplicity one theorems and conservation relations, and their (100%) invariant theoretic nature. The first asserts that certain dimension is either 0 or 1 and the second asserts that the sum of certain dimensions is fixed.

Poster competition winner 1: Jin Lingfei (NTU)
Title of Project: Application of Classical Hermitian Self-Orthogonal MDS Codes to Quantum MDS Codes

Poster competition winner 2: Zhao Xiaofei (NUS)
Title of Project: Uniformly correct multiscale time integrators for highly oscillatory second order differential equations

7. Singapore Mathematical Society Masterclasses

• Date: November 17 2012
• Venue: National University of Singapore

This one day program targets at mathematically talented students at secondary 2 level. 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. This year, a total of 47 students from 12 schools attended in the Masterclasses.

Speaker 1: Associate Professor Victor Tan (Department of Mathematics, National University of Singapore)
Topic: Fractals – Endless Repeated Figures

Abstract: This talk cum hands-on session introduces students to some of the exciting mathematics behind some of the most stunningly beautiful images in mathematics -- fractals. The concept of complication (and beauty) arising from infinite iteration of simple operations will be reinforced through the Iterated Function System (IFS). This is an important result of Michael Barnsley and is useful in modeling nature. Students will be able to appreciate its power by using the IFS to model trees, leaves, mountains and etc. The mathematical concepts that will be introduced include Euclidean geometry, transformations, matrices, limits etc.

Speaker 2: Dr David Chew (Department of Statistics and Applied Probability, National University of Singapore)
Topic: Probability Through Games

Abstract: The theory of probability is a thriving mathematical area and has many potential applications in real problems. We will give a brief introduction to some important concepts, its history and go through selected famous problems. Through simple and fun activities, we seek to reinforce these concepts and shed some insights on some of these problems.