The 46th International Mathematical Olympiad in Mexico

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The preparations culminating in the 46th International Mathematical Olympiad in Mérida, Mexico, reached their climax in July 2005. The IMO is an annual competition between the most able young mathematicians in the world. The host nation varies from year to year, and this time the event was held on the Yucatán peninsula, in the area inhabited by the Mayan people.

The actual competition consists of two papers, each containing three very hard questions drawn from algebra, combinatorics, geometry and number theory. Each question is marked out of 7, according to an agreed marking scheme. There are no cheap marks at an IMO. Half the competitors receive medals, and these are awarded in the ratio gold:silver:bronze $= 1 : 2 : 3$. This year 93 nations tried to compete, but a couple were unable to secure visas so in the event there were 91 nations present. Each country may send up to six students, and most do send the maximum number. Like the athletic olympic games, the competition is between individuals, not countries, but inevitably nations compete unofficially by comparing the sum of the marks obtained by their students. Populations of countries, educational standards and levels of preparation vary widely between nations. Some countries have specialist IMO schools which take talented young mathematicians out of the normal school system at a young age, and others have training regimes which involve weekly meeting of the most able students with their trainers.

In the UK we do not allow IMO preparations to interfere with normal school life, and almost all our events take place during school vacations. Our training is amateur, and is conducted by a small army of volunteers, many of whom were once IMO competitors themselves. This year a quite exceptional role was played by the deputy leader, Adrian Sanders. In his final year in post, he made extraordinary efforts to nurture the mathematical development of the team, and I am sure that they are grateful to him. This is not to ignore

the efforts of everyone else involved. Next year Adrian will be replaced by Ceri Fiddes of Millfield School; she has been shadowing Adrian's role for some time.

When trying to measure UK performance at the IMO we tend to compare ourselves with the other large social democracies of Western Europe since this is, broadly speaking, a fair fight. The annual friendly tussle between Germany and the UK adds spice to the competition for both teams. Such rivalries happen at all levels; the Scandinavian nations compete among themselves, as do the Latin American countries for example.

As usual the year began with a training camp at Bath for students new to IMO preparation. Two participants of that event, Saul Glasman and Jack Shotton, were to go on to figure in our IMO team in Mexico. During the year our IMO squad of 20 were fed the usual diet of problem sheets and practice examinations. The next camp was held in Tata, Hungary, together with Hungarian students over the new year. I think the high point of that camp was when the Hungarian deputy, Sandor Dobos, illustrated his lecture on projective geometry by picking up the overhead projector, and varying the shape of a triangle by shining the image at the ceiling and onto the walls. Do not try this at home.

The camp at Trinity College Cambridge at Easter was also a success, and Sandor flew in as a guest trainer. As always we were blessed with a dazzling array of training talent. David Monk returned after a break of a few years, and in harness with Christopher Bradley, set about giving our students a serious taste for geometry. A large number of former team members gave sessions, along with former team leaders Adam McBride and Tony Gardiner. Following two rounds of the First Selection Test, we designated a squad of 8 for the final push. At the end of May we met at Oundle school for a camp and more selection tests. Eventually the 6 students of the UK team were selected. They were Saul Glasman, Latymer School, London; Nathan Kettle, Hitchin Boys School, Hertfordshire; Andre Kueh, Bromsgrove School, Worcestershire; Matthew Lee, Robert Smyth School, Market Harborough, Leicestershire; Martin Orr, Methodist College, Belfast and finally Jack Shotton, Portsmouth Grammar School. The two reserves were Tom Eccles of St Paul's School, London and Alex Smith (for the second year running) of King Edward VIth Five Ways, Birmingham. Here are the questions of the 46th IMO:

Day 1

Problem 1 Six points are chosen on the sides of an equilateral triangle ABC: A_1, A_2 on BC; B_1, B_2 on CA; C_1, C_2 on AB. These points are the vertices of a convex hexagon $A_1A_2B_1B_2C_1C_2$ with equal side lengths. Prove that the lines A_1B_2, B_1C_2 and C_1A_2 are concurrent.

