The 43rd International Mathematical Olympiad Leader's Report
by Arthur Baragar

I'm sipping a beer, sitting on the patio of a pub in Dunblane, overlooking the river. The water is stained brown by the peat bogs it drains through. With me are Bill Sands of the University of Calgary, and Graham Wright, Executive Director of the CMS. We are in Scotland for the International Mathematical Olympiad - I am leader of the Canadian team, Bill is observing, and Graham came over for a couple of days to Chair the meeting of the APMO (the Asian Pacific Mathematics Olympiad, which is currently being run by Canada).

Over the past few days, the International Jury (the leaders of the 84 competing countries) selected the six challenging problems that would make up the 43rd International Mathematical Olympiad. When we first arrived in Scotland, we were given a short list of twenty-seven problems and twenty-four hours to solve them, a daunting task when one thinks of it. After all, the students are given nine hours over two days to do six questions - and they are quite often better problem solvers than we are! On the second day, we were given the official solutions and we began our selection process. The meetings took place in English, though motions were translated into the four other official languages of the IMO - French, German, Russian, and Spanish. Once the exam was set, it was translated into the five official languages, and then the appropriate leaders translated the exam into the language of their students. In a matter of hours, the exam was translated into over forty languages! That we were finished with our task is a testament to the skills of this year's Chair, Adam McBride. Our schedule had been rushed, but not overly so, and we were enjoying a well deserved night of fresh air.

The topic of conversation turns to the prospects of the Canadian team. I am optimistic, but cautious. The training went well and the students are well prepared, but ... well, there are 'buts.'

Our team training took place over two weeks in St. John's, Newfoundland. The location was ideal. Our hosts, Nabil Shalaby, and his colleagues from Memorial University, were excellent. The weather and setting was quite pleasant, and the distractions were minimal. We worked hard, but still found the time for a little recreation, including a hike up Signal Hill and a whale and bird watching tour. The latter was a highlight that I'll never forget.

Back in Dunblane, we finished our beers and treked back up the hill to our hotel - a grand old building built on the location of a natural spring. We enter the haze of the lobby, a harsh reminder that the rest of the world smokes, but also a reminder that the rest of the world is here. It is quite incredible to be in the company of representatives of 84 countries.

The Competition

The competition is held in two parts over two days. Each day, the students have four and a half hours to solve three problems. This is, of course, the most exciting time for the students. The Deputy Leaders share the excitement of the students when they leave the exam, but it's not so exciting for the Leaders. We are still sequestered, since we know the contents of the exam. We must wait until late evening before we have any idea of how well our students are doing. That's when we receive the team's scripts from that day.

Excitement builds as I read them. Roger Mong from Don Mills Collegiate Institute in Toronto, solved all three problems from the first day. His solution to Problem 3 follows the clever "Bulgarian solution," which is a prettier solution than the official solution. Roger is an energetic young man who has the ability to divert his teammates from their tasks and still solve the problems assigned him. He was on last year's IMO team, and we have high hopes for him this year. No one else on the team got Problem 3, but that doesn't worry me. It is a tough question and I do not expect many to solve it. The team did well on the other two problems - it looks like eight or nine complete solutions.

On the second day of the exam, the jury's isolation ends. We travel into Glasgow and meet the students as they leave the exam. I anxiously quiz the students about their performance. Roger is disappointed, which worries me, since Roger is not one for understatement. I press for more details and discover that his disappointment is that he didn't solve Problem 6. In contrast, Olena Bormashenko, also from Don Mills Collegiate Institute, is thrilled with her performance. At our summer camp, she sometimes expressed doubts that she belonged there, a suggestion that we pretty much ignored. She now wonders if her performance is good enough for a bronze. I don't commit myself.

Coordination

The grading of the scripts is a procedure called coordination. The coordinators are mathematicians from the host country. The leaders and deputy leaders of each team look over their team's scripts and decide on grades. They bring their scripts before the coordinators and describe what the students have done that deserves the grade they suggest. Between them, a final grade is agreed upon. It is a remarkably workable procedure.

We first coordinate Problem 5, a functional equation problem. Such problems are usually very difficult to grade because students who do not solve them often find relevant identities that get buried amongst endless calculations. Fortunately, four of our students solved this problem, so there is not much scavenging to do. In fact, with respect to this problem, we were quite lucky. Naoki Sato, our Deputy Leader, assigned a problem during the summer camp that was directly

relevant to this problem. This was done after I left, so I was unaware of the advantage our students had (and hence, there was no conflict of interest when the problem was selected). But coordination still holds a surprise for us. I expect to get a seven (full marks) for Olena's paper, but one of the coordinators expresses skepticism over a step. I patiently wait for her to figure it out ... but no, she points out a gut wrenching error. It's the type of error that drives professors batty when they see their students make them, and here is Canada's cream making the same mistake (and I didn't catch it!) My heart sinks and I begin to wonder if I can even salvage a five for this paper. I timidly ask for that grade when Naoki asserts his belief that it is worth at least a six, ... and they agree! What a relief.

