



## Report on the 56th International Mathematical Olympiad

Chiang Mai, Thailand

July 4-16, 2015

The Singapore National Team to the 56th International Mathematical Olympiad in Chiang Mai, Thailand consisted of the following members:

Team Leader	: Wong Yan Loi	(National University of Singapore)
Deputy Leader	: Teo Teck Kian Thomas	(Raffles Institution)
Contestants	: Tan Kieren Sheldon	(Raffles Institution)
	Lin Kewei David	(Raffles Institution)
	Ma Zhao Yu	(Raffles Institution)
	Tan Siah Yong	(Raffles Institution)
	Toh Shan Hong Dylan	(NUS High)
Observers	: Liu Yijia	(Raffles Institution)
	: Tay Tiong Seng	(National University of Singapore)
	Lee Chan Lye	(NUS High)
	Ang Yan Sheng	(Observer sponsored by MOE)
	Kuan Jun Jie Joseph	(Observer sponsored by SMS)

### Jury Meetings

Leaders arrived Chiang Mai of Thailand on 4 July and stayed in the Holiday Inn for the rest of the period in this year's IMO. During the first 6 days, 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), 7 combinatorics problems (C1-C7), 8 geometry problems (G1-G8) and 8 number theory problems (N1-N8).

#### Selection of the Problems

The jury voted to approve the protocol for constructing the IMO papers. This protocol had been tried out for the last 2 years 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 in the other 2 categories. 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 problems 2 and 5. The 2 hard problems were then open for selection in any category.

The chosen problems were Day 1: C2 proposed by Netherlands, N5 proposed by Serbia, G6 proposed by Ukraine; Day 2: G2 proposed by Greece, A4 proposed by Albania, C5 proposed by Australia.

## The Competition

The opening ceremony was held at the Convention Hall of Chiang Mai University. It was presided over by princess Maha Chakri Sirindhorn of Thailand.

For the first day of competition, the leaders were transferred to the student's hotel and spent the first half hour to answer students' questions. I received 1 question from our contestants. Afterwards, the leaders were invited for an excursion to the elephant camp. In the evening, the asian pacific countries had a meeting on APMO matters. In the meeting, Mexico, Peru and Australia were appointed to be the senior, assistant and moderating countries for APMO 2016 respectively.

We received the day 1 solution scripts of our students in the late evening. An initial assessment showed that all except David solved problem 1. Only Sheldon and Zhao Yu solved problem 2 and Zhao Yu had a succinct solution. David solved problem 3 using inversion.

In the next day after the question and answer session, we met our deputy leader Mr Thomas Teo and observers B: Mr Lee Chan Lye, Ang Yan Sheng, Joseph Kuan. At night, we received the scripts of the second day paper. All of them solved problem 4. Only Sheldon solved problem 5.

## Coordination

The next 2-3 days were for coordination. Basically we got the marks that we desired. Our scores though lower than last year were still satisfactory, especially in problem 2. In this year's IMO, the medium problems were harder. We expected a lower medal cutoff.

## Cutoff and Result

The guidelines for awarding the prizes are: normally less than  $\frac{1}{2}$  of the total contestants will get a medal; and the number of gold, silver and bronze medals are approximately in the ratio 1:2:3. Based on these guidelines, it was decided and approved that the cut-o for gold was at 26, silver at 19 and bronze at 14. Singapore got 1 gold, 4 silvers, 1 bronze and ranked 10th among 104 countries. There were a total of 39 golds, 100 silvers, 143 bronzes and 126 honorable mentions awarded to 577 contestants (52 female contestants). Detail results can be found at the end of this report and at the IMO official website.

## Conclusion

The achievement this year is satisfactory. Basically, the students have done their best despite some minor oversights and unlucky instances. Generally our students are weaker in geometry and we need to work on the geometry training more. We need to train them more on the write-up of the solutions so as to improve on the clarity and the logical flow of their arguments.