Problem 2 Let $a_1, a_2, \ldots$ be a sequence of integers with infinitely many positive terms and infinitely many negative terms. Suppose that for each positive integer n, the numbers $a_1, a_2, \ldots, a_n$ leave different remainders on division by n. Prove that each integer occurs exactly once in the sequence.

Problem 3 Let x, y and z be positive real numbers such that $xyz \geq 1$. Prove that

$$\frac{x^5 - x^2}{x^5 + y^2 + z^2} + \frac{y^5 - y^2}{y^5 + z^2 + x^2} + \frac{z^5 - z^2}{z^5 + x^2 + y^2} \geq 0.$$

Day 2

Problem 4 Consider the sequence $a_1, a_2, \ldots$ defined by

$$a_n = 2^n + 3^n + 6^n - 1 \quad (n = 1, 2, \ldots).$$

Determine all positive integers that are relatively prime to every term of the sequence.

Problem 5 Let $ABCD$ be a given convex quadrilateral with sides BC and AD equal in length and not parallel. Let E and F be interior points of the sides BC and AD respectively such that $BE = DF$. The lines AC and BD meet at P, the lines BD and EF meet at Q, the lines EF and AC meet at R. Consider all the triangles PQR as E and F vary. Show that the circumcircles of these triangles have a common point other than P.

Problem 6 In a mathematical competition 6 problems were posed to the contestants. Each pair of problems was solved by more than $\frac{2}{5}$ of the contestants. Nobody solved all 6 problems. Show that there were at least 2 contestants who each solved exactly 5 problems.

On each day, the students had 4 hours 30 minutes to address the problems. Here are the results of the UK team. The cut-offs for bronze, silver and gold medals were 12, 23 and 35 points respectively. They obtained one gold, three silver and two bronze medals, our best medal harvest since 1996, according to the following table (we keep our traditional UNK codes, though the local organizers used GBR; the hunks from UNK will not have this):

	$P1$	$P2$	$P3$	$P4$	$P5$	$P6$	Σ	Medal
UNK1 Saul Glasman	2	7	0	7	3	1	20	Bronze
UNK2 Nathan Kettle	7	7	7	7	3	2	33	Silver
UNK3 Andre Kueh	3	7	7	7	1	7	32	Silver
UNK4 Matthew Lee	1	7	0	7	7	1	23	Silver
UNK5 Martin Orr	7	7	6	7	7	1	35	Gold
UNK6 Jack Shotton	2	7	0	7	0	0	16	Bronze
	22	42	20	42	21	12	159	1G, 3S, 2B

Collectively the team scored 159 points giving the UK an unofficial ranking of 13/91. This year the UK retained its 2004 ranking of 3rd in the EU, after Hungary and Germany (passing Poland but passed by Germany). We improved our position in the Commonwealth from 3rd in 2004 to 1st place in 2005. Nations performing very well this year include Italy (120), which unusually managed to finish ahead of France (83), and Denmark (69) which took the Scandinavian championship. Peru (104) have made dramatic strides this year, and almost snatched the Latin American championship from Colombia (105). Luxembourg was the leading Grand Duchy and the UK topped the table of those nations which include a conjunction in their full title. Hungary get the landlocked crown, and the leading country whose rank (54th) exceeds its score (50) is Macedonia. Japan (8th) is the leading monarchy. The dominant nation with a prime score is Romania (191), and the table-topper among the nations with score which is not *quadratfrei* is Russia ($212 = 2^2 \cdot 53$).

Here is the unofficial table of the top 30 countries (out of 91) in 2005.

1.	China	235	11.	Bulgaria	173	21.	Moldova	130
2.	USA	213	12.	Germany	163	21.	Turkey	130
3.	Russia	212	13.	United Kingdom	159	23.	Thailand	128
4.	Iran	201	14.	Singapore	145	24.	Italy	120
5.	Korea	200	15.	Vietnam	143	25.	Australia	117
6.	Romania	191	16.	Czech Republic	139	26.	Kazakhstan	112
7.	Taiwan	190	17.	Hong Kong	138	27.	Columbia	105
8.	Japan	188	18.	Belarus	136	27.	Poland	105
9.	Hungary	181	19.	Canada	132	29.	Peru	104
9.	Ukraine	181	20.	Slovakia	131	30.	Israel	99+

The rankings of selected other countries are France 32nd, India 36th, New Zealand 38th, Ireland 51st, Spain 58th and South Africa 62nd. One question on the Hebrew paper was not printed correctly. This impeded two students and a small indefinite quantity should be added to the Israeli score, so their true position is given by a probability distribution.

