

IMO 2013 Student Report

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15 – 29 July 2013

1 Introduction

This year, the International Mathematical Olympiad was held in Santa Marta, Colombia from 17th July to 29th July. The International Mathematical Olympiad (or IMO for short) is an annual competition where aspiring young mathematicians from across the globe can meet each other and sit two difficult 4.5 hour exams with 3 questions each.

The purpose of this report is to relate the events of the IMO and the pre-IMO camp from the student perspective, and, together with Geoff Smith's report as leader, readers can hopefully get a good idea of what IMO 2013 was like. This year our deputy leader, Dominic Yeo, who incidentally began the tradition of writing an unofficial student report 6 years ago, is also producing a diary on his blog ¹.

Firstly I will show the reader the 6 problems we encountered during this year's IMO, and of course our results.

2 Problems

Day 1

1. Prove that for any pair of positive integers k and n , there exist k positive integers m_1, m_2, \dots, m_k (not necessarily different) such that

$$1 + \frac{2^k - 1}{n} = \left(1 + \frac{1}{m_1}\right) \left(1 + \frac{1}{m_2}\right) \cdots \left(1 + \frac{1}{m_k}\right).$$

2. A configuration of 4027 points in the plane is called *Colombian* if it consists of 2013 red points and 2014 blue points, and no three of the points of the configuration are collinear. By drawing some lines, the plane is divided into several regions. An arrangement of lines is *good* for a Colombian configuration if the following two conditions are satisfied:
 - no line passes through any point of the configuration;
 - no region contains points of both colours

¹This is split into four parts, the first of which is <http://eventuallyalmosteverywhere.wordpress.com/2013/07/17/imo-2013-part-one-travel-and-training/>

Find the least value of k such that for any Colombian configuration of 4027 points, there is a good arrangement of k lines.

3. Let the excircle of triangle ABC opposite the vertex A be tangent to the side BC at the point A_1 . Define the points B_1 on CA and C_1 on AB analogously, using the excircles opposite B and C , respectively. Suppose that the circumcentre of triangle $A_1B_1C_1$ lies on the circumcircle of triangle ABC . Prove that the triangle ABC is right-angled.

Day 2

4. Let ABC be an acute-angled triangle with orthocentre H , and let W be a point on the side BC , lying strictly between B and C . The points M and N are the feet of the altitudes from B and C , respectively. Denote by ω_1 the circumcircle of BWN , and let X be the point on ω_1 such that WX is a diameter of ω_1 . Analogously, denote by ω_2 the circumcircle of CWN , and let Y be the point on ω_2 such that WY is a diameter of ω_2 . Prove that X, Y and H are collinear.
5. Let $\mathbb{Q}_{>0}$ be the set of positive rational numbers. Let $f : \mathbb{Q}_{>0} \mapsto \mathbb{R}$ be a function satisfying the following three conditions:
 - (i) for all $x, y \in \mathbb{Q}_{>0}$, we have $f(x)f(y) \geq f(xy)$;
 - (ii) for all $x, y \in \mathbb{Q}_{>0}$, we have $f(x+y) \geq f(x) + f(y)$;
 - (iii) there exists a rational number $a > 1$ such that $f(a) = a$.

Prove that $f(x) = x$ for all $x \in \mathbb{Q}_{>0}$.

6. Let $n \geq 3$ be an integer, and consider a circle with $n+1$ equally spaced points marked on it. Consider all labellings of these points with the numbers $0, 1, \dots, n$ such that each label is used exactly once; two such labellings are considered to be the same if one can be obtained from the other by a rotation of the circle. A labelling is called *beautiful* if, for any four labels $a < b < c < d$ with $a + d = b + c$, the chord joining the points labelled a and d does not intersect the chord joining the points labelled b and c . Let M be the number of such beautiful labellings, and let N be the number of ordered pairs (x, y) of positive integers such that $x + y \leq n$ and $\gcd(x, y) = 1$. Prove that

