

# International Mathematical Olympiad 2012

## UK Students' Report (2)

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### Introduction

It has become a tradition in recent years for a students' report to be written, detailing the various interesting and amusing events of the IMO from the students' perspective. This report is intended to complement the leader's report, describing the events that we (the team) witnessed or heard of ourselves, and ignoring most of the stuff that we hear from James and Jack.

The team this year consisted of James Aaronson, Sam Cappleman-Lynes, Andrew Carlotti, Daniel Hu, Josh Lam and Matei Mandache. James Cranch and Jack Shotton were Leader and Deputy Leader respectively, while Bev Detoef was Observer C (observer with contestants). Geoff Smith was officially Observer A (observer with leader), but operated primarily in his other role, as a member of the IMO AB (Advisory Board).

### Sunday 1st July

We meet at Heathrow Airport Terminal 5 at around 6:00 PM, except Jack, who is running late. Fortunately we allow for such delays. Our uniform is given to us by James Aaronson's parents, who kindly brought it to the airport, and we then say goodbye to them, and to Sam's 'bodyguard' Florence Salter, and go to drop off our bags.

Having passed through security, we look for somewhere to eat, and quickly settle upon the Giraffe restaurant. Here Sam produces his many cubes—he has a  $3 \times 3 \times 3$  Rubik's cube, a  $4 \times 4 \times 4$  cube and a  $5 \times 5 \times 5$  cube. He also has a Gigaminx, a dodecahedron with a side length of five. These puzzles will provide us with much amusement, especially during the pre-IMO camp.

The flight is uneventful. Since we are flying with British Airways, we have the luxury of individual screens on the seats in front, and a wide range of movies and television programmes to choose from. Since it is an overnight flight, we would also like to sleep. This means that we are unable to fully exploit the in-flight entertainment system.

## Monday 2nd July

After a long flight we disembark early in the morning in Buenos Aires. Passport control here is like at any other airport, but it seems that the baggage reclaim belts have a slight quirk. Every few minutes, a poorly positioned bag jams up the entrance to the baggage hall, and the rest of the bags start piling up outside, with some falling off the belt. James and I decide to do the airport a favour by watching the hatch and dragging through any bag which appears to have got caught. This system works well, and we are eventually reunited with our bags, at which point we abandon all other bags to their fate.

We will be staying at St George's International School in Quilmes. After a short minibus journey we are met there by Stephen Kay, one of the maths teachers. Stephen will do a superb job of looking after us over the next week.

In the afternoon, while waiting for the Australians, we decide to engage in the traditional sport of Ultimate Frisbee. We are using the ring-shaped Frisbee I brought to last year's Oundle camp, and it has seen better days. The rim is loose, and every few throws the Frisbee has to be reassembled. It is, however, the best we have, until Matei and James Cranch get their dish-shaped Frisbees from their rooms.

The Australian team arrive later, in the evening, and after dinner and a few games, we go to our rooms to sleep. The teams, apart from Nancy, are sleeping in the boys' boarding house. Nancy is with Bev in the girls' boarding house. The other adults are staying with some of the school staff.

## Tuesday 3rd July

This morning we have the first of five training papers. After the paper, we have lunch, and then spend the afternoon amusing ourselves in a variety of ways. While Jack and James mark the morning's paper. At 5 o'clock we have a snack, and then at 8 o'clock we have dinner.

In the evening, we need to go back to the maths room to get some of our stuff. Unfortunately, the door we usually use is locked. Jack suggests running back to Stephen's house to get him to open it for us. As if by magic, Stephen turns up. He suggests that we use the door five metres away around the corner, which is standing wide open. We laugh at our mistake, and sheepishly go in to get the stuff.

## Wednesday 4th July

This morning James Cranch leaves the school to begin his journey to the IMO proper. We then sit another practice paper.

In the afternoon we are briefed about the 'Buenos Aires Mathematical Olympiad'. This paper is one of the traditional parts of a pre-IMO camp (under various names). It in fact consists of two papers—one which the British set for the Australians, and one which they set for us. We will sit the papers

on Friday, and afterwards we must devise a sensible mark scheme and work in pairs to mark each others scripts. To complete the mock IMO setup, we must then agree the marks with Jack and Ivan, who act as the coordinators for all the questions.

This evening, however, we are only selecting the problems for the paper. In a show of equality, we are given a shortlist of six problems, while the Australians are apparently free to use any of their training problems that we have not yet encountered. We therefore break the rules slightly, and use one problem that is not on the shortlist—a nice geometry problem invented by Sam. We also attempt to use a problem from our NSTs (sat at Oundle this year), but Ivan rejects it due to our use of complicated notation.

When we go off to bed, I am holding the Australians' mascot, a large koala named Sampson, who is permanently holding a smaller koala, named 'Sampson's Appendix'. It seems as though the Australians are going to forget him, so I make a half hearted attempt to hold him so that they will see him. They do not, so I end up looking after him for the night.