The quality of hospitality and organization delivered by our Mexican hosts was quite exceptional. Throughout the IMO, hurricane Emily bored across the Caribbean toward us, and hit the Yucatán peninsula on the very day that the closing ceremony was scheduled. Shelters were constructed in windowless function rooms, and events were rescheduled and relocated at very short notice, but this all happened with remarkable smoothness. Congratulations Mexico, and many thanks.

Leader's Diary 2005

June 23 Ceri Fiddes, UK Observer for IMO 2005 and deputy UK leader designate for 2006 has been thrown from and subsequently under a horse. She has a broken leg and is ruled out of IMO 2005 by her doctors. This seems an over-reaction. All she had to do was to say that she didn't want to come.

June 24 We have passport problems. I had decided to upgrade my battered and mangled document for a neat new one designed to please the most discriminating US immigration official. I applied in good time at the start of June but an unexpected tangle in the process (don't trust the Post Office checking service) has me starting to get nervous. However, we now discover

that Andre Kueh's passport is not machine readable. In order to pass through the USA he will need either a visa or an upgraded passport. We have a week to sort this out.

June 28 Joy. My shiny new smooth unbattered passport arrives, and Adrian has an appointment on June 30th in the afternoon with a view to getting Andre a new passport. This will involve Adrian first driving to Andre's school to pick up his application form, then to Bath to get my signature, and finally to London to get the new passport using the only passport interview slot available at any passport office in the United Kingdom this week.

July 1 Adrian picks up Andre's passport with less than 24 hours to spare.

July 2-6 The team gather at 10am at Gatwick Airport. The Shotton family make a surprise donation of a team mascot, an orange cuddly toy in the form of large Newt who answers to the name Newton. Our Continental flight was on time, and we arrived at George Bush International in good spirits and ready to face the cheerless footsoldiers of the US Department of Homeland Security. Their main tactic is to ask you to prove that you plan to leave again. In the age of ticketless travel this is a good wheeze for inflicting grief on tired and confused travellers. The new fingerprint machines are pretty useless; you have to press down with extraordinary force before Mr Sour is what passes for happy in this context.

Rice University have sent a bus to meet us. It is blessedly air-conditioned and fit for purpose. We are whisked to campus, where we meet students who helpfully show us our rooms, give us keys and so on. As expected, there is no bedding, so a small party goes to Wal-Mart to purchase 8 sets of their cheapest.

The accommodation is excellent and we have our own dedicated and magnificent cook in the form of Chef Chenko. This fellow goes through life apparently unaware of A. C. Milan's European footballer of the year. He has clearly been briefed to pander to us, and produces an endless stream of giant meals fit for gridiron footballers. He never ceases to be disappointed at the meagre indentations we are able to make in his food piles. I contact Jason in the Housing Department who has arranged things for us. One curiosity about this substantial university is that it does not have a shop which sells things a student might want, such as soap, shampoo or a toothbrush. You can purchase baseball caps without difficulty, but they are of limited value in the context of personal hygiene. I put this problem to Jason, who avers that there is no such shop nearby. He promptly drives me to Wal-Mart himself. Nice one Jason.

The team soon settle into a daily routine of exams, food piles and problems sessions.

July 7 It is Nathan's 18th birthday, and the worst kept secret of the camp is that we will be watching the Houston Astros play the San Diego Padres at the Minute Maid baseball stadium tonight. There is the problem of how to get there. We ask various people on campus, who struggle in turn with the idea that we don't have cars. Someone helpfully suggests that we take the tram into town. I ask if we could then take a taxi, and receive the reply that this would probably work. I hit the internet, and drag up a map of downtown Houston. I turn up a winning strategy: take the tram into town, then walk half a mile to the stadium. This works. It takes us past the Houston Court House, and consequently we walk past endless bail bond emporia.