By evening, we have coordinated three problems and I know approximately what to expect on the other three. I send an email to Graham Wright (who had returned to Canada a few days earlier) to let him know that I expect a gold, a silver, and three bronze medals. Naoki and I decide to make the trip out to the students' residence to congratulate them.

The students' residences are quite comfortable. They all have individual rooms and share a kitchen, lounge, and washroom. We find the students in good spirits. Olena asks again whether she'll win a bronze. Grinning, I avoid the question. I think she'll get a silver, but don't want to be proved wrong.

This is our first meeting with the students since coordination began. We've taken a good look at the scripts, and have a few questions for some of them. Ralph Furmaniak has a partial solution to Problem 6 that is worth at least two points, but he introduces an idea that might make it worth more. I want to know what he was thinking. Ralph hails from London, Ontario, where he attends the John Paul II Secondary School. He thinks better on his feet (literally) and I even once warned him, in jest, that he would have to write the Olympiad sitting down. He nervously shifts his weight from one foot to the other, trying to explain his ideas on Problem 6, but I don't see anything useful.

By noon of the next day, our six perfect scores for Problem 4 are posted and some of the leaders begin to notice our strong showing, though I am still a bit nervous. Hans-Dietrich Gronau, the Leader of the German team, offers his congratulations and asks me what I expect our final score to be. Around 140, I reply, and I ask him how the German team is doing. One hundred and forty four. I am floored. We're up there with Germany! I was proud of how well our team was doing, but until then, I had no idea just how well. I held in my hands the scripts for Problem 6. With renewed energy (could we actually catch up with Germany?) I looked them over one more time, and suddenly, I understood what Ralph was trying to tell me. I went into coordination looking to get a three for his script, and I did.

The Results

The scores of each country are slowly filling up, organized by country and not in any way that helps me with the big picture. I seek out Gordon Lessells of the Irish team and Michael Albert of the New Zealand team. (Some of you might remember Michael - he was on the very successful Waterloo Putnam team from the early '80's.) Gordon is organizing the data into a sensible fashion and they both offer their analysis. By evening, Gordon is confident we will be twelfth, and places medal cutoffs to within a couple of points. It is now clear that our team will get a gold medal, and at least three silver medals and a bronze medal. Our team includes two students at the lower end of Gordon's estimates. If we are lucky, then Ralph might also get a bronze medal, and Robert Barrington-Leigh might get a silver instead of a bronze medal. Robert attends Old Scona Academic High School (my old high school) in Edmonton, Alberta, and will be eligible for next year's team.

At the Awards Ceremony, Roger Mong is awarded a gold medal that is presented to him by the Princess Royal. He is tied for 12th overall (there are three perfect scores and 4th place is a mere two points higher than Roger's score). Olena Bormashenko, Alex Fink, and Tianyi (David) Han won silver medals. Alex is from Calgary, where he attended Queen Elizabeth High School. Though he is the youngest member of the team, his ambitions to attend university this year will make him ineligible for next year's team. David is from Toronto, where he has graduated from Woburn Collegiate Institute. Robert Barrington-Leigh won a bronze medal with a score that is one point shy of the cutoff for a silver medal. Ralph Furmaniak received an honourable mention for his perfect score on Problem 4, and has a score that is one point out of the medals. A total of 479 students competed and just under half (232) get medals. Of those, approximately a third win silver medals and a sixth win gold medals.

Our 'unofficial' team score is 142 (this is an individual competition, not a team competition). We are tied with Hungary for twelfth place, one point behind Iran, and two points behind Germany. It is Canada's best showing ever!*[1] The first nine countries are China (212 points), Russia (204), USA (171), Bulgaria (167), Vietnam (166), Korea (163), Taiwan (161), Romania (157), and India (156). We handily beat the teams we usually compare ourselves with: Japan (tied for 16th with 133 points), France (19th, 127), Australia (26th, 117), the United Kingdom (27th, 116), and New Zealand (tied 35th, 82).

I want to again congratulate the team for doing so well, and thank them for representing Canada with distinction. It was a pleasure working with them, and I look forward to hearing of their future successes.

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[1]This claim deserves an asterisk. In 1981, Canada placed 7th out of 36 nations; in 1988, we were 10th out of 49; and in 1990 we were 11th out of 54.