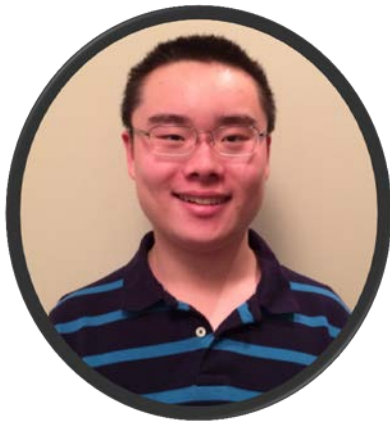




Canadian Mathematical Society
Société mathématique du Canada

2015 Samuel Beatty Contestant: Kai Sun

Report on the 2015 CMO and BIRS Summer Math Camp



My journey of doing math contests all started with the hopes and dreams of competing in the Canadian Math Olympiad, or CMO. The CMO, Canada's top high school mathematical competition, is one of the three contests important to the selection process of the Canadian team for the International Math Olympiad (IMO).

Participants with excellent results at the Canadian Open Math Challenge (COMC) will earn an invitation to write the CMO; out of nearly 6000 students, approximately 50 to 60 of the top students from the COMC are invited to write the CMO. The next highest 50-75 students are invited to write the qualifying Repêchage (CMOQR). From there, another 20 students are invited to write the CMO. In 2015, 82 students wrote the CMO, and luckily, I was one of them.

The CMO consists of five difficult but very beautiful essay-style problems to be solved in three hours. Each question is worth 7 marks, for a total of 35 points and they are arranged roughly in order of increasing difficulty. Each problem is not intended to be tedious or calculation-heavy, or require any advanced theorems or concepts. Instead, each problem contains a series of difficulties which will puzzle and trick the mind until one can find an ingenious and innovative idea or approach to overcome each impediment. Then, the problem is solved.

Every question on the CMO 2015 was exceptionally nice. Problem 1 was a functional inequality defined on the positive integers. This was the perfect introductory Olympiad problem; it allowed the competitors to settle in and adapt to the nature of Olympiad problems. It was not too

hard and therefore gave many participants encouragement and hope to solve the upcoming problems. Using a clever strong induction argument on n , the problem was easily solved.

Problem 2 was a good geometrical inequality. At first glance, the inequality looks very ugly. However, after playing around with it for a while, the inequality simplifies to a straightforward inequality by using some Power of a Point and Cosine Law cleverly.

Problem 3 was an interesting combinatorics problem involving turtles moving between unit squares in a square grid. It asked for the maximum number of times the turtle can enter a row or column and therefore required you to prove the maximum and then prove that there existed a construction for which the maximum occurred. Trying



Canadian Mathematical Society
Société mathématique du Canada

small cases allowed you to pin down some properties which guided you to the solution. Problem 4 was a very beautiful problem in Euclidean geometry. The condition given was quite convoluted, but worked out nicely in the end. This problem could be attacked using many different techniques, including phantom points, spiral similarity, and projective geometry.

Problem 5, the hardest problem on the test, asked to prove an amazing number theoretic result. Almost no one was able to solve this challenging, but beautiful problem during the test.

Doing well on the CMO as well as the Asian Pacific Math Olympiad (APMO) and the United States of America Math Olympiad (USAMO), I had the honor of being invited to the prestigious BIRS Summer Math Camp.

The summer math camp was held in Banff at the Banff International Research Station for Mathematical Innovation and Discovery (BIRS). Every day, we would get up and have breakfast at around 7:00 to 8:00; our room was very prompt when it came to waking up, but the other room really liked to sleep at least an hour longer! Then, we would meet in the classroom at around 8:00 to 9:00 and either have a mock Olympiad or a lecture and problem solving session.



This year's BIRS Summer Math Camp consisted of eight members: Alex Song from Exeter NH, Kevin Sun from Exeter NH, Bill Huang from West Windsor NJ, Michael Pang from Winnipeg MB, Alexander Whatley from Houston TX, Hunter Xu from Vancouver BC, Steven Yang from Vancouver BC, and myself from London ON.

Our team leader was Jacob Tsimmerman from University of Toronto, our deputy leader was Lindsey Shorser from University of Toronto, and our leader observer was James Rickards from University of Cambridge. Moreover, we were very fortunate to have Andrew Critch, David Arthur, and Hunter Spink to join us as trainers. We had one of the most phenomenal and experienced group of trainers; Jacob and Lindsey were leaders of the Canadian IMO team in 2012 and the team came in fifth out of more than 100 countries and Jacob and James did extremely well in the IMO.



Canadian Mathematical Society
Société mathématique du Canada

After lunch, we would normally have a lecture and problem solving session. After supper, we would normally do a relaxed problem solving session or play some fun math games, most notably the stock market game that Andrew showed us. In addition to that, much of our free time was used for working on math problems. I would estimate that we did more than $2\pi+1$ hours of math every day, for a grand total of more than 50 hours of math in a week!

BIRS definitely gave the best accommodation that anyone could wish for. The rooms were enormous and spacious and the classroom was comfortable. The food was unbelievably delicious; it was a buffet and there were a huge variety of scrumptious food every day. The location of BIRS in Banff was an ideal choice; the views and sights of nature were so wonderful and pleasing.

In addition to math, we did many activities and sight-seeing in Banff. After dinner, we would occasionally play basketball or swim in the local sports facility to balance out the extraordinary food served at BIRS. We would also go on walks in the beautiful town or on hikes in Tunnel Mountain where the spectacular scenes of nature captivated us. We also went to the Banff upper hot springs. There were definitely a ton of things to do at Banff!

This last week had gone by much too quickly. It was definitely one of the most enjoyable weeks of my life and will bring many fantastic memories. This would not be possible without the support of the Canadian Mathematical Society and sponsors like the Samuel Beatty Fund; you have truly inspired and helped many of the world's future mathematicians.

I would also like to thank the trainers for helping us succeed to the extent which we did and sharing with us the many experiences and problem solving techniques that you have learned. The BIRS summer math camp is a phenomenal experience and hopefully, this experience can brighten our potential, future mathletes for many years to come!

Samuel Beatty Fund

University of Toronto