We queue up outside the ground, and our bags are searched. It turns out that it is not allowed to bring consumables into the stadium unless they are sold by the sponsors. Saul has his water confiscated. We are amazed when we get inside. Imagine a premiership stadium with a roof, and then have it air-conditioned when outside the weather is fit only for salamanders. On one wall is a 19th century style railroad, and a full size train will run up and down the track to celebrate home runs.

Adrian has been giving us fastidious tutorials on all aspects of baseball, but I will not show off my new found knowledge here. Suffice it to say that the game is a mixture of rounders and testosterone. The fans are mainly bluecollar, i.e. American working class. We sit among many very genial Homer Simpsons. Manners are exemplary, and little kids are everywhere. Earlier today four bombs had gone off in London. The match begins with the Union Jack on screen, the British national anthem and a silence. There is much mutual hushing as this crowd quickly brings itself to orderly attention. There is not a flicker of doubt, as far as this crowd is concerned, we are in the early 1940s again.

The match is delightful. It is more like test cricket than I had imagined. Instead of the tedious and repetitive bland dramas of basketball, there are long periods of inaction when the crowd fetch food and drink, punctuated by moments of extreme violence as mighty home runs are struck. There are enough ways to deliver the ball to rival Shane Warne's repertoire.

July 8 Today I must leave to join the jury. In these health and safety rich times, it is unthinkable that Adrian should look after the team on his own. We have an excellent fix for the absence of Ceri; Thomas Barnet-Lamb flies down from Boston where he is doing a Ph.D. at Harvard. We pre-position

senior wranglers throughout the world for use in such emergencies. I pass Thomas without meeting at George Bush International. Thanks.

In the departure lounge I meet several IMO friends, including Bogdan who used to be from Romania but now turns out to be the IMO observer from Pakistan. When the Irish leadership turn up we lock verbal horns in the usual way. The American leader Zuming Feng turns up, and the Azerbaijani and Slovenian leaderships. The flight south to Mérida is uneventful, and we are met with smiling Mexican faces. There is a non-trivial bus journey to the Yucatán Reef Hotel. Leaders arrive in very substantial numbers, very late. We queue up to register and get our keys. It turns out that this process is ponderous, and there is only one guy working the desk. Personally, this was easily the worst moment of what was otherwise a very well organized IMO; if only someone had pointed out the truth – that there was a free bar next door, and we could sit and have a margarita instead of waiting in line and in the heat, then there would have been 30 much happier bunnies. No matter, from that moment on it all got much better.

July 9 and 10 I struggle with the questions as usual. There are some nice (relatively) easy number theory problems, and lots of medium geometry ones. The algebra list is woefully short and there are lots of combinatorics questions. We get the solutions far too soon, and the jury begins its deliberations. We choose questions 1 and 4 first: a number theory question and a geometry question which is falsely perceived to be fairly easy. If we had been given more time to struggle with this question, its subtlety might have become clear. It will turn out that there are many false trails that can be followed in this question, and it would have been better classified as of medium difficulty. The harder questions are selected next, and since there is a good combinatorics question, the obvious thing is to select what has been classified as the hardest algebra question. Many leaders don't know the technique known as Muirhead's inequality, and some of those who do seem to think that it is an advanced exotic technique. In fact many of the IMO students are networking to great effect, partly with the help of the twin internet sites *Mathlinks* and *AoPS – the Art of Problem Solving*, and they are sharing ideas and techniques independent of their national training regimes. The IMO problem selection committee and jurors will have to monitor these sites to see what ideas the students are sharing. It turns out that Muirhead's inequality might be better known among the students than parts of the jury.

July 11 The students are arriving as we finalize the paper. This has been a swifter process than usual. Could this be related in any way to the almost

always open free bar? In the evening I prepare for the English language committee which I will chair next day. This means I slope off to my room early and try to cast the questions in perfect English myself, in order to have something to start with.

