IMO POST 2015

THE 56TH INTERNATIONAL MATHEMATICAL OLYMPIAD
JULY 4-16, 2015 IN CHIANG MAI, THAILAND

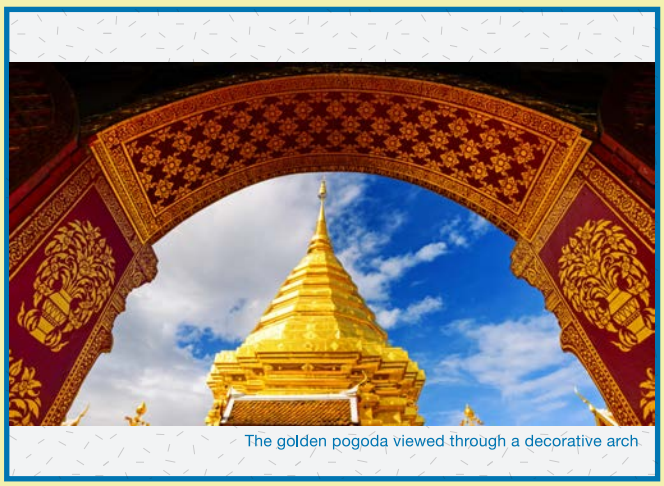
DAILY NEWSLETTER JULY 12, 2015 ISSUE 04

DESTINATION: DOI SUTHEP

Doi Suthep is one of Chiang Mai's most visited sites. For first-time visitors especially, a trip up the mountain is a must.

Doi Suthep is about 15 km from the city center and just a few minutes drive from our contest venue. It is 1,676 meters (5,499 ft) in elevation and is one of the twin peaks of a granite mountain. Together, the two peaks form the Doi Suthep-Pui National Park.

At the foot of the mountain on Suthep Road, you will find the Khru Ba Srivichai Shrine. This is a monument to the much-revered monk who built the road up to Wat Phra That Doi Suthep, the most sacred temple in Chiang Mai. The temple is located some 11 km from this point. It was built in AD 1386 by order of a Chiang Mai king as a place to enshrine a holy relic of the Lord Buddha. The temple's gilded pagoda is Chiang Mai's most iconic sight, followed not far behind by the naga serpent staircase that leads up to the compound.

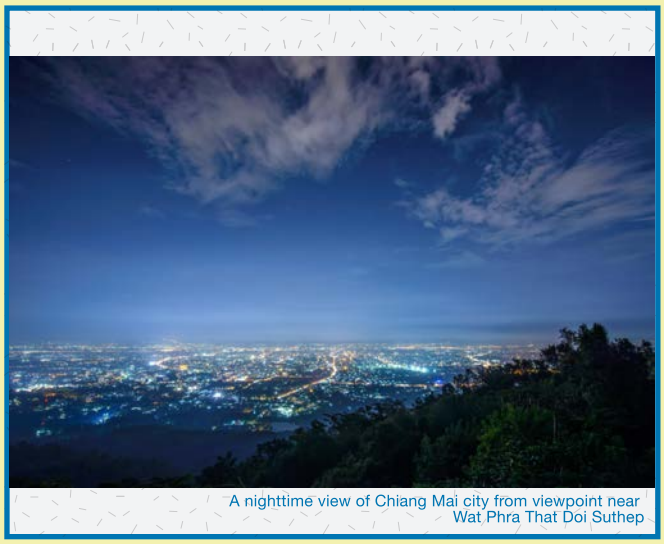


The golden pogoda viewed through a decorative arch

To give you an idea of how important the temple is to the people of Chiang Mai, consider this: when Khru Ba Srivichai announced he was going to build a road to the temple, thousands of locals volunteered their labor. With some 5,000 people pitching in each day, the road was completed in less than 6 months. It was opened on April 30, 1935. That same year, Wat Phra That Doi Suthep was elevated to National Heritage Site status.