## Thursday 5th July

I turn up to breakfast this morning with Sampson, which triggers several contradictory responses from the Australian team. Some of them accuse me of kidnapping him. Others suggest that this was all part of their plan to use him to spy on Sam and me and steal our secrets. I reject the second theory as absurd, and then pick holes in their first theory too.

After breakfast we have another paper, and then lunch. During lunch, several girls approach Sam and ask him if he can really solve a Rubik's cube one handed. They gather around him as he demonstrates that this is the case. We then add that he can do cubes blindfold before demonstrating our team spirit by making a hasty exit and abandoning him. A few minutes later he catches up with us—apparently they had to go to lessons.

In the evening we nearly have a small catastrophe—Sam's small bear, who has been adopted as our team's mascot (to counter the Australians' rather larger koala), has disappeared. After a frantic search I discover the culprit is in fact Sampson, who is jealously hiding Theodore in his arms. We suggest that the Australians ought to keep their mascot under better control.

## Friday 6th July

This morning we sit the Buenos Aires Mathematical Olympiad. The papers appear to be fairly reasonable, though it seems that some of the marking may be slightly tougher.

After lunch we split up into pairs to see how hard the marking really is. I am working with Sam on the geometry problem. Most of our scripts are fairly easy to mark, but we have difficulty with a couple of them. Yanning has solved the

problem using a fairly neat trig bash. This in itself presents us with no problems, but the coordinators ask us what happens when the triangle is isosceles—the trig bash does not work here. For this ‘oversight’ we nearly dock him a mark, until we find a simple proof for this case that we missed when originally marking the script. This highlights how difficult marking can sometimes be.

Some of the other markers are having even more difficulty with marking. Alex Gunning has produced a complicated attempt at solving their Problem 3, but it is neither complete nor easily understandable. Ivan and Jack have to help with the marking of this problem. Another script to cause particular trouble is my script to our Problem 3. I have quoted a theorem which is not true, but is conveniently true in all the cases where I actually need it. Furthermore, I do not produce an explicit construction in my solution. Again, Jack and Ivan have to explain it to the pair marking that problem.

Later we decide to have a picture of both teams with the Mathematical Ashes between us. While waiting for Jack and Ivan to catch up with us, the Australians wander off into a building. One of them tells us to come and look at something, and before we know it, Sampson plummets onto our heads, acting as a ‘drop-bear’. However, it turns out Sampson is not well enough trained—I just catch him and walk off. I eventually return him for the photo, in which both mascots are trying to claim the Ashes trophy and urn.

Jack points out that the sports hall appears to be open, so some of us go and have a look, intending to play football there. This, however, doesn’t happen (though we do play a game outside). We also definitely have nothing to do with the alarm going off in the sports hall.

## Saturday 7th July

Today’s paper is, according to some, the most important paper of the fortnight. It is the paper that will decide who wins the Ashes this year. Last year we tied with the Australians, so retained them by default, having won the previous year. We were fairly confident of victory this year, having consistently beaten them by a few questions on the practice papers. Kaimyn Chapman has therefore decided to take drastic action. He has created a cube out of paper, and coloured it to resemble a Rubik’s cube. This is supposed to distract Sam. However, after the paper, we seem to be a few questions ahead, so even if the distraction had worked, we reckon we could have won.

In the afternoon, we play games for a while. Then we are summoned back to the maths block to hear the results. Jack’s call turns out to be a little premature, as it is over ten minutes before Ivan returns from his accommodation. When Ivan eventually returns, the results are announced, one competitor at a time. Before the last results are announced, it is clear that we have won, as Matei needs just –11 points for us to beat the Australians—he clearly has scored more.

Having established the winner, we go out for another game of Frisbee. By now my Frisbee has deteriorated to the extent that it is essentially being held together by a ring of tape, which keeps coming loose. While I go to tape it up for

the second time this evening, the rest of the UK and Australian teams agree that my Frisbee would be better off hanging round the upright on the rugby goal. When I discover this, the Frisbee disappears into my bag, and stays there. We play instead with Matei's, as James Cranch's has disappeared. Matei's Frisbee later gets lost too.

## Sunday 8th July

This morning, we leave the school early, and are taken to the 'Omnibus' station in Buenos Aires. It would appear that the main form of intercity travel in Argentina is by coach, as the bus station is far more developed than any I have seen in the UK. The coaches are extremely comfortable, with reclining seats and footrests, and most of us are able to sleep on the five and a half hour journey. Food is also available, in the form of a packet of round biscuits. Most of our team (me included) sample the biscuits, and decide that a whole packet is too much to eat in one go. We are also shown a film, *Contraband*, during which the sound is just audible without headphones. Once the film has finished, we are able to familiarise ourselves with the music from the DVD's main menu, which is played on a loop every 30 seconds for well over an hour. The teams from New Zealand, the Netherlands and Lithuania are also present on the bus, though at this stage we do not speak to them much.

Arriving in Mar del Plata, we are greeted by our guide, Javier Corti. Javier, like us, has competed in an international olympiad. However, unlike most of the team, he competed in the International Olympiad in Informatics, participating between 2005 and 2007. This is an experience that I too will soon have, competing for the UK in the IOI at the end of September this year.