The committee meets first thing in the morning. These days everyone is welcome in the ELC, including its most important member, the leader of France. We like to have simple sentences in IMO questions; ones which ideally can be translated almost word for word into as many languages as possible. French is rather special, and does not allow the rather free word order and grammatical latitude of English. Therefore the English language version has to be designed so that it can be easily translated into French. As each English sentence is suggested, we turn to FRA7, Claude Deschamps, to receive either a blessing (a shrug which indicates that all is well) or a sad shaking of the head which indicates that a particular piece of Anglo-Saxon thuggery simply cannot be expressed in French.

The leader of Ireland IRE7 is full of, well, suggestions. It seems best to install him as committee secretary, a position always reserved for a person likely to cause trouble if not kept busy. IND7 comes up with a suggestion for rewording Problem 5. I punish him by making him write it out in full. This keeps him busy while we discuss Problem 6. In the end he produces something rather good. This is all rather good fun. One advantage of coming from multicultural UK is that one is used to listening to English expressed in diverse accents from all over the world. Now, these accents are not necessarily mutually intelligible, and one or two members of the ELC speak English in such a way that few people understand them. Part of my job is to repeat their sometimes excellent suggestions in standard English so that everyone can follow, but also without drawing attention to the problem. This has its comic side.

When all this is done, we do it all again but in front of the full jury. I carry on in the chair. I now have the advantage that the ELC should be on board, so that they can't really stand up and start making radical suggestions to reword the questions because they have signed up to the ELC version. Nonetheless, there is still much fun to be had, especially with suggestions flowing freely from NZL7, a native Russian speaker. We finish in time for lunch, and we try to type up the definitive English version as quickly as possible.

In the afternoon the versions of the other official languages are approved; French, German, Russian and Spanish, and overnight the full babel of pa-

pers is produced. There is a banquet which gets to stop early because of high drama; KOR7 has discovered that Problem 5 is broken in an extremal configuration. The jury fixes the language by inserting the word "interior" so that children can sleep more easily in their beds.

July 12 More drama in the morning: non-verbatim translations of wording into two languages have produced versions which give some students a minor advantage. This is picked up by at least two polyglots, and these versions are fixed.

The opening ceremony includes only finite quantities of folkloric dancing, for which we are all grateful. One part of it is actually rather good, with spinning dancers balancing drinks in their sombreros. That is a real skill. Also the speeches are in Spanish, and are mercifully translated into English on screen rather than being repeated. Good choice Mexican organizers! Our team looks neat and impressive in their uniforms. The South African leader remarks to me that they look very academic. I seek to give the impression that they are dilettantes and dissolute playboys without a hope in hell; there is no need to raise expectations.

We listen to the co-ordinators' proposals for marking schemes. These are mainly fine but there are difficulties with Problem 3. When the jury explain the complications of the suggested system, the co-ordinators go away and produce a much clearer (and fairer) scheme.

July 13 The exams begin. For the first half hour the students are allowed to ask questions of clarification. These should be faxed to the leaders' site and answers to each question should be approved by the jury. Unfortunately there is a communications failure, and we don't receive the questions until after a significant but not disastrous delay. Mercifully there are no outright comedy questions from the UK this year.

That evening the students' solutions arrive at the leaders' hotel. A first reading has me feeling rather pleased. UNK2 may well have had a perfect day, and UNK5 is not far off. Everyone has got a question out. Late at night, just before the bar shuts at 2am, I slip down for a celebratory rum and coke wearing my best poker face. I expected to find the bar full, but all the other leaders are either asleep or working on scripts. The only other IMO person there is a well-known figure of firm opinions, exemplary intellectual standards and a delicious manner which may well give him the role of a Bond villain in an 007 movie one day. "How did your students do on Problem 3?" he asks. I reply that we have at most three full solutions. "Three!!?" he replies, lifting an eyebrow somewhere close to Polaris. "At most three, I can't

be certain yet" I reply. There is a pause. He goes on, "I have looked at the scripts of a *good* country, and they only have two correct solutions. When you say at most three, does this this include zero?" (he manages to suppress the implicit "Mr Bond?"). "Of course", I reply.