In the old days, to reach the temple you had to climb the 300-plus steps. Today, there's a cable car if you don't feel like climbing (round-trip fare: 20 baht). Many still do the climb, however, and whether or not they do it to show the strength of their faith, it's not a bad way to get some exercise!

To enter the temple proper, visitors must be appropriately dressed and must remove footwear. Within the site you can see elements of Buddhism and Hinduism. The lower-level terrace has a shrine to Sudeva, the hermit which lived on the mountain



A nighttime view of Chiang Mai city from viewpoint near Wat Phra That Doi Suthep

and gave it its name, and a statue of the white elephant who carried the Buddha's relic up the mountain. On the upper level terrace is the golden pagoda that enshrines the relic.

The terrace areas offer panoramic views of the city. So don't forget to bring your camera along and make sure you have plenty of memory available.

Some 4 km up the road from the temple is Bhubing Palace (also written as Phuping Palace), built in 1961 as a winter residence for the Thai Royal Family. For many years, Their Majesties the King and Queen would use Bhubing as their northern base as they pioneered development efforts such as the crop substitution program to wean hilltribe people from the cultivation of opium poppies. Parts of the palace are open to the public when the Royal Family is not in residence. The rose gardens within its walls are said to be among the most beautiful anywhere and as such they are one of the top attractions of this city known as "The Rose of the North".

The upper level of the terrace showing the golden pogoda

"My name is Alexander and I am a contestant from the Danish IMO team 2015. The rest of the team consists of Matias, Emil, Eigil, Stine and Mads, the last three of whom are attending the IMO for their second time. My goal was to go to the IMO next year, so I was excited when I qualified for the team this year. I am looking forward to meeting new people who share my interest in math and the IMO will be my first real experience of a "feast of mathematics". I am also looking forward to the last week leading up to the IMO. During this week, the Danish team will practice together with the other Nordic countries and The Viking Battle is held to determine who the real Vikings of the Nordic countries are."

DENMARK

"Përshëndetje Tajlandë !"

Ramadan Limani (leader): It's my pleasure that my country KOSOVO is participating in the 56th IMO that is taking place in your beautiful city of Chiang Mai. This is a big event for all mathematicians from all over the world and I wish a very good and fair contest to all contestants and let the best win.

Albert Hoxha (contestant): I'm really happy to participate in the IMO and I really hope that everyone is going to have a great experience while at the same time I would like to thank the staff of the IMO, sponsors, and all the people who help and make it possible for us high school students all over the world (who share the same ambitions about mathematics) to participate in such a competition.

Doruntina Sylejmani (contestant): For as long as I can remember I have always had a great passion for mathematics. Since I was a child nothing made me happier than studying new theories and solving new challenging problems. Although I have participated in countless mathematics competitions in my country, none of them has made me feel as proud as being selected as one of the participants for this year's International Mathematical Olympiad (IMO). I feel honored to not only be one of the 6 participants that will represent my country but to also be a part of the future mathematicians of the world. Kosovo is only one of over 100 countries participating from 5 continents and I cannot wait to be a part of this amazing experience and the opportunity to meet new people from different cultures.

KOSOVO

Hello fellow mathematicians.

We are from Malaysia, which is adjacent to the organizing country. Our team consists of 2 returning members and 4 first-timers.

Here's our simple introduction: Generally speaking, we are a new team. Our aim this year is that everyone gets an award.

Our Leader, Mr. Suhaimi Ramly, has been involved in the IMO for 16 years as leader, observer and contestant. Our Deputy Leader, Dr. Nor Sakinah, is our "mother" away from home. Last but not least, our observer A, Mr. Iqbal, is a physics teacher who teaches us advanced physics, complementing our knowledge in mathematics.

We hope to get to know all of you in these few days in Thailand. Do come and meet us! Finally, good luck and have fun in Thailand!