Our journey from the bus station to the hotel is quick, and gives me an opportunity to comment on the good synchronisation of the traffic lights in Mar del Plata, as our minibus appears to be carried along on a wave of green, a similar such wave being visible further up the road. If only traffic in London flowed so smoothly. The hotel, the Gran Hotel Provincial, is an impressive site with a massive brick facade, sandwiched between a busy road and the South Atlantic Ocean. We check into our rooms and take our luggage up in the lift. On the way down I choose to take their stairs, marked on the map as the 'principal escalera'. This description turns out to be inaccurate—there are in fact two staircases, wound round each other in a double helix. We will therefore have to be careful which staircase we use, particularly on the first floor, where one of the two doors is closed to the public. To avoid problems with access to the first floor, the hotel have kindly labelled all the doors on higher floors. Those on the staircase we must take for the first floor instruct us to use the other door, while those on the incorrect staircase assure us that we are on the correct one.

Once we reach the ground floor, we are given a brief tour of the hotel by Javier. He shows us the dining rooms, the entrance to the exam rooms, the lobby and the recreation hall. The recreation hall houses almost every form of entertainment imaginable. Our team heads straight for the table of Rubik's

Cubes, disguised Rubik's Cubes and other similar puzzles, and there is nothing Javier can do to tempt us away from them. Eventually, he decides that the best thing to do is to go and fetch our IMO backpacks and goodies for us. Meanwhile, I determine that the best solving strategy for one of the 'cubes' is to dismantle and rebuild the puzzle, if only to allow me to determine how it works.

Despite the allure of the recreation hall, we are eventually persuaded that food would be a good option, having not eaten since breakfast (it is now the middle of the afternoon and dinner is not until eight o'clock). We therefore head out of the hotel with Javier. With the exception of James, we are all content to eat pizza, so, to Javier's surprise, we order eight large pizzas and some other stuff for James. Javier turns out to be correct in guessing that eight pizzas is too much for us to eat—seven however, would have been ideal.

Back at the hotel, our team disperses to enjoy the various activities available. I head straight for the 24000 piece jigsaw (*LIFE: The Great Challenge*), and begin to work my way through a small subset of its pieces (working with the Irish Deputy Leader Gordon Lessells on a cheetah and two zebras). Others enjoy a variety of activities such as chess, Triple Bongui (a version of Set in which the shapes have grown legs and antennae) and Ta-Te-Ti-To (3D  $4 \times 4 \times 4$  noughts and crosses). There is also a music room, containing a keyboard, drums and guitars. Along one wall is a row of console games and spread around the hall are pool tables and table tennis tables. There is also a karaoke set up in a corner. This turns out to be a magnet for mostly bad singing, from which there is no escape other than leaving the recreation hall.

Dinner takes place at a traditionally late hour, and we get our food at 9:30. As in Amsterdam last year, most meals are buffets. The food is definitely edible (mostly), and though there are minor issues with getting food out to us at the first few meals, these problems are quickly dealt with. This is fairly impressive given that hotel is catering for almost a thousand people, some of whom aren't even sleeping in this hotel, and with a variety of specific dietary requirements.

The evening then progresses in much the same way as the late afternoon, and we head off to bed at a variety of times.

## Monday 9th July

Today is the day of the opening ceremony. This takes place in the morning, and after breakfast we are told to meet in the recreation hall. Once all the teams are gathered, we begin a procession to the theatre. On the way, we pay no regard to traffic in the roads we cross—its absence, however, suggests that the roads are temporarily closed. At the head of our procession is a group of people best described as forming a small carnival. About a dozen brightly costumed people are leading the procession, followed by more people, each of whom has one of two smaller drums, or a cymbal on top of a bass drum. One also has a trumpet, which he plays as we enter the venue for the opening ceremony itself.

Before the opening ceremony can begin, we must wait for the leaders to arrive. When they enter, they are seated on the balcony above us, so most

of the teams crowd forward into the area in front, to see their leaders. I am separated from the rest of the team here, choosing to head to an empty spot with a good view of the balcony. I therefore miss James's traditional thumbs up, but am the only team member to see Geoff, with a double-thumbs up. We speculate about what these signals could mean.

The opening ceremony itself begins with an interpretation of the Argentinian National Anthem, followed by a series of speeches. New to the proceedings this year is an oath that all participants must take, promising not to cheat and to uphold the integrity and spirit of the contest. This may have some positive effect, but I fail to see why it would affect people's actions in any way.

Following these speeches is the parade of countries. Usually, we are arranged in alphabetical order in the venue, and people, often the guides, tell us exactly when to stand up, and where to go. This year, we are arranged in alphabetical order, but have no idea exactly when we are supposed to go up. As a result, several teams are slow to reach the stage, and many appear out of order. Once on stage, however, teams behave in the same manner as normal. Some teams throw gifts out into the audience. This is, as usual, disappointing for the UK team, whose position alphabetically places us at the back of the theatre, where even the Austrians' Frisbees do not reach us.