$$M = N + 1.$$

3 Results

Contestant Code	Name	Q1	Q2	Q3	Q4	Q5	Q6	Total	Medal
UNK1	Andrew Carlotti	7	7	0	7	7	6	34	Gold
UNK2	Gabriel Gendler	7	5	0	7	6	0	25	Silver
UNK3	Daniel Hu	7	7	0	7	7	2	30	Silver
UNK4	Sahl Khan	7	0	0	7	7	0	21	Bronze
UNK5	Warren Li	7	7	0	7	7	0	28	Silver
UNK6	Matei Mandache	7	7	0	7	7	5	33	Gold
	Min	7	0	0	7	6	0	20	Bronze
	Max	7	7	0	7	7	6	34	Gold
	Total	42	33	0	42	41	13	131	9 th

The UK's performance this year was incredibly strong, and in fact it has been our best performance since 1996 and our first top ten finish since 2003. Amazingly, we managed to come top in the EU, beating rival countries such as Romania, Bulgaria and Poland. This was largely due to the excellent performance of Andrew Carlotti (joint with our non-competing contestant Max), who has now overtaken John Rickard and Simon Norton to become number 1 in the UK IMO hall of fame. This places him as nineteenth in the overall IMO hall of fame. This year has also been the first time that our non-competing contestant Min has earned a medal since 2005.

From here onwards, I will begin describing the events that happened over the two weeks, in a diary format:

4 Student Diary

4.1 Travel

Sunday 14th July 2013

Today the adults, Gabriel, Matei, Daniel and I are scheduled to meet at Holiday Inn Heathrow so we can get an early start the following morning. To my annoyance, my train from York to London is delayed by about 2 hours and this causes me to be very late to the hotel. In addition to this, I almost go on the wrong hotel transfer bus; there are four Holiday Inns in Heathrow. Nevertheless, I manage to make it to the right hotel in the end. Matei and Daniel have just returned from the International Physics Olympiad in Copenhagen and have stories to tell. We are also given our UKMT uniform, which includes two shirts, a blazer and a tie as well as a Panama hat.

Monday 15th July 2013

We meet Sahl at Heathrow early in the morning. We reflect upon the fact that this is the first time that we have sent the exact same team to two competitions, namely IMO13

and RMM13. To get to Santa Marta, we must take 3 flights, from Heathrow to Madrid, from Madrid to Bogotá and from Bogotá to Santa Marta. Andrew, on the other hand, is flying over with the Australian team from Australia, where the International Olympiad in Informatics was held this year. His journey involves an overnight stay in Santiago, and the rest of us are glad that we can get the journey over with in one day (although this ‘one day’ does include a jump six hours back due to a time zone change). The long plane journey across the Atlantic mainly involves sleeping and a functional equation constructed by Sahl: find all functions $f : \mathbb{Z} \mapsto \mathbb{Z}$ which satisfy

$$f(x)f(y) + f(x + y) = f(xy + 1).$$

An interested reader may quickly discover that there are many cases involved in solving this functional equation, and in fact there are many solutions. Daniel later tries to generalise the functional equation, but makes limited progress.

Upon reaching Bogotá airport, we encounter the issue of actually getting into Colombia. Gabriel and I, being under 18, were told to bring a notarised parental permission letter under very short notice, and this proved to be a difficult task for me as there are only two notary publics (people who can notarise documents) in York. Of course, these prove to be completely unnecessary and we enter Colombia fairly smoothly.

At Bogotá airport, we meet our guide Maria Rueda, and after arriving at Santa Marta, we take a bus to our accommodation for the following week, the Hotel Villas Santorini. After splitting the rooms into a four (me, Gabriel, Andrew and Daniel) and a two (Matei and Sahl i.e. those who actually intend to sleep) we quickly decide to retire.