May e to the power of i times pi be negative one,
Malaysian IMO Team 2015 (Hanissa, Ivan, Sean, Kin Aun, Wing Chun & Zi Song)

MALAYSIA

Hello, I am the leader of the Hong Kong team to IMO 2015

The 6 team members in the 2015 Hong Kong IMO team are Cheung Wai Lam (S5), Kwok Man Yi (S4), Lee Shun Ming Samuel (S4), Tung Kam Chuen (S6), Wu John Michael (S4) and Yu Hoi Wai (S4). We are glad to tell you that the 57th IMO in 2016 will be held in Hong Kong. Having the experience of holding the 35th IMO in 1994, we are proud to be the hosting city once more in the next IMO. Therefore, apart from trying our best in the 2015 IMO, we will treasure the experience gained this year and hope to perform well in the next IMO in our home city.

HONG KONG

IMO POST 2015 NEWS

July 10 was the first day of exam. Contestants' months and years of preparations were put to the test. Meanwhile, deputy team leaders and observers spent the day taking in some of Chiang Mai's most famous sights.

Deputy team leaders and observers from around the world took a day trip to Maesa Elephant Camp in Maerim District. There, they enjoyed rafting, elephant riding and an elephant show.

Nelly Cristina Carvajal Flórez, an observer from Brazil, said she was fascinated by the elephant painting show, having never seen elephants display this skill before. An animal lover, Nelly is an abandoned-pet rescue volunteer in her home country.

As the day-trippers boarded ox-carts that would take them to the elephants, Chilean Team Leader Hernan Burgos volunteered to drive one of the carts, causing both surprise and admiration. When asked by a member of the liaison staff how he was doing, he smiled and said "Everything is under control!" We believe you had a great time, Hernan!

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The first day of exam went without a hitch. Leaving the exam room, a member of Team Singapore said he felt no pressure at first but began to feel a bit worried when time started to run out. However, he felt that his preparations had served him well. A contestant from Bangladesh said the first day's problems were neither easy nor excessively difficult, but they were different from the practice exams he had worked on. The challenge of the IMO exam, he said, lies in the fact that you cannot guess what problems you will get. He concluded that he did reasonably well, though not as well as he had hoped. Another interviewee, a member of the Nigerian Team, said that he did as well as he had expected and even if some of the problems were unexpected, he had done his best today.

Canadian Hall of Famer is holder of 4 golds

After the first day of exam wound to a close, Canadian contestant Alex Song shared that today's problems were slightly more difficult than past years'. He was confident, however, that he had done a good job. A student at Philips Exeter Academy, Alex is com-

s 6th IMO, having won 4 golds and a bronze in the last 5 years ace in the IMO Hall of Fame in the process). Alex said he excitedly ard to the second day of exam and shared that the key to being th is to do as many practice problems as possible.

In the Recreation Room an hour before the exam started, Nigerian contestants Sekinat Yahaya and Yusuf Atolagbe said they were ready to give their best. Even though this is their first IMO, the pair aim for gold.

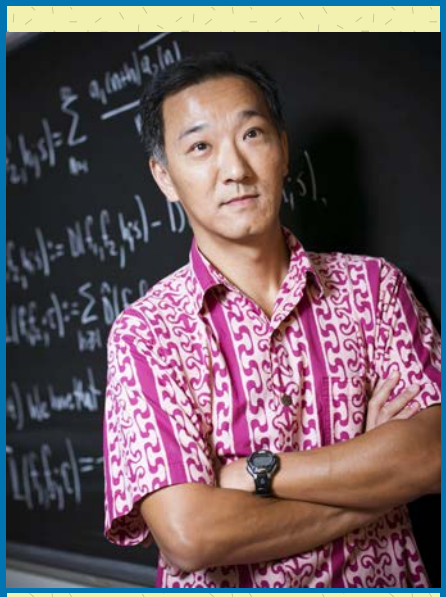
Excitement was in the air as exam time drew near. Different teams had different ways to pep themselves up. Team Czech performed a meditation technique and sang and danced in a circle to relax and get ready for the challenge ahead.