After the opening ceremony we return to the hotel (in a less flamboyant manner), and spend time in the recreation hall and the dining hall before heading off to bed for a good night's sleep.

## Tuesday 10th July

Today we get up and go down for breakfast by eight o'clock, since we must be ready to enter the contest room by 8:30. This year is unusual in that the contest is being held on site (though this was also the case in Kazakhstan), and we are effectively all in the same room (there are in fact four rooms, but three are separated by a row of pillars, and the fourth is through a set of large double doors, so barely counts as separate). By 8:45 we are all sat down in the hall, awaiting the signal to start. This takes the form of loud ringing noise, such as an alarm clock might make, and takes place at 9:00:25, according to the precisely synchronised clocks around the hall (an improvement upon previous years, particularly 2010). It is also the last audible signal we are given until the end of the contest (usually there are more announcements), the reasoning being that we are capable of working out the time from the clocks, and would prefer not to have the distractions of announcements during the exam.

We emerge from the exam to find Jack and Bev, and discuss how we did on the paper. Five of us are claiming a solution to Problem 1, the geometry question. Matei has failed to do so, but makes up for this with a partial solution to Problem 2—the inequality. He has proven it for  $n \geq 11$ . I am the only other person with significant progress—I have solved the problem with a couple of doses of calculus. Usually calculus either fails or gets horrendously messy, but here I feel it gives a nice (albeit long) solution.

We also have two partial solutions for Problem 3. This problem has two parts, and concerns a game called the ‘Liar’s Guessing Game’. Both James and I have solved part 1, and I am claiming significant progress towards a solution on part 2.

After lunch (which, inexplicably, does not begin until half an hour after the exam ends), we initially wander down to the recreation hall. However, when it is suggested that we should go for a short walk with the Australians, we agree. We begin by walking along the edge of the beach, near the bottom of a slope leading up to the road. Daniel experiences a sudden urge to run up this slope, but is chased off by a stray dog, sending us into hysterics. We then go down to the shore between two bits of private beach (presumably closed for the winter). We decide that the sea is, surprisingly, wet, though Kaimyn and I fail to reach an agreement on its temperature—he claims it is cold, but I disagree.

We then leave the beach, and some of us decide to race up to the main road. On the other side of the road is a café, where we have some drinks before returning to the hotel, for a fairly relaxed evening.

## Wednesday 11th July

As on the previous day, we aim to be at breakfast by eight o’clock. Based upon a small suggestion from Jack at the previous night’s debrief, I have completed my solution to Problem 3. I tell him this, mentioning that I was ‘0.01’ away from a solution. Unfortunately, it seems that this won’t earn me a score of 6.99.

After the second paper, which we agree was harder than the first one, we are able to see James again. We complain to him about the standard of some of the problems—he denies responsibility, claiming that the jury had to choose the best from a bad lot. We also discuss the problems. Today, everyone claims a solution to Problem 4. Josh has solved Problem 5, and both Matei and I are claiming progress on Problem 6. Both of us have correctly found and proven the integers  $n$  for which the equation cannot hold. However, I am suspicious of his apparent solution—it looks like something I had tried and failed to do. A quick check of his algebra proves my suspicions correct—unfortunately he is out by 18, having mixed up  $2t$  and  $2t - 2$ .

Now that the papers are over, we begin to consider what medals we might get. This is harder than in previous years, due to the relatively large number of part marks we are expecting to score. However, at this stage it looks like we will be getting one gold/silver, one silver/bronze, one safe bronze and three borderline bronzes. I shall not comment much on how these expectations change over the next few days, as James’s report can give a much better account of how the coordination went.

Now that the competition is over, the recreation hall will stay open much longer (officially until four o’clock in the morning). There are also some new activities available each night. This evening a circus workshop is present. I and several other members of the team try out various activities, including plate spinning, juggling with rings, clubs and balls, and diabolos. It turns out that

it is actually quite easy to learn to juggle rings—after a few hours of practice I could juggle three rings semi-reliably and Daniel was not far behind. However, it is also very easy to injure your hands by catching the rings badly, so around 2:00 I retired to the jigsaw, having made my hands sore, and even drawn a little blood.

## Thursday 12th July

Today is a relatively uneventful day. Before leaving our rooms, we are greeted by a note reminding us that we will be financially liable for any damage to our rooms and the hotel in general. I wonder why this reminder has been sent out.

During the day we hear the results of the coordination of Problems 4 and 6, although the coordination of my script for the latter has been postponed. Most of the marks are as expected, but I have disappointingly lost a mark on Problem 4. Discussion with James and Jack reveals that the cause of my lost mark can be described as laziness, although I would prefer to call it exhaustion—the problem required the consideration of so many cases that I was fed up with it by the end.