4.2 Pre-IMO Camp

Tuesday 16th July 2013

We wake up in the morning for the first of the practise 4.5 hour papers designed to make us ready for the IMO. Although our villa is generally quite comfortable, it is not well-suited for six students sitting a maths exam, and we are forced to bring three tables into our villa. This causes the floor to be covered in sawdust by the time the exam is finished. The turbulent air conditioning in our room proves to be very irritating, as paper would often fly off the tables during the exams. After the exam, we make and eat lunch while we meet the Australian IMO team, who train with us in the pre-IMO camp. They are – in lexicographical order by surname – Alex Chua, Alex Gunning, Jason Kwong, Seyoon Ragavan, Rachel Wong and Jonathan Zheng. To pass time while the leaders mark our scripts, we play a few games of Mafia with the Australians. Our scripts seem to be fine, but it turns out that none of us have scored 7 on the geometry question, because there is an unpleasant amount of diagram dependency which none of us have bothered to tackle fully. After our debrief, we discover that there is a hotel restaurant reasonably close to the villas and we decide to eat there.

Wednesday 17th July 2013

Today is the second of our practice exams. Geoff leaves to go to Barranquilla, where the leaders are residing prior to the contest. Much like at the RMM, we prove to be incompetent

at using the toilet properly, and we are forced to use Matei and Sahl's toilet for the following few days. Anyway, we spend the afternoon playing the fast talking description board game Articulate!, and then we go to dinner. Since the Australians decide to spend a long time talking after finishing their meals, the UNKs excluding Andrew go back to the hotel first. Upon returning to the hotel we find our villa locked, Gabriel has the idea of us hiding underneath the stairs in the Australians' villa so we can scare them while Sampson, the Australians' infamous mascot, drop-bears his own team. During this time we also discover that Dominic Yeo is writing his own deputy leader's report in his blog, where he refers to a blog named 'the other Ashes' (so named because of the Mathematical Ashes competition). This blog contains strange posts such as 'Ashes Row – to Cross or not to Cross?' (a discussion of whether students should not cross out erroneous arguments in hope that the markers do not find the error), and we are curious about who the author is. We find out later that the author is Geoff's brother Pete, and that the purpose of the blog is to attract the attention of the British and Australian press.

Thursday 18th July 2013

Today is the third of our practise exams. I manage to misread the first question which appears to be quite simple but involves a large case bash. We are also briefed about the Santa Marta olympiad, which involves the UNKs picking 3 problems for the Aussies to do and vice versa. We must also mark each others scripts. We are given a shortlist from which the problems are chosen, but like last year we are allowed to submit our own questions. We propose the functional equation constructed by Sahl on the plane, but this is rejected as the training exams are, according to Dominic, supposed to be a 'meaningful use of time'. Therefore we settle for a nice geometry question involving the circumcentre and orthocentre which has a nice solution using the butterfly theorem. We also choose a number theory problem involving the Euler ϕ function and a hard combinatorics problem.

In the afternoon we are forced to leave the villa by cleaners, and we decide to use the pool outside our villa for the first time. We play a few games of Mafia in the pool. After this we go to Santa Marta for a change of scenery. After wandering around the city we eat at a restaurant that finds it difficult to solve the combinatorics problem of seating 15 people while using the fewest number of tables and the least space. Eventually we decide to sit outside. While eating, we discover that our guide Maria was in fact an IMO participant in 2011 and in 2012. As we head back to the hotel, we experience Colombia's amateurish driving standards. As Gabriel says, "I don't think we will die, not because it seems impossible, but only because the probability of it happening is just less than 50%". Later in the evening, we are visited by the Israeli team, which means that Villas 1–4 of the Hotel Santorini are all for IMO teams. This is expected, as the Hotel Irotama, the venue of the IMO, is about 3 minutes away on foot.

Friday 19th July 2013

This is the day of the Santa Marta olympiad, and we brace ourselves for the apparently difficult paper the Australians set for us. We find a reasonably simple number theory problem, a nice combinatorics problem, and a hard geometry involving areas of cyclic pentagons. I

manage to misread yet another question. In the afternoon we are to mark the Australians' scripts. Matei and I are given the geometry, and this goes quite smoothly, whereas there are some issues associated with marking the other two problems we gave the Aussies. For example, Gunning's script for Q3 appears to be incomplete, but in fact he inserts a small note explaining the way to complete the solution. The Q2s, on the other hand, are a complete nightmare to decipher, let alone mark. In the end, the scripts are just given to the deputy leaders who still found difficulty marking.