A few free hours for the liaison team

Contestants spent a full 4 hours tackling the first day's problems. Waiting outside the Exam Room, members of the liaison team found different ways to pass the time. But as soon as exam time was over, all eagerly went back to their job of taking care of contestants.

WE ARE VERY HAPPY TO WELCOME PROF. KEN ONO TO IMO 2015. HE WILL ALSO GIVE A TALK ON JULY 14.

Currently the Asa Griggs Candler Professor of Mathematics at Emory University, Prof. Ono has published widely on number theory, combinatorics and algebra. He is regarded as an expert in the theory of integer partitions and modular forms. Prof. Ono served as a mathematical consultant for the movie 'The Man Who Knew Infinity' based on Ramanujan's biography written by Robert Kanigal, and stars in the 2013 docudrama 'The Genius of Srinivasa Ramanujan'.



Born in the US to Japanese-American parents, he received his BA from the University of Chicago and earned a Ph.D. at UCLA. He has received many awards for his research including the Presidential Career Award (PECASE), the National Science Foundation Director's Distinguished Teaching Scholar Award, a Sloan Fellowship, a Packard Fellowship and a Guggenheim Fellowship.

Prof. Ono is actively involved in the mentoring of young mathematicians of all ages. A lifelong athlete who raced bicycle in his youth, in recent years he has competed in triathlons as a member of Team USA. He lives with his family in Atlanta.

ANNOUNCING THE IMO 2015

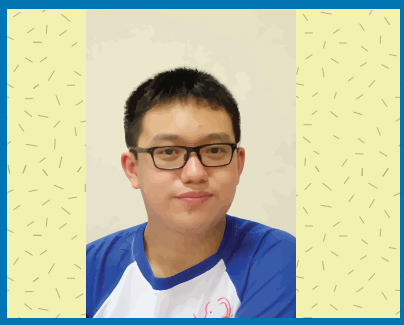
FRIENDSHIP PRIZE!

IMO 2015 brings together participants from around the world. To encourage everyone to get to know each other, we hereby invite all to nominate your favorite new friend for **THE FIRST-EVER FRIENDSHIP PRIZE.** Each participant can nominate 1 person, the only condition being that your nominee **CANNOT BE YOUR OWN TEAMMATE.** The person who receives the most votes will be our Friendship Prize Winner. We also have prizes for 3 lucky voters (to be decided by a lucky draw). Nominate your favorite new friend by email to IMO2015newsletter@gmail.com by July 13. Be sure to include your nominee's name and country. The list of winners will be published in the July 15 Issue.

If you have an announcement to make, we'll be happy to print it. It can be about a program of study, an important day in your country, or anything else that you think will be of interest to other readers. Email your announcement to IMO2015newsletter@gmail.com. We reserve the right to edit your submission for length and style.

HAPPY BIRTHDAY

Given Name: **Hjalti Þór**
Family Name: **Ísleifsson**
Country: **Iceland (ISL)**
Date of Birth: **12/07/1996**
IMO role: **Contestant**



Given Name: **Farrell Eldrian**
Family Name: **Wu**
Country: **Philippines (PHI)**
Date of Birth: **12/07/2000**
IMO role: **Contestant**

Given Name: **Jagdesh**
Family Name: **Ramnanan**
Country: **Trinidad and Tobago (TTO)**
Date of Birth: **12/07/1987**
IMO role: **Deputy leader**

GUESS ME!

MATH IS FUN

The coefficient of x in the equation $x^2 + px + q = 0$ was taken as 17 in place of 13 and thus its roots were found to be -2 and -15. Find the roots of the original equation.

Email your answer to imo2015newsletter@gmail.com. You'll be eligible to win a fabulous prize!

MEET THE PRESS

WE ARE ON THE WEB, TWITTER AND FACEBOOK!