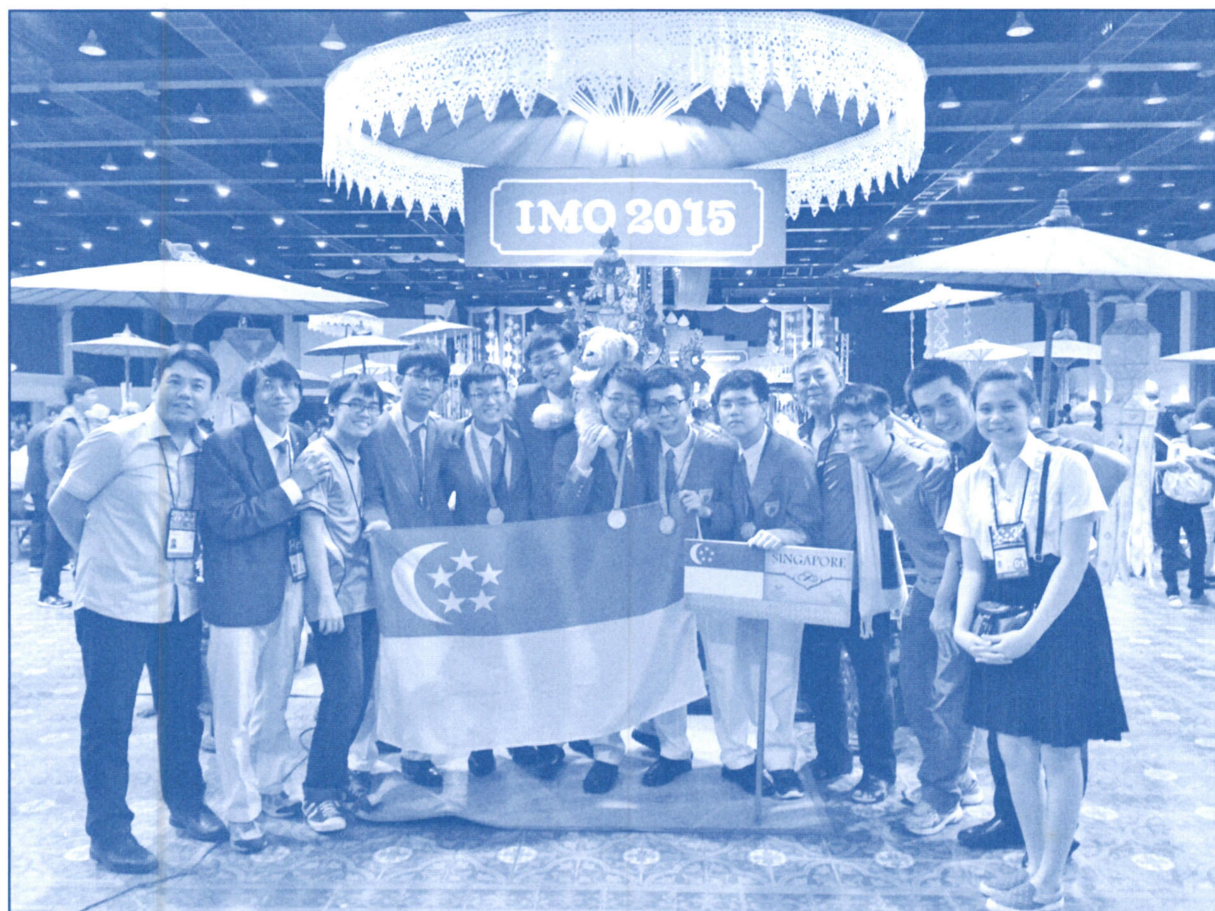
Wong Yan Loi  
Team Leader of the Singapore IMO Team  
21 July 2015

Singapore Team's Results											
	1	2	3	4	5	6	Total	Rank	Rank(%)	Award	
Tan Sheldon Kieren	7	7	1	7	7	0	29	19	96.88	Gold	
Lin Kewei David	4	2	7	7	3	2	25	40	93.23	Silver	
Ma Zhao Yu	7	7	1	7	1	1	24	55	90.63	Silver	
Tan Siah Yong	7	5	0	7	2	2	23	58	90.10	Silver	
Toh Shan Hong Dylan	7	2	1	7	3	0	20	101	82.64	Silver	
Liu Yijia	7	3	0	7	1	0	18	140	75.87	Bronze	
	39	26	10	42	17	5	139	10	91.26	G,S,S,S,S,B	

There are 577 contestants from 104 countries.

Further result can be viewed at the official website:

[http://www.imo-official.org/team\\_r.aspx?code=SGP&year=2015](http://www.imo-official.org/team_r.aspx?code=SGP&year=2015)



Team photos. From left to right: Deputy Leader: Teo Teck Kian Thomas, Leader: Wong Yan Loi, Observer: Ang Yan Sheng, Contestants: Liu Yijia, Toh Shan Hong Dylan, Lin Kewei David, Tan Sheldon Kieren, Tan Siah Yong, Ma Zhao Yu, Observer: Tay Tiong Seng, Kuan Jun Jie Joseph, Lee Chan Lye, Guide.