After marking some of us play the card game Camps with the Israeli team and later some of us decide to climb from the outside onto the Australians' balcony. In the evening we plan another ambush on the Australians but the execution is not brilliant, apart from Sahl who manages to cause some shock by jumping from the top of the stairs.

Saturday 20th July 2013

Today is the day of the Mathematical Ashes, an annual competition between the U.K. and Australian IMO teams where the prize is an urn containing the ashes of the burnt scripts from the first such competition in 2008. The Australians at this point had already worked out what types of problems were going to be on the Ashes, and as good sportsmen they told us that they were predicting an easy combinatorics, a medium number theory and a hard geometry. This is indeed the case. The combinatorics and number theory are both reasonably simple, while the geometry appears to be untouchable. Amazingly Matei manages to cartesian bash the problem, and we are anxious to find out about the results.

After the paper we decide to go to the beach to play frisbee with the Australians. Matei has brought two frisbees, a partially broken frisbee and a very light frisbee that will be largely affected by the wind. We begin by using the former, but it breaks apart every few throws and we are forced to switch. After a few games of ultimate frisbee, we decide to go back to the hotel. But before we do this, we bury Jason in the sand, and some of us show our proficiency in drinking water straight from a large bottle, while others fail miserably.

After we returned to the villas we are happy to find out that we had won the Ashes by one point (82–81) and Dominic quickly debriefs us about the last three papers. In the evening I go to sleep early, so am completely oblivious of whatever is to happen during the night, but I do find out that at some point Daniel's bed broke and he was forced to sleep elsewhere. Luckily, Andrew (who was on the bottom bunk of the broken bed) was not there at the time and thus no-one was hurt too badly.

4.3 Arrival at Hotel Irotama

Sunday 21st July 2013

For the first time in 5 days, we do not find ourselves in front of an exam in the morning. Instead, we are to quickly pack in preparation for the three minute walk to the Hotel Irotama, followed by the ten minute walk from the hotel entrance to the bungalow suite we will be staying in. The team is split into two threes for the rooms – it turns out the organisers have possibly unknowingly used the same strategy that we used at the RMM, which is to put returning contestants (Andrew, Daniel and Matei) in one room and the rest (Gabriel, Sahl

and me) in another. We are happy to discover that the air conditioning works, and receive our bags of IMO goodies. This year the goodies include lanyards, t-shirts, pencil cases and stationery, a water bottle and the IMO 2013 program. We are also given some information about the logistics of the exam.

Following this, we have lunch, where we meet the American team. After discovering that their clues for the word game Contact border on the nonsensical, we invent some equally bizarre hypothetical drinking games, for example a game where you take a shot for every three lines of maths written. We establish that Sahl, who is extremely economical in his write-ups, would be very good at such a game. Gabriel also invents a three dimensional form of exchange chess, involving four simultaneous games of 3-player chess, that can be represented as games taking place on the faces of a tetrahedron, where the vertices represent teams of 3.

After lunch we check out the pool in the middle of the hotel. It is quite a large pool, with a water slide. We begin by playing a game of water polo against the Australians, except using a small bouncy ball instead of a properly sized one. Using the rule that goal size should be directly proportional to the ball size, we use the stair railings as goals. We linger in the pool for at least an hour and a half despite the many signs near the pool telling us to take regular breaks from the water, and we conclude by having a go on the water slide.

We head to dinner, and eat with the Australians. We are visited by a few people, including some of the Canadian IMO team. They decide to play a game in which they have to identify the deputy leaders of the UK and Australian teams. It is evident that ageing works somewhat differently in Canada, because they seem to believe the order of likelihood of being deputy leader in the UK team is Matei, Gabriel, Me, Daniel, then Dominic (and this is with prior knowledge that Andrew is a contestant). A similar phenomenon occurs when they do the same with the Aussie team, and Ivan Guo (their deputy leader) is indeed picked last.