We also hear during the morning (or what remains of it once we're all awake) that one team was thrown out of the hotel. It seems that they were caught drinking and smoking in one of their rooms. They are now going to stay in a hotel on the other side of Mar del Plata. This is more of a punishment than it may seem, as they are now denied the opportunity to socialise with other countries, a key part of the IMO experience.

Our team has had its fair share of mystery too. Matei has been called in his room by a girl from another team: apparently she wishes to speak to UNK4—Daniel Hu. We debate among ourselves what this could mean, and quickly conclude that Daniel must be attractive.

In the evening there are Tango sessions available for those who are interested. None of the UK team are, but we watch Kaimyn, Nancy and John dancing for a bit. The Tango also means that the circus stuff isn't there, so later I head upstairs in search of more interesting stuff. I eventually come across a group of Latin Americans, including one I know from last year, playing a game of 'Mafia'. This is a popular game among the UK team, and other English-speaking countries, and we had already played a few games the previous night. Having observed one game in Spanish, understanding parts of it, I am invited to join the next. This leads to slight complications, as the bits of Spanish I could understand before are now in English, and the bits I couldn't understand remain in Spanish. Fortunately, Alejandra (from Guatemala) is sitting next to me and is willing to translate. I first met her last year while playing Uno, and it is good to see old friendships being renewed. With her help, and the help of Mailén (the New Zealand guide), who translated some of the later games, I manage to keep track of what is going on. There are, however, cheers when I am eliminated from one of the games; they can then complete the game in Spanish only. I subsequently spend the rest of the evening (or early morning)

with members of the New Zealand team and their guide, before going up to bed.

## Friday 13th July

There had been some confusion about our time of departure this morning, so at 9:00 some of us are summoned from our beds for a hasty breakfast and a departure by 9:30 (this actually ends up being later). This is our only excursion during the whole IMO, and takes us to “Aquarium”. “Aquarium” take animals that have been found by other people, look after them, and, in some cases, train them to perform tricks.

While waiting to leave, Daniel and Matei spot Daniel’s ‘mystery girl’. However, she runs off when they approach, in what we guess must be embarrassment.

The morning at “Aquarium” is spent being shepherded round the park in several groups (our team is part of the orange group) seeing a few animals, such as flamingoes. We are also shown a film about a fictional turtle’s life. This turtle appears in a few different places, and each time narrowly avoids being killed as a result of human destruction of the wildlife. We find this very amusing, despite it being entirely in Spanish—in any other context I would have described it as mock propaganda.

After a relatively disappointing morning we have lunch. We have a choice of half a dozen different places to get our food from, with queues of varying lengths. In the end, it is almost an hour before we all have our food, as they are unable to cope with the unusually large number of customers. I order some chicken, which has by far the longest waiting time. By the time it arrives, the rest of our group has left, so I eat my food quickly before the team heads for the rest of the group, arriving part way through a dolphin show.

In the afternoon, as well as this dolphin show, we also see some penguins, including a brown furry one who cannot get wet, and a few other animals. The highlight of the afternoon, however, are the other shows we see. Both shows are quite impressive and more than make up for the boredom of the morning. The first is a sea lion show. The sea lions have been so well trained that they appear to be acting like humans. One of the contestants is asked to volunteer to do some stuff (with appropriate gestures from the sea lions). He is then asked to perform the same tricks as the sea lions, including being told to enter the water (he refuses). As compensation for this humiliation he is allowed to kiss one of the sea lions (cue the cheesy romantic music).

The dolphin show is equally impressive, if not more so. As well as the obvious stunts, such as jumping out of the water and doing flips, the dolphins are also capable of using their noses to push their trainers through the water and into the air. One of them also plays ‘fetch’ with a Frisbee-like disc—this is a game that the UK and Australian teams are also good at.

Anyone who is superstitious or British will probably not be surprised at what happens next. It begins to rain. Heavily. Fortunately it is time to go anyway, so we rush towards the coaches and scramble on board, though not before becoming soaking wet and cold. We are, however, fortunate enough to

be one of the first ones back to the coaches. When we return to the hotel, we do not have far to walk, and it is not long before we are back in warm dry clothing.

The evening, in contrast to the excitement of the rest of the day, is just like any other evening. We get told the results of the coordination of Problems 1, 2 and 3, and my Problem 6 script. There are few surprises in these results, and most of us receive scores at the high end of what James and Jack had been expecting. After dinner, I get a crash course in comedy sketches and weird YouTube videos from some of the New Zealand team, before heading down to the recreation hall for another long night of entertainment.

## Saturday 14th July

I have no idea what happens during Saturday morning, having slept through till 12:30 (just in time for an early lunch). However, I expect I didn't miss much.

After lunch, Javier suggests that we go out to the local ice rink to do some skating. This is a popular suggestion, so we head out soon after. The ice rink is small, and the quality of the ice is poor, but since most of us are beginners we did not mind this much. When we get there, the Australian and South African teams are already there, and like us, seem to be just managing to avoid a small catastrophe. This is better than another team, however, who do not even manage to stand up for a team photo.