July 14 Today the communications are working and the jury disposes of the students' questions in short order. We then decamp to Mérida in a fleet of buses, and meet our students as they leave the exam. The students are all pretty pleased. They have all solved at least two problems so we should have six medals again, and this is excellent for morale. Three students, Nathan, Andre and Martin, have all done the best part of five problems so we will be in the hunt for gold medals we hope. It is delightful to see Adrian again. He has been ill for the past 24 hours and apparently almost vomited over the students after the first paper.

Adrian and I are in the leaders' hotel, which is disappointingly only a little superior to the hotel which houses our students and their splendid guide, Sandra. Our place has only one indoor waterfall and therefore compares unfavourably with the leaders' hotel at the Washington IMO of 2001. Still, sometimes one must suffer for mathematics, and I try out my treble bed.

The students can now relax and start to make friends with the other teams. They will have many adventures, including Jack Shotton having a fish land on his head while he was swimming, and Matthew giving free rein to his humour by cheating at all possible games. Andre and Nathan seem to be popular with a very non-empty subset of the girls. Andre uses boyish charm, whereas Nathan deploys his impressive height. Saul is busy setting new records for losing hotel keys, and Martin is quietly confident.

July 15 and 16 The co-ordination is brilliant. The co-ordinators have clearly read our scripts in detail, and for the most part are suggesting correct marks. In our co-ordination for Problem 3, the co-ordinators incorrectly imagine that there is a hole in Nathan's solution. After careful analysis, they back down and he gets full marks. The biggest difficulty concerns Andre's solution for Problem 1. It is a non-standard attempt, and involves an unusual clinch in that he deploys the fact that a triangle with Brocard angle of 30 degrees must be equilateral. We arrive brandishing a text-book in which this fact is stated, and pronounced well-known. However, his solution is flawed elsewhere, and it is a matter of working out what it is worth since it is outside the marking scheme. We are hoping for 5/7 but in fact, after consultation with the problem captain, it gets 3/7. We cannot complain because there is a logical case for this mark.

There is also minor grief with Problem 6. Andre has a solution which is superficially similar to a flawed solution that the co-ordinators have seen earlier, so the co-ordinators are very suspicious. Adrian is taking the lead on this question. We go through it line by line. Time after time they home in on a particular line and ask how it follows from the preceding analysis. Time and again Adrian quietly explains how it works. After half an hour, they begin to realise that Adrian knows exactly what he is talking about, and following the detailed textual analysis they eventually acknowledge that it is worth 7/7.

Usually, during co-ordination, marks are put up as they become known. Ideally this should happen both at both the students' site and on a wall outside co-ordination. This adds to the drama, and winds the tension up as leaders and deputies try to work out medal boundaries, and whether or not they will finish above their traditional rivals in the unofficial ranking. On the first day, no marks go up at all which is very frustrating, but on the second day marks start to appear. Traditionally Gordon Lessells, the Irish deputy, uses his bookmaking skills to forecast medal boundaries with astonishing accuracy by means of his little book and bespoke undecipherable notation. This year he makes an uncharacteristic slip (for which he has a predictable raft of excuses) and forecasts the bronze boundary well above the correct answer. In the evening the jury meets very late to set the medal thresholds. There are 12, 23 and 35. Martin has an IMO gold to sit beside his Informatics Olympiad gold, Nathan and Andre have strong silvers, and Matthew has squeaked a silver medal. Saul and Jack have solid bronzes.

It is sad news that the Irish star Fiachra Knox has missed a gold medal by just one mark. Still, he obtained the first ever silver medal for the Irish Republic, and both he and the rest of the Irish team made friends throughout the IMO.