In the evening we head to the Australians' room. Their room is a quite large one on the twelfth floor of the Irotama del Sol, the building at the entrance of the resort. We are jealous that they have protection from mosquitos due to their altitude. We then play a game of Mafia. However, this is not normal Mafia. This is a game of Mafia in which characters are rebranded as IMO related people. For example, civilians are now contestants and the paparazzi becomes Joseph Myers. Unfortunately, our deputy leaders have the idea that we need to be well rested for the exams, so put an end to our game.

4.4 Opening Ceremony and Exams

Monday 22nd July 2013

Today is the day of the opening ceremony. The ceremony is to take place in a hall in Barranquilla, the city that the leaders are staying in and a two-hour bus journey from Santa Marta. The ceremony begins with a few speeches, given by the mayor of Barranquilla, the chair of the jury, the chair of the IMO advisory board, and many others. We are then given a taste of Colombian music, before the presentation of teams begins. This involves the Barranquilla carnival accompanying teams as they walk onto a stage, get a picture taken of them, and go back again.

Originally we intended to throw frisbees at the audience during our moment of glory, but they ended up stuck in customs. Therefore in the end we have Gabriel carry Sahl while the rest of us just wave cheerfully. By the time the presentation of teams finishes, the opening ceremony has been over two hours long, and the leaders are allowed to leave. The rest of us, however, are required to see a demonstration from the Barranquilla carnival group. This means that the opening ceremony feels almost as long as the opening ceremony in the actual Olympics.

By the time the ceremony concludes we are all quite hungry, and begin to feel slightly annoyed when no food appears. Luckily, just as we are about to leave, some lunch is provided, including a 'vegetarian' option. This turns out to be the same as the normal option and after some outrage from the many vegetarians in our group, this is fixed. In the end we are fortunate to have so many vegetarians because the turkey in the sandwiches provided is speculated to have been the cause of some digestion issues later in the day.

Tuesday 23rd July 2013

This is the day of the first exam. Coaches are provided for the teams to go to the exam venue, another hotel better suited for seating large numbers of people and which is about twenty minutes away by foot. We enter the exam hall about an hour early and are given a short pep talk by Dominic before the exam begins. I am then shown to my exam room by the guides and sit down in my assigned seat, which happens to be next to AUS6 Jonathan Zheng. For the exam we are given four cards (a water card, a WC card, a paper card and a help card) which are to be held up when you require such assistance.

The exam begins and we are given notice of the time every half an hour. The paper contains a number theory problem, a nice combinatorics problem about lines and regions, and a geometry problem concerning the tangency points of excircles. I manage to find an inductive solution to the first problem in a reasonable amount of time, and spend most of the time on the second. I solve it and finish writing it up with about half an hour to spare, so I spend the remaining time merely drawing a few diagrams for the last question. I see some commotion occurring at Jonathan's table next to me, and it turns out that he was denied paper because one of the invigilators had misread the regulations.

We meet up with Dominic to debrief while walking back to the hotel along the beach. Everyone seems satisfied with the paper, as we all claim question 1 and four of us claim complete solutions to question 2. Gabriel, however, has all the ideas for question 2 but the final bits are only in his rough.

We spend the rest of the day swimming and finding out about other teams' progress. When we talk to the Romanian team we find out that their problem 2 was mistranslated and many of them ended up solving the wrong problem. We hope that this will not affect their scores too badly.

In the evening, we decide to visit the Australians again but we are unable to find them. Gabriel then gets distracted by the luggage trolley. After using somewhat ridiculous gestures to 'persuade' a member of the hotel staff to let us use the trolley to carry the apparently injured Sahl, we rush down the path towards our suite, attracting the attention of the Aussies, the Colombians, and many others. Our journey comes to an unfortunate end when we go past Ivan, Dominic and Bev, who tell us to return the trolley immediately and then

go to sleep. We do the former, and a visit from the adults to the Aussies' room causes us to do the latter.