No	Country	1	2	3	4	5	6	Total	Rank	G	S	B	HM
1	United States of America	42	32	31	42	25	13	185	1	5	1	0	0
2	People's Republic of China	42	36	12	42	22	27	181	2	4	2	0	0
3	Republic of Korea	42	15	18	42	25	19	161	3	3	1	2	0
4	Democratic People's Republic of Korea	42	25	17	42	22	8	156	4	3	3	0	0
5	Vietnam	35	21	23	42	28	2	151	5	2	3	1	0
6	Australia	42	26	11	42	20	7	148	6	2	4	0	0
7	Islamic Republic of Iran	40	14	31	42	12	6	145	7	3	2	1	0
8	Russian Federation	42	19	8	42	9	21	141	8	0	6	0	0
9	Canada	39	17	7	42	21	14	140	9	2	0	4	0
10	Singapore	39	26	10	42	17	5	139	10	1	4	1	0
11	Ukraine	33	22	10	42	19	9	135	11	2	3	1	0
12	Thailand	42	21	1	42	28	0	134	12	2	3	1	0
13	Romania	37	21	12	42	20	0	132	13	1	4	1	0
14	France	36	16	8	41	16	3	120	14	0	3	3	0
15	Croatia	36	18	4	39	22	0	119	15	1	3	1	0
16	Peru	33	16	9	37	23	0	118	16	2	2	1	0
17	Poland	33	12	21	38	7	6	117	17	1	1	4	0
18	Taiwan	35	9	5	40	18	8	115	18	0	4	1	1
19	Mexico	42	14	5	42	9	2	114	19	1	2	3	0
20	Hungary	42	13	4	38	11	5	113	20	0	3	3	0
21	Turkey	36	26	6	35	10	0	113	20	0	5	0	0
22	Brazil	38	7	5	42	14	3	109	22	0	3	3	0
23	Japan	42	11	8	38	8	2	109	22	0	3	3	0
24	United Kingdom	42	15	3	36	12	1	109	22	0	4	1	1
25	Kazakhstan	30	14	3	42	16	0	105	25	1	1	2	2
26	Armenia	39	7	9	42	7	0	104	26	0	1	5	0
27	Germany	35	14	3	33	9	8	102	27	0	2	3	0
28	Hong Kong	41	12	1	23	17	7	101	28	0	2	3	1
29	Bulgaria	36	13	9	32	5	5	100	29	0	2	1	2
30	Indonesia	36	5	1	42	16	0	100	29	0	2	4	0
31	Italy	27	16	15	26	12	4	100	29	1	2	0	0
32	Serbia	35	11	1	35	18	0	100	29	1	1	2	2
33	Bangladesh	32	6	4	42	13	0	97	33	0	1	4	1
34	Slovakia	33	13	0	36	5	10	97	33	0	2	3	0
35	Macau	26	2	3	42	15	0	88	35	0	1	2	3
36	Philippines	35	6	2	35	7	2	87	36	0	2	2	1
37	India	17	23	4	37	5	0	86	37	0	1	2	3
38	Republic of Moldova	32	1	8	31	13	0	85	38	0	1	2	3
39	Belarus	31	7	2	38	6	0	84	39	0	0	3	3
40	Israel	36	14	5	18	9	1	83	40	1	0	2	2
41	Saudi Arabia	25	6	1	39	10	0	81	41	0	1	3	2
42	Georgia	31	6	1	35	7	0	80	42	0	1	3	1
43	Bosnia and Herzegovina	21	4	3	42	6	0	76	43	0	0	2	4
44	Netherlands	35	7	0	29	5	0	76	43	0	0	3	1
45	Czech Republic	38	5	0	24	7	0	74	45	0	0	3	3
46	Mongolia	23	4	2	35	10	0	74	45	0	0	2	4
47	Switzerland	38	4	0	25	7	0	74	45	0	0	3	2
48	Azerbaijan	12	10	1	42	8	0	73	48	0	0	2	4
49	Colombia	32	3	2	31	3	1	72	49	0	0	4	0
50	New Zealand	30	1	0	33	8	0	72	49	0	0	2	4
51	Greece	19	7	1	37	7	0	71	51	0	1	2	2
52	Argentina	33	4	0	29	4	0	70	52	0	0	1	4
53	Portugal	32	5	1	22	10	0	70	52	0	0	3	1

