STRANGE NEW UNIVERSE

Two Summers at Mathcamp

by Sara Sheehan

The 2004 Canada/USA Mathcamp T-shirts read, "Out of nothing I have created a strange new universe." János Bolyai was talking about mathematics, but I think he could just as easily have been talking about Mathcamp itself. For five weeks in the summer, 110 campers and staff come together to learn, teach, and marvel at some of the most intriguing and startling mathematics out there, from the Calculus Crash Course to Hard-Core Problem Solving. For me, Mathcamp was undoubtedly a strange new universe that took time to understand and explore. But I eventually came to love it.

My journey to Mathcamp began with Mathpath (a middle school summer program) 2002 at Black Hills State University in Spearfish, South Dakota. Four weeks of math in the summer might sound like cruel and unusual punishment to some, but I couldn't have been more excited. The 60 of us went to lectures in the morning, and in the afternoon we split up into groups and did more hands-on problem solving, taking turns putting our solutions on the board.

Mathpath was my first experience with peers who truly shared my passion for math, a passion that I had previously avoided discussing. It was an amazing feeling to be in a math class where everyone was focusing on the material, asking questions, and learning together. Mathpath whet my appetite for a greater variety of topics in mathematics, which brought me to Mathcamp 2003 at the University of Puget Sound in Tacoma, Washington, and Mathcamp 2004 at Colby College in Waterville, Maine.*

Team problem-solving activities sparked intense collaboration among teammates.

Finding My Depth

Mathcamp was an entirely different world from Mathpath. For the first time, I felt completely out of my league as the other students discussed theorems I'd never heard of and solved problems I didn't understand. We put together our own schedules from the multiple mathematical options available each hour of the day. Classes ranged in difficulty from one star to four stars and in length from one day to four weeks. I decided to stick mostly to one- and two-star classes, with some of my favorites being Proof Techniques, Beginning Problem Solving, Counting, and Linear Algebra. I also took some quirkier classes like Math of Juggling; Games, Gambling, and Economics; Mathematical Physics; Cheap Calculus Tricks; The Tacoma Narrows Bridge Disaster; and several lectures by John Conway, a professor at Princeton and the creator of many mathematical objects and games, including Conway's Game of Life.

Proof Techniques helped me build on methods I already knew, like proof by contradiction and the pigeonhole principle, and introduced me to new methods like induction and invariants. These methods were put to use in Dorin Andrica's Beginning Problem Solving class: every day we would share our solutions to the problems from the day before. I was amazed by the number of different ways to solve the same problem. After three of us had presented solutions, Dorin would quietly walk up to the board and show us yet another, even more elegant approach.

Besides the classes, there were always many other exciting opportunities to do math. Weekly Team