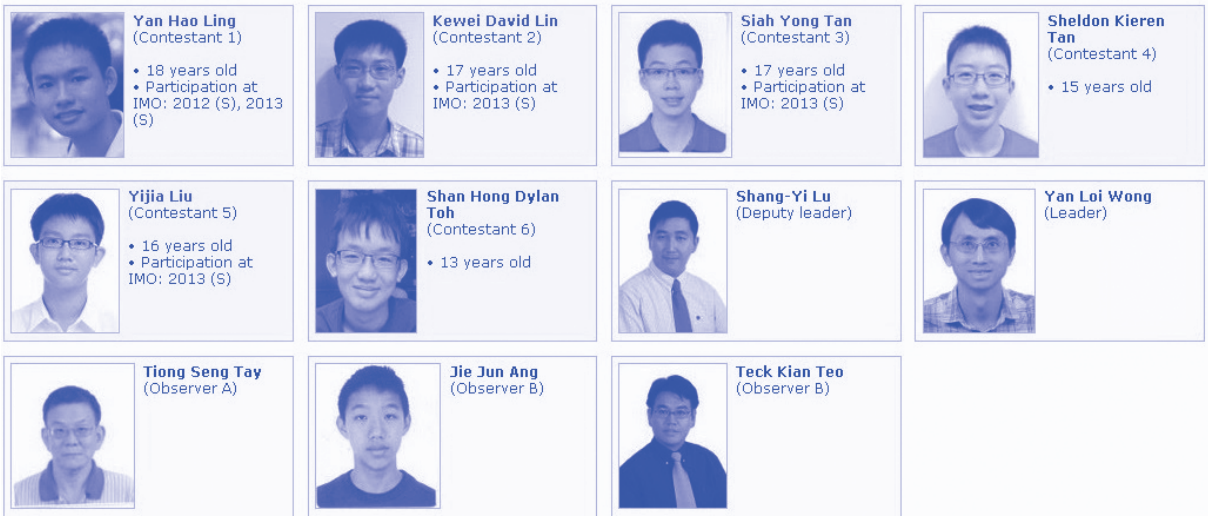
Report on the 55th International Mathematical Olympiad

Cape Town, South Africa - July 3-13, 2014

Wong Yan Loi

The Singapore National Team to the 55th International Mathematical Olympiad in Cape Town, South Africa consisted of the following members:

Team Leader	:	Wong Yan Loi (National University of Singapore)
Deputy Leader	:	Lu Shangyi (Raffles Institution)
Contestants	:	Liu Yijia (Raffles Institution)
		Tan Kieren Sheldon (Raffles Institution)
		Tan Siah Yong (Raffles Institution)
		Ling Yan Hao (NUS High School of Mathematics and Sciences)
		Toh Shan Hong Dylan (NUS High School of Mathematics and Sciences)
		Lin Kewei David (Raffles Institution)
Observers	:	Tay Tiong Seng (National University of Singapore)
		Teo Teck Kian Thomas (Raffles Institution)
		Ang Jie Jun (Observer sponsored by MOE)



Jury Meetings

Leaders arrived Cape Town of South Africa on 3 July and stayed until the first day of competition on 8 July. During these 6 day, leaders held several rounds of meetings to discuss, select, translate the problems as well as to discuss the marking schemes of the solutions. In the beginning we were given a booklet of shortlisted problems consisting of 6 algebra problems (A1-A6), 9 combinatorics problems (C1-C9), 7 geometry problems (G1-G7), 8 number theory problems (N1-N8). The problems C1, C4, N4, and N5 were discarded due to their similarity with problems that had appeared in other country's competitions.

SIMO 2014 Program			
Date	Contestants	Deputy Leaders	Leaders
July 2			Early arrivals
July 3			Arrival day Workshop for coordinators
July 4			Jury meeting
July 5			Jury meeting
July 6	Arrival day	Arrival day	Jury meeting
July 7	Opening ceremony		
July 8	First day of contest		Q & A
July 9	Second day of contest		Q & A Leaders move to UCT
July 10	Peninsular tours for teams	Coordination	
July 11	Celebrity Lectures	Coordination	
July 12	Excursion to V&A Waterfront / Closing Ceremony		
July 13	Departure day		

Selection of the Problems

The jury voted to approve the protocol for constructing the IMO papers. This protocol had been tried out last year and appeared to be efficient and favorable to most leaders. The aim was to set a more balanced paper on all 4 categories. The first step was to select the best easy and the best medium problems in each of the 4 categories. This would result in selecting 4 easy problems and 4 medium problems. Note that each pair of the best easy problems has a unique corresponding pair of best medium problems. Among the "4 choose 2" combinations of best pairs of easy problems plus the best pairs of medium problems, the leaders voted for the most favorable combination as problems 1 and 4 together with 2 and 5.