Wednesday 24th July 2013

This is the day of the second exam. Security is more stringent than yesterday, so the deputy leaders are not allowed into the building.

This time the paper contains a simple geometry, a functional inequality and a combinatorics problem about labellings of points around a circle. Being unable to find a geometric solution within the first two hours of the allotted time, I decide to employ cartesian coordinates. This is the first time that I have ever handed in a coordinate bash, and this makes me no longer a 'geometry virgin'. I then spend another one and a half hours on the function and solve it, leaving me almost no time for the hard question.

After the exam we are surprised to find out that we have done even better than yesterday, with everybody claiming the first two problems and a lot of progress on problem 6. Andrew has a full solution to 6 and looks on track to receive his third IMO gold. We walk back to the hotel in scorching heat and head straight to the pool.

The leaders are scheduled to arrive today, and indeed we quickly find Geoff and have a chat. This chat is short, however, as he and Dominic are to work hard on marking our scripts.

After a refreshing swim we go to the internet room inside the auditorium. The very existence of this room, which was also open for use before and during the actual contest, is bizarre because the main hotel wifi was turned off for the competition. This seems to suggest that we are being watched while using the internet in the internet room. Anyway, we do not spend too much time in there after we discover a small entrance to the rest of the auditorium, which should be locked. We explore the auditorium, finding the kitchen, the coordinators' room and many other rooms, before exiting via the IMO office, which leaves some leaders rather bemused.

4.5 Coordination and Closing Ceremony

Thursday 25th July 2013

Today involves the coordination of problems 1, 4 and 5. I get up rather late, due to having stayed up late the previous night. I walk around in order to find people and settle for a game of Mao with an array of others. The so called excursion on the program turns out to be a few on-site activities, which includes a talk on tilings by the chair of the problem selection committee, Federico Ardila. We decide that listening to the talk would be a reasonable use of time.

The talk is about relating tilings to other areas of mathematics, including graph theory, number theory, geometry, and algebra. We find out many interesting results concerning many different tiling methods. Many of the ideas presented can be found online at <http://math.sfsu.edu/federico/Articles/tilings.pdf>. We are also impressed to hear that Harald Helfgott, the mathematician who proved the weak Goldbach conjecture, is to give a talk about his proof the following day.

As the day comes to a close we are so far the winning team, as so far only one mark has been lost. However, tomorrow seems a much tougher day for coordination, especially problem 6.

Friday 26th July 2013

Once again most of us have a late start this morning. We first hear news about the coordination of problem 3, which has not gone as well as we had hoped, but we are looking quite optimistically at problem 6 with Matei finding a way to complete his solution. However, the time slot for our problem 6 coordination is the latest possible, and Geoff and Dominic work to make sure we can get an earlier slot.

We make our way towards the auditorium for the Helfgott lecture, wondering exactly what types of methods are to be used in the proof. The talk contains a brief introduction to the Goldbach conjecture, followed by his proof. The proof utilises high-end analytic methods and most of us are lost by the end. Anyhow, it gives us an idea of what modern number theory is like.

After a quick swim, we go to hear the news about problems 2 and 6. We appear to have a bronze, two silvers, one borderline silver/gold, and two solid golds. We can only look forward to the jury meeting later this evening.

About an hour into the jury meeting, we decide to go to the auditorium and wait for the meeting to finish and Geoff to tell us what has happened. However, we are very anxious and use the entrance from the internet room to spy on the jury meeting from the coordinators' room. We see that the medal boundaries are 15, 24 and 31 for bronze, silver and gold respectively. We also see the ranking of the countries. We are unsurprised to find that China, South Korea, and USA have the top three ranks, and are very happy to find out that we have come ninth.

After the meeting concludes we meet up with Geoff and Dominic and we talk briefly about the results. Daniel is given the sceptre of UNK for being one mark off Gold, and I am awarded the golden pen, the prize for having the most convoluted script that still merits full marks, for my coordinate bash.