Having scored fairly well on the geometry questions, now is the time to peddle the new UKMT publication "Plane Euclidean Geometry" by Christopher Bradley and Tony Gardiner. A box of 20 steaming copies has arrived from the UK. I put them on sale, and am almost trampled in the rush. We sell out immediately. Readers interested in this competitively priced thick volume of geometric delights, written with the needs of IMO students in mind, should visit `http://www.ukmt.org.uk/`

All this time, CNN has been reporting Hurricane Emily as she makes her way toward us, gathering strength en route. The Yucatán minister of tourism visits the leaders' hotel to assure us that everything will be fine,

so we know that we are in deep trouble. There is no 'our man in Mérida', but there is a consul in Cancún. Since Cancún may become matchwood, Adrian goes straight for the Embassy in Mexico City. They are splendid, give sound advice, and promise to send a rescue mission in the event that the whole province is demolished. We activate Joseph Myers on the IMO hotline in Cambridge, and he phones round the parents of the team members to reassure them that we have a plan to ride out the hurricane.

July 17 The governor of Quintana Roo has ordered the evacuation of the neighbouring coastal city of Cancún, but we are in a better situation. The IMO city of Mérida is inland, so will be proof against the storm surge. Winds of about 200 mph are expected from about 2am tomorrow. Country people living in wooden houses have every reason to be very afraid, but we are staying in robust hurricane resistant buildings, so if anyone in the town is safe, we are. The leaders' hotel is next to the students' hotel, but it will not be possible to pass between these buildings in hurricane force winds.

The team and Adrian shoot off in the early morning to visit a Mayan pyramid, and I head to Wal-Mart to get hurricane supplies. I manage to get plenty of bottled water, biscuits and chocolate but the shops have sold out of torches and lamps. The emergency generators in the hotels should kick in if necessary.

The excursion returns just after lunch, just as the weather is starting to deteriorate. After supper Adrian and I decamp to the students' hotel for the night. It is not that we think that the team will be in immediate danger, but we prefer not to be separated during the storm. Adrian has more helpful chats on the phone with the British Embassy. Don't begrudge your passport charges; the money is well spent.

When we join the team they are in a very large windowless room with hundreds of other youngsters. This is going to be a hurricane slumber party, and I can already tell that it will be awful. Photographs are available on the net via *Mathlinks*. Valentin is pushing his luck (yoga position indeed).

July 18 It is midnight. There are table tennis tables, table football machines and hockey tables in the shelter. When the lights are turned out the students carry on playing the games in the murk. At first this is funny, and then very funny, and finally it gets annoying, and eventually very annoying indeed. The whole room turns against these clowns, and the room is filled with a hiss as we try to 'shhhh' these gamers off the tables. Most desist, but a hardened few carry on. Finally, our team member Nathan Kettle jumps up and heads purposefully across the room toward the moral dwarves in the corner. It

seems likely that Nathan will thump one or two of the miscreants, so I leap up and follow him. While I know that it is my duty to restrain him, a voice is whispering in my ear that if I arrive a few seconds too late, perhaps it will be no bad thing. However, Nathan is a gentleman, and when he arrives at the tables he merely give an impromptu lesson in loud Anglo-Saxon. He retires, and the scum at the tables just carry on. I arrive, and without raising my voice I put on my best psychopathic look, and ask the nearest table footballer which nation he is from. He tells me, but I cannot know for sure that he is telling the truth. I tell them to stop and fold my arms. They back off, and I stand at the tables for about 5 minutes. It is clear what will happen. As soon as I retire to the far end of the room the noise starts again. I give in, and move to the corridor in the expectation that the forces of natural selection will operate in the function room, and that the table-footballers will eventually be lynched or beaten to a paste. Outside I find one of the local organizers. I tell her the problem and she sends in guides to take care of the gamers.

I find a chair to sleep in near the atrium. Finally the winds arrive and a sound like the rushing of a train comes from the roof. However, the noise starts to abate fairly quickly. It turns out that at the last moment Emily has changed direction, and she has only clipped us rather than rolling straight through us. Midmorning we are allowed out, and the students are allowed back to their rooms. I am delighted to find that Mérida has got off very lightly.

It must have been heart-breaking for the local organizers to have to cancel the outdoor farewell banquet that evening, and instead we have an improvised medal ceremony moved to the exam hall. This is a great success, and a Mexican band walks through the hall playing stirring music. Perhaps the high point of the ceremony is when a Moldovan student is awarded a special prize for his stunning solution to Problem 3. I am standing next to the Moldovan leader, and to say that he is pleased does not really capture his mood.