While skating, we decide to play a game of 'it'. After a few minutes, however, the game degenerates when everyone is 'it', and Sam has just been tagged again. Some investigation reveals that James is the source of this multiplicity, so we cut him out of the game. Unfortunately, it is not long before other members of the team succumb to James's malevolent influence, and before long we have cut out all but three players. This seems like a rather degenerate game, so we are forced to give up on it.

After skating for significantly more than our allotted hour, we leave the rink and Javier takes us to get some churros (also called 'Spanish doughnuts') from a nearby cafe.

By the evening, many more interesting things are beginning to happen. By now we have heard the results of the coordination of Problem 5—here we unexpectedly get two 2s, as well as a rather less unexpected 7 for Josh.

In the early evening, Daniel and I decide to try taking our newly acquired juggling skills one step further, or rather, one person further. Disappointingly, we are able to master even some of the simpler patterns with two people, and as this is the last time the circus equipment is available to us, we are never able to achieve our aim of juggling 6 rings between two people.

Some time this evening, James plays in the final of the Ta-Te-Ti-To tournament. He wins the match, gaining a t-shirt announcing this fact, as a reward.

Today is also Sam's birthday. This means that he has the 'Birthday song' (presumably a Spanish version of Happy Birthday) sung to him, and gets to serve some cake. Like James, he gets a t-shirt, this one proclaiming "I had my birthday at the IMO".

Starting at some time past midnight, the major event this evening is ‘IMO’s Got Talent’. Judging by the dodgy karaoke that dominates at first, I begin to doubt the bold statement in the competition’s name. It must, however, be remembered that many people’s ‘talents’ may have needed equipment that was unavailable to demonstrate, so the karaoke was, in most cases, the best thing available to use. There are also some good acts though—there was one person who was playing the guitar, the harmonica and singing (not quite at the same time), which I found more impressive and agreeable to my ears than most of the other acts.

During this time I am mostly working on the 24000 piece jigsaw. It had been looking like it was unlikely to be finished before we left the IMO, but up until now I had reckoned that there was a slim chance of completing. Tonight, however, I realise the sea part of it needs doing, so I start working on it. This quickly destroys any remaining hope I have of completing it, and by early morning I have given up on the jigsaw completely. However, I have subsequently discovered that it may be sent to Colombia, so I may have a chance to help complete it after all.

By 4:00 the qualifying round of IMO’s Got Talent is complete (the final is to be held tomorrow/today). This leads to an impromptu rave, which seems to be particularly popular among the guides, and also among the Spanish-speaking teams. Meanwhile, with some concern over the state of the UK-Argentine relationship, our team, with the help of the Australians, decide to build a bean-bag fortress in the corner of the room. Despite some difficulties in constructing a roof from such floppy materials, our work is eventually complete, and we retire to a position where random passers-by can laugh at the antics of a group of teenagers, visible through the windows of the hotel. Unfortunately our masterpiece is short-lived, as one of the guides suggests that a tower of beanbags leaning against the window is not a good idea. We therefore evacuate the fortress by crawling out through the walls, causing it to collapse into a comfortable heap. I then lay down on this resulting heap and soon find myself buried under a pile of beanbags. This turns out to be surprisingly comfortable, so I just lie where I am, kicking off my shoe when they try tying the laces together. Eventually, after much messing around with the beanbags, we abandon our mess, and wander back towards the rave. Sam and I take the opportunity to use the table-tennis tables—most other people are either asleep or raving, so there is no one else using them. This has the additional advantage of placing us behind the speakers, where, for some strange reason, the music is much more tolerable and the distortion is almost inaudible.

When the party finally finishes at six, I am left with a major dilemma: “To sleep, or not to sleep?” I quickly refine this to “When should I sleep?” With breakfast opening at 8 and the medal boundaries expected out soon after 10 o’clock, I decide that rather than sleeping through breakfast and the announcement of the medal boundaries, I will sleep before lunch. Convinced that this is a good plan, I go up to my room and start working on C7 from last year’s shortlist. This problem has been nicknamed the ‘napkins’ problem, and was apparently intended to be so hard that even Lisa Sauermann (previously top of

the IMO Hall of Fame with a perfect score last year) wouldn't be able to solve it. I am therefore very surprised to solve it an hour and a half, while drifting in and out of sleep.

## Sunday 15th July

Having solved C7, I come down for breakfast at eight o'clock, just as it is starting. When Bev comes down soon after, she is very surprised to see me there, though immediately guesses, correctly, how much sleep I have had.

As the morning progresses, more and more people come down, have breakfast, and begin waiting for the medal boundaries. By 10:30 we are all wondering how long it will be till they are announced. We have already heard that there is a disagreement between the coordinators and the US leader about the mark of one of their scripts for Problem 4, so we know it could be a while before the results are out.

Then someone decides it would be the perfect opportunity for a massive photo, with most of the teams present. This involves us walking outside and standing up for a while, something I do only reluctantly due to tiredness. Only three of our team are present for the photo, the other three being upstairs, possibly asleep.