Afterwards we head to the Irotama del Sol to play a game of Mao with the Aussies and the Kiwis. After I finish for the second time I drift into sleep, only to find upon waking that only Andrew and a few of the Kiwis remain. The others have apparently gone to the internet room. I myself then also go to the internet room and find most of them researching results on the IMO official website. Sahl then goes back to our room, taking our only key. (We originally had two key cards, but we lost one, and even though we replaced it, it became dysfunctional after a few uses.) Gabriel and I are therefore forced to sleep in the other room.

Saturday 27th July 2013

There is an excursion planned for today, but we decide not to go after hearing reports of the deputy leader excursion 3 days ago. This is shown to be a wise decision as the excursion actually finished early, despite being delayed by an hour.

The main event today is the closing ceremony, which is to be held at Quinta de San Pedro Alejandrino, a memorial site for Simón Bolívar, who died there after a long struggle

with TB. The ceremony is held outside, which is questionable because it is very dark by the time the award ceremony begins. The gold medallists are sat at the front in order of score, while the silver and bronze medallists are just sat in alphabetical order. The ceremony begins with a memorial service by some soldiers, followed by a few speeches and a musical performance involving a very talented young accordionist. As usual, honourable mentions are not mentioned, then bronze, silver and gold medal presentations occur in that order. We all make sure to have our flag the right way round, and more importantly, we are good at making sure our flags are in front of other peoples'. At the end the four top scorers are given their medals, and though in the closing ceremony they are said to have full marks, there are actually no perfect scorers this year.

After the ceremony there is a short music and dance performance and at this point many of the teams begin leaving. We manage to lose Gabriel and Geoff, but they are found when we return to the hotel for the farewell meal. This is outside next to the swimming pool, where there is later some disco music. We distribute our BMO booklets, and the Golden Microphone (awarded to the jury member who makes the most speeches) is awarded to Angelo di Pasquale, the leader of Australia.

I then return to our room to sleep while most of the others decide to party. I am therefore not amused when I am woken at 4am by a group of people, including an almost delirious Gabriel.

4.6 Return home

Sunday 28th July 2013

I wake up in the morning to hear that half of our team have pulled all nighters despite the 3 plane journeys we are to face. We hear about the American deputy leader Po-Shen Loh's travel arrangements. He had intended to go to Bogotá early to take part in a fundraising activity, but both his flight and the fundraising activity are cancelled, proving that two wrongs do not make a right, but at least are better than just one wrong. Our travel back is the inverse of our travel to Colombia, so involves two transfers at Bogotá and at Madrid. After arriving at Bogotá the tannoys call for Andrew Carlotti, which causes a slight panic, but it turns out that it was just a random baggage search.

Monday 29th July 2013

We arrive at Madrid airport in time for lunch, and we make it back to Heathrow without any problems. Once we arrive we have a small awards ceremony where we are given our certificates. It is a great relief to be back after such a long journey, and I can only hope that I will be able to have another incredible opportunity in IMO 2014, which is to be held in South Africa.

5 Acknowledgements

Many people were needed to allow us to do so well this year. A few of them are listed below and I give them many thanks for all their effort in contributing towards the best UK

performance since 1996.

- Geoff and Dominic, for being fantastic leaders and working hard to get all the marks we deserved, as well as being great people to talk to.
- Bev, for making sure that we were where we were supposed to be and for keeping us as well-behaved as possible during the trip.
- The Colombian organisers and the Universidad Antonio Nariño, for organising such a memorable event.
- The Barranquilla carnival and various music groups that supplied us with valuable entertainment in the opening and closing ceremonies.
- The Hotel Santorini and the Hotel Irotama, for being great venues for the pre-IMO camp and the IMO.
- Our guide, Maria Rueda, for looking after us both before and during the IMO.
- All the people working for UKMT who supported the team throughout the year.
- All the staff at UKMT training camps, for giving us the knowledge we needed to perform so well at the competition.
- Andrew, Gabriel, Daniel, Sahl and Matei, for being great company during the trip. I wish Andrew, Daniel, Sahl and Matei good luck for their oncoming year at Trinity College, and I look forward to seeing them again in the future.