As in past years, a "beauty" contest were held to get an idea on the level of difficulty as well as the beauty of the shortlisted problems. It appeared that most of the combinatorics problems were of medium and hard difficulty. It was decided that there were no easy combinatorics problems. Then the best easy problems in each category were determined to be A1, G1, N1, and the best medium problems in each category were A2, C3, G3, N3. This gave rise to only 3 combinations for pairs of easy and medium problems: (A1,G1)+(C3,N3), (A1,N1)+(C3,G3), (G1,N1)+(A2,C3). Eventually, (A1,G1)+(C3,N3) were chosen for the paper. Next the leaders discussed the hard problems. It was suggested that C5 can be strengthened to a harder problem C5' and a stronger result could be asked. Contestants could get marks based on the progress of their work of this open ended problem. In the end, a total of 12 pairs of hard problems were proposed. After several rounds of discussion and voting, the pair (G5, C5') were chosen. The chosen problems were Day 1: A1 proposed by Austria, C3 proposed by Croatia, G5 proposed by Iran; Day 2: G1 proposed by Georgia, N3 proposed by Luxembourg, C5 proposed by Austria. It appeared that other than the 2 geometry questions, the rest of the 4 questions were of combinatorics in favor.

Venue of SIMO 2014: University of Cape Town

The Competition

The opening ceremony were held at the University of Cape Town. In the evening, the jury and the coordinators had a meeting to discuss the marking schemes. For the first day of competition, the leaders spent the first half hour to answer students' questions. Afterwards, the leaders were invited for an excursion to the Botanic garden. In the late afternoon, the Asian Pacific countries had a meeting on APMO. Australia and Mexico were appointed to be the assistant and moderating countries for APMO 2015 respectively. A second meeting in the evening was held to discuss the marking scheme.

We received the day 1 solution scripts of our students in the late evening. An initial assessment showed that all solved problems 1 and 2 with some minor mistakes. None could solve problem 3 which is a medium hard geometry problem.

In the next day after the question and answer session, the leaders were transferred to the University of Cape Town. We met our deputy leader Mr Lu Shangyi, our observers B, Mr Thomas Teo and Ang Jie Jun. After the second day of competition, we had a meeting with the students to go through the mistakes and arguments in their solutions. All of them solved problem 4. Four of them solved problem 5. Only Sheldon and Yijia had progress on problem 6. We spent the rest of the day to go through the answer scripts carefully.

Coordination

The next 2 days were for coordination. We went through the coordination of problems 5 and 1 very quickly. Basically we got the marks that we desired. Yijia had a solution using complex numbers, but was unable to nish it. The coordination of this problem was delayed to the next day. Eventually 4 points were awarded for Yijia's problem 3. A jury meeting was called to resolve an urgent issue of the marking scheme of problem 3. The coordination for problems 1 and 6 were also simple and fast.

There was a delay in the coordination of problem 2 due to a backlog of scripts from other countries Thanks to Jie Jun's effort, we managed to resolve an issue raised by the coordinator on Yijia's problem

3, and Yijia obtained full mark for this problem. Our score were quite satisfactory, especially in problem 5. In the evening, there was a joint meeting with IMO advisory board.

Cutoff and Result

The guidelines for awarding the prizes are: about half of the total number of contestants will get a medal; and the number of gold, silver and bronze medals will be approximately in the ratio 1:2:3. Based on these guidelines, it was proposed and approved that the cut-off for gold was at 29, silver at 22 and bronze at 16. Singapore got 3 golds, 2 silvers, 1 bronze and ranked 8th among 101 countries. There were a total of 49 golds, 113 silvers, 133 bronzes and 151 honorable mentions awarded to 560 contestants (56 female contestants). Detailed results can be found at the IMO official website http://www.imo-official.org/team_r.aspx?code=SGP&year=2014.

Singapore Team's Results

	1	2	3	4	5	6	Total	Rank	Percentile	Award
Liu Yijia	7	7	4	7	7	0	32	28	95.17	Gold
Tan Sheldon Kieren	7	7	0	7	7	3	31	34	94.10	Gold
Tan Siah Yong	7	6	1	7	7	2	30	36	93.74	Gold
Ling Yan Hao	6	5	0	7	7	0	25	95	83.18	Silver
Toh Shan Hong Dylan	7	7	0	7	1	0	22	124	78	Silver
Lin Kewei David	7	6	1	7	0	0	21	163	71.02	Bronze
	41	38	6	42	29	5	161	8	93.00	G,G,G,S,S,B

Conclusion

The achievement this year is encouraging and is a significant progress. For this year's team, we have two young talented students: Sheldon a gold medallist at the age of 14 and Dylan a silver medallist at the age of 13. Hopefully it sets the march for better results in subsequent years. Generally the students were weaker in geometry and we need to work on the geometry training more.

Finally during the IMO advisory board meeting, it was announced that United Kingdom will host the IMO 2019.

The author is the team leader of the 2014 Singapore IMO Team and an Associate Professor in the Department of Mathematics, National University of Singapore.