When we return, the medal boundaries still haven't been agreed. My 'fool-proof' plan for getting sleep is now seeming very flimsy, and by the time the results come out, I have given up all hope of sleeping before the end of the IMO.

The medal boundaries are good news for us—our two borderline bronzes became definite bronzes, and everyone who'd been on another boundary got the higher of the two medals. We finish up with a total of 115 points, placing us joint first with the Netherlands in Western Europe. Individually, we have a medal each (for the first time in three years): a gold, a silver and four bronzes.

Since the results came out so late, it is now time to act on Geoff's proposal of eating out "somewhere with nice steak". Since we don't know how much time we will have after lunch, we change into uniforms before leaving the hotel, and meet Geoff near a restaurant. This is our first chance to speak to him during the IMO—apparently he also tried to meet us after the second paper, but got lost.

To demonstrate our individuality and independence, the majority of us decide that we would like to order "the same". This single option actually refers to multiple dishes, with some of us having beef, while others have a rather less meaty pasta. While waiting for the food to arrive, we carry out a couple of recently established traditions. The first is the awarding of the 'sceptre of UNK'. This is initially used as a device for making one's opinion known in Jury meetings, but its primary purpose is in fact to ensure that its bearer will make no false statements. This year it is awarded to Matei, to aid him in his quest for truth at next year's IMO.

The second award to be given out is the 'Golden Pen'. This is rather perverse award is given to the person with the most convoluted script that nonetheless

manages to achieve 7 points. This year it seems likely to be awarded for a Problem 4 script, so I feel relieved to have avoided it, both by writing a fairly straight forward script, and by failing to score full marks on the question. This is why I am eventually awarded it for Problem 2 instead.

After the meal, with no time for pudding, we return to the hotel to meet up before heading to the closing ceremony. This takes place in the next building along the seafront, in the Auditorium Theatre. It is thus only a short walk, and clearly not worth bringing in a load of drummers for it. In the theatre, those with medals are instructed to sit in a seat with their mark marked on it; we do not know where the others are supposed to sit, but this is not an issue for any of our team, who all won medals. As with the opening ceremony, the ceremony opens with an interpretation of the National Anthem. We also have another set of speeches, one of which sounds suspiciously similar to one from the opening ceremony. Then the medals are given out, with those with fewer points going up first. This highlights a slight logistical error: contestants with the lower scores in each row are seated at the right hand end, but are instructed to leave by the left hand end of the row. This means that everyone has to pass most of the other people in their row twice—once while walking and once while seated. On stage, however, the medals are presented in an orderly fashion, and the people awarding the medals (mostly coordinators, it seems) clearly know what they are doing. Noticeably absent from this year's ceremony is the over-the-top presentation to the top scorer (Jeck Lim; Singapore). This is probably largely because he is not the same as the person who moved into first place in the IMO Hall of Fame this year (Teodor von Burg; Serbia).

After the closing ceremony we have pictures taken with several other teams who haven't rushed off (such as Australia, who have a plane to catch; we don't see them again). There are also some majorettes, in highly ornate military uniforms—no one seems to know who they are or why they are there, so we have a photo with them anyway. We then return to the hotel for a private celebration, before going back downstairs.

Dinner is a significantly different affair tonight. We are sat in what had been the contest room, but is now full of tables, and our food is brought out to us. This is disappointing, as it means that there is no choice. In addition, the portions seem rather small (at least compared to the full plates I've been having at previous meals). By the time our pudding arrives (after a lot of waiting), they are already running the IMO's Got Talent final. There are four participants in the final, and the eventual winner is a singer from the Romania team, Ioana-Maria Tamaş. We then have a performance from a loud rock band. This is not, we decide, suitable entertainment for a dinner, as there is no way of escaping from the noise without sacrificing our chance to finish eating.

As the dinner finishes, it gradually turns into a rave. Our entire team leaves before the rave finishes. Downstairs, the recreation hall is being kitted out with even more treats for us, most prominently an inflatable obstacle course. A sign on the door informs us that the room will be opening at 00:47. When it actually opens, seven minutes late, Sam and I head straight for the obstacle course, and have two goes before the queue starts getting long (we each beat the other once).

Later, we also have a go on the ‘mechanical bull’, along with Jack. After my first go I establish that the design of the bull causes most people (me included) to place their weight too far forward. When I later have another go, I put my weight as far back as possible, so that my centre of mass is almost exactly on the centre of rotation. This seemingly optimal strategy is not enough to keep me on it, however; the operator realises what I am doing and simply sends me into long, fast spin intended to make me dizzy. I then fall almost straight off once he starts rocking it. The dizziness continues to affect me for almost half an hour afterwards, so I decide a third go is not a good idea.

Besides the inflatable, the only changes to the recreation hall appear to be the reinstatement of the karaoke, and the appearance of some thread for making things like bracelets. I try out one of these activities shortly before breakfast. There is also a stack of white IMO t-shirts, intended for signing, and many people from other teams keep coming over and asking us to sign their t-shirts.