The local organizers announce that there will be an all-night party at the student hotel, and that teams catching early flights might as well forget about sleep. This is all very well in principle, but we are all feeling mangled from sleeping on the floor the night before.

Blofeld softens for a moment, and congratulates me on the performance of the British team. He singles out the excellent performance of ‘the English girl’. Now, astute readers may have noticed that for once we don’t have one.

I later realise that he is probably confusing the provenance of the impressive NZL4.

July 19 Our team sensibly snatch a few hours bedrest before the flight back. This involves a long wait between flights in Houston (where we say farewell to Andre who makes his own way to Singapore). When we arrive at Gatwick I approach immigration last. The officer won't let me in and asks me to take a seat. I assume that my new passport has been incorrectly activated or some such thing, but then a couple of detectives move in. It seems that someone with the same name as me is wanted for murder. After I prove where I live, everyone relaxes and they let me in. Such are the perils of being called Smith. We are met by happy families. The Lee family is extraordinarily pleased to see Matthew (perhaps they have forgotten what he is like). Mrs Kettle is stuck in traffic so Nathan, Martin and I go for breakfast and after a while Mrs Kettle joins us. Finally Martin and I are left alone. He has to catch a flight to Belfast in a few hours, and I bid him farewell. I think he is a bit pleased that his mark is higher than Paul Jefferys's gold medal score in 2004.

Full team scores: Albania 44, Argentina 65, Armenia 82, Australia 117, Austria 74, Azerbaijan 59, Bangladesh 3, Belarus 136, Belgium 74, Bolivia (2) 0, Bosnia & Herzegovina 49, Brazil 82, Bulgaria 173, Canada 132, China 235, Columbia 105, Costa Rica 37, Croatia 82, Cuba (4) 54, Cyprus 14, Czech Republic 139, Denmark 69, Ecuador 17, El Salvador 25, Estonia 68, Finland 49, France 83, Georgia 80, Germany 163, Greece 58, Guatemala (3) 6, Hong Kong 138, Hungary 181, Iceland 23, India 81, Indonesia 70, Iran 201, Ireland 55, Israel 99+, Italy 120, Japan 188, Kazakhstan 112, Korea 200, Kuwait (5) 3 Kyrgyzstan 46, Latvia 62, Liechtenstein (3) 4, Lithuania 53, Luxembourg (2) 3, Macau 38, Macedonia 50, Malaysia 15, Mexico 91, Moldova 130, Morocco 18, Mozambique (5) 2, Netherlands 62, New Zealand 77, Norway 38, Pakistan 11, Paraguay 12, Peru 104, Phillipines 30, Poland 105, Portugal 27, Puerto Rico 8, Romania 191, Russia 212, Saudi Arabia 3, Serbia and Montenegro 75, Singapore 145, Slovakia 131, Slovenia 49, South Africa 39, Spain 46, Sri Lanka 32, Sweden 42, Switzerland 70, Taiwan 190, Tajikistan (3) 3 Thailand 128, Trinidad and Tobago 13, Tunisia (3) 9 Turkey 130, Turkmenistan (3) 18 Ukraine 181, United Kingdom 159, United States 213, Uruguay (5) 37, Venezuela (2) 15, Vietnam 143.

I thank everyone who helped in the vast collective effort which goes into UK IMO training and support. The team delivered the goods, very near to the upper limits of our most optimistic expectations.

As well as thanking everyone who helped train our team, I would like to

thank the reserves who played a vital role. We are also grateful for financial and other support from the Department for Education and Skills, the United Kingdom Mathematics Trust, the microelectronics company ARM, The Royal Society, the Bolyai Society of Hungary and the publishing house Springer Verlag. We are also grateful to all the administrators and secretaries who have helped us in unseen ways, in particular Miss Angela Gould who is now leaving UKMT having helped IMO preparation in many ways in recent years.

Finally, I am sure that all recent UK IMO squad members and trainers would wish to congratulate the Hungarian deputy Sandor Dobos and Miss Tímea Tóth on their recent marriage.

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