To get the latest IMO 2015 news and updates, go to our WEBSITE: HTTP://WWW.IMO2015.ORG/
follow us on TWITTER: HTTPS://TWITTER.COM/IMO2015THAILAND
or Like us on FACEBOOK: HTTPS://WWW.FACEBOOK.COM/IMO2015CHIANGMAITHAILAND

MATHEMATICS IN EVERYDAY LIFE

PageRank: THE MATH BEHIND GOOGLE SEARCH

PageRank: THE MATH BEHIND GOOGLE SEARCH

Your friends are talking about the movie "The Theory of Everything", about a young Stephen Hawking. They mention motor neurone disease. You wonder what kind of disease that is, so you open up Google Search and type in "motor neurone disease". In the blink of an eye, a long list of search results appears, and you begin clicking and reading. After a few minutes of this, you have a pretty good idea what motor neurone disease is, but now you have a new question: How does Google know which pages to display, or, more to the point, which pages are most relevant to your search query?

The answer is: PageRank. This mechanism is an algorithm that combines many fields of mathematics including graph theory, linear algebra, Markov chain, information theory and numerical analysis. Its goal is to assign a rank to every web page and influence the order in which Google displays search results. Rather than relying on page contents, it uses the link structure of the web itself to rank the importance of web pages.

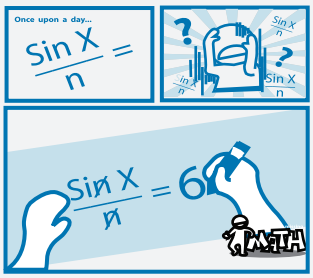
How does this work? First, PageRank models link the structure of the web as a directed graph where webpages are nodes and links from webpages to other webpages are edges with the direction of the movement. Then it expresses the directed graphs as the $n \times n$ matrix H where n is the number of webpages. A row vector $1 \times n$ called π^T is used to hold PageRank values for all pages. Suppose page i has $p_i > 0$ links to other webpages. If webpage i has a link to webpage j, then the element in row i and column j of H is $H_{ij} = \frac{1}{p_i}$. Otherwise, $H_{ij} = 0$. H is a huge matrix containing lots of zeros. If a website, k, has no link to others, then the k^{th} row contains all zeros.

The corresponding node k is called a dangling node. This is fixed by using $S = H + a(\frac{1}{n}e^T)$ where a is a vector with $a_i = 1$ if page i is a dangling node and 0 otherwise. Finally, a Google matrix is obtained as $G = \alpha S + (1-\alpha)\frac{1}{n}ee^T$ where α is a scalar between 0 and 1, and e is a vector of all 1s. This can be modified, for example, by using ev^T instead of $\frac{1}{n}ee^T$. A vector $v > 0$ is a probability vector, called personalization or teleportation vector. Now we arrive at the PageRank problem: Solving the following eigenvalue problem for π^T: $\pi^T = \pi^T G$, $\pi^T e = 1$. An easy method to use is the Power Method, by iterating $[\pi^{(m+1)}]^T = [\pi^{(m)}]^T G$. The result is shown in such a way that if $\pi_i > \pi_k$ then page i may be displayed before page k (it also depends on hypertext analysis).

Now the result of your search query is ready for you!

PageRank is yet another example of how mathematics can make life easier—and one more reason to love math!

Reference
Google's PageRank and beyond: The science of search engine ranking by Amy Langville and Carl Meyer.



AGENDA | DAY 4, SUNDAY JULY 12

LEADERS and DEPUTY LEADERS		CONTESTANTS	
7:00 am	Breakfast	7:00 am	Breakfast
12:00 am	Lunch	8:30 am-5:00 pm	Excursion
1:30 pm	Coordination	5:30 pm	Dinner
5:30 pm	Dinner		

QUOTE FROM GREAT MATHEMATICIANS #4

"Being a language, mathematics may be used not only to inform but also, among other things, to seduce."

Benoit Mandelbrot (1924-2010), a Polish-born French-American mathematician and the father of fractal geometry. He made discoveries that are fundamental to computer graphics and animation and led to the creation of formulas used in designing cellphone antennas and computer chips.

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