## Monday 16th July

Breakfast seems to come round far too quickly this morning, ending the festivities of the previous night. The UK team fetch their luggage down and, one by one, begin eating breakfast. We also sign a UK flag. This has become a traditional gift from the UK team to their guide at all international competitions.

It seems that last night Josh, James and Matei finally got to speak to Daniel’s ‘mystery girl’. It turns out that she was in fact interested in seeing Josh, who she recognised from last year’s IMO, but managed to mix up the contestant codes. Some time during the night, she turned up in Josh and Matei’s room and engaged them in conversation, until a passing member of staff pointed out that girls and boys weren’t allowed in the same room. This is, I suspect, one of the few times contestants have been grateful for this rule.

After breakfast, we take our luggage through to the entrance hall, and then I wander back through to say goodbye to anyone I meet and know well. Unusually, the people I know aren’t all asleep (unlike previous years). The only exception is Javier, our guide, who, we later discover, slept through his alarm. We therefore have to give the flag to someone else to pass on.

Before we leave, we are also caught by someone with another t-shirt. It is for me, and reads “Puzzle MVP”. I have to ask what the MVP means—“Most Valuable Player”, apparently. I am also asked if there is anyone else I can think of who should get one. Since I can only remember the name of one other person who was working there often (Gordon Lessells, the Irish Deputy, who they already know about), I am useless here. Someone also raises the issue of how there can be more than one ‘MVP’. This is one question I cannot answer.

Now we finally leave for good. Our transport to Mar del Plata bus station is once again by minibus. Here we meet the Austrian leader, Robert Geretschläger, who will be on the same coach as us. The coach journey is less eventful than before (and that was pretty uneventful)—I wake up in time to see the end of War Horse, and I suspect that most of the rest of the team was probably asleep

most of the time as well.

In Buenos Aires we have another minibus transfer, kindly provided by St George's College, this time to the airport. For some reason we have arrived with over five hours to spare. While Bev checks in Daniel (the system would not allow her to do so last night), we find ourselves attracting the attention of a group of girls. To escape this, we go up onto the balcony under which they are sitting to have lunch, in what is definitely not a reflection of the scene from *Romeo and Juliet*. After lunch (pizzas again), some of us go and study the airport's display about 'Las Malvinas'.

The queue for security is a long one, but unlike in other airports, it moves quickly, so it is not too long before we are through security and passport control. We then play card games while waiting to board the plane.

## Tuesday 17th July

Again, I have slept for the majority of the journey, but am awake for the last couple of hours. James observes that Sam could be entering a competition for "most sleep in  $x$  time", where  $x$  is some value I cannot remember. It seems likely—he has barely been awake while travelling. Meanwhile, James and I work on our reports in parallel—I point out to him that he has placed something on the wrong day, but owing to our strange sleeping patterns this is ambiguous and he does not initially understand.

The descent into Madrid is far from pleasant, and to counter this I go into 'sickness-avoidance mode'. When we finally land, the pilot receives a round of applause. I know this is customary in some places, but I don't understand why you would applaud someone just for doing their job.

Owing to a late departure, being held over Madrid and a probable headwind, we are left with under half an hour before our connecting flight is due to leave. We rush through the airport to the gate, only to see the aeroplane pushed back from the stand, and to be told we've missed the flight. Fortunately they have booked us onto the next plane to London, and it is only an hour and a half later. To compensate for our delay, we are presented with vouchers for three meals. There are nine of us, and, as good mathematicians, we understand the equivalence of three and nine.

Our journey to the other side of the airport (we have to walk almost as far as is possible within Terminal 4) takes some time, but we arrive in good time and set about looking for the restaurant these vouchers refer to. It turns out that we need to double back for five minutes. However, the restaurant does not take too long to find, and we decide to buy whatever we want, paying for the difference between that and the three free meals ourselves.

We then return to the gate and soon after board the plane. It is, annoyingly, more comfortable than the one we spent twelve hours in. There are no issues with the flight, and when we arrive at Heathrow, the queues at passport control are short, and the baggage is almost waiting for us. (Is this really Heathrow? Why is everything working so well?) After a short presentation of certificates,

we then go home our separate ways, to catch up on more much needed sleep.

## Conclusion

I would like to conclude with a few general remarks. Every year, and this year in particular, the IMO is a wonderful experience, that I'm sure none of us will ever forget. For this experience, we should thank many people, most of whom are duly mentioned in James Cranch's report. I would, however, like to express gratitude to two specific people. Firstly, to our guide, Javier Corti, who was there helping us throughout the IMO, and whose local knowledge provided us with several enjoyable 'excursions'. Without his assistance, we would often have been lost, either geographically, or due to our poor comprehension of Spanish. Secondly, to someone who eludes thanks in James's report: James himself. While not setting the paper or marking our somewhat challenging scripts (an important job in itself), he was often with us, to entertain us with his vast supply of ghastly puns, and to ensure that we didn't enjoy ourselves too much (or too little). I hope to see James carrying out this job with similar levels of enthusiasm at next year's IMO too.