No	Country	1	2	3	4	5	6	Total	Rank	G	S	B	HM
54	Syria	17	4	1	39	8	0	69	54	0	1	1	3
55	South Africa	27	4	0	27	8	2	68	55	0	0	1	2
56	Belgium	31	6	1	18	8	3	67	56	0	1	0	3
57	Malaysia	28	2	1	30	5	0	66	57	0	0	3	1
58	Turkmenistan	18	3	1	29	13	0	64	58	0	0	2	2
59	Uzbekistan	6	9	1	37	11	0	64	58	0	0	3	2
60	Austria	30	4	0	25	4	0	63	60	0	0	3	1
61	Sweden	36	2	1	18	6	0	63	60	0	0	2	2
62	Algeria	17	6	2	30	5	0	60	62	0	1	1	2
63	Cyprus	27	1	4	18	8	0	58	63	0	1	0	2
64	Tajikistan	11	10	2	30	4	0	57	64	0	1	1	2
65	Lithuania	30	3	0	17	4	0	54	65	0	0	1	1
66	Norway	29	4	0	14	7	0	54	65	0	1	0	2
67	Costa Rica	18	1	0	30	4	0	53	67	0	0	2	2
68	Paraguay	20	4	0	25	4	0	53	67	0	0	3	0
69	Denmark	23	3	0	23	3	0	52	69	0	0	2	1
70	Estonia	28	1	0	14	7	1	51	70	0	0	1	3
71	Sri Lanka	15	0	1	30	5	0	51	70	0	0	0	4
72	Spain	27	1	0	15	4	0	47	72	0	0	1	2
73	Slovenia	30	1	0	14	1	0	46	73	0	0	1	1
74	The former Yugoslav Republic of Macedonia	12	1	2	24	6	0	45	74	0	0	1	1
75	Iceland	19	2	0	19	1	0	41	75	0	0	0	3
76	Tunisia	16	1	1	18	5	0	41	75	0	0	1	2
77	Albania	7	2	1	23	4	0	37	77	0	0	0	3
78	Ireland	12	2	0	19	4	0	37	77	0	0	0	3
79	Latvia	20	1	0	11	4	0	36	79	0	0	0	3
80	Ecuador	7	2	0	16	2	0	27	80	0	0	0	2
81	Morocco	6	1	1	11	8	0	27	80	0	0	0	1
82	Finland	17	0	0	8	1	0	26	82	0	0	0	1
83	Nicaragua	1	1	1	21	2	0	26	82	0	0	0	3
84	Trinidad and Tobago	11	4	0	9	2	0	26	82	0	1	0	0
85	Pakistan	7	3	0	13	2	0	25	85	0	0	1	0
86	Cambodia	1	0	1	20	2	0	24	86	0	0	0	2
87	Kosovo	6	2	0	10	6	0	24	86	0	0	0	1
88	Nigeria	4	1	1	14	2	0	22	88	0	0	0	2
89	Montenegro	7	2	0	7	3	0	19	89	0	0	1	0
90	Liechtenstein	7	2	0	7	2	0	18	90	0	0	1	0
91	Puerto Rico	8	0	0	10	0	0	18	90	0	0	1	0
92	Kyrgyzstan	1	2	1	11	2	0	17	92	0	0	0	0
93	Uruguay	7	0	0	8	1	0	16	93	0	0	0	1
94	Cuba	7	0	0	7	1	0	15	94	0	0	1	0
95	El Salvador	2	2	1	2	7	0	14	95	0	0	0	0
96	Venezuela	2	0	0	10	1	0	13	96	0	0	0	1
97	Chile	2	1	0	9	0	0	12	97	0	0	0	1
98	Luxembourg	2	0	0	9	1	0	12	97	0	0	0	1
99	Panama	2	0	1	4	2	0	9	99	0	0	0	0
100	Uganda	0	0	0	6	0	0	6	100	0	0	0	0
101	Bolivia	1	1	0	3	0	0	5	101	0	0	0	0
102	Ghana	1	0	0	4	0	0	5	101	0	0	0	0
103	Botswana	0	0	0	1	0	0	1	103	0	0	0	0
104	Tanzania	0	0	0	0	0	0	0	104	0	0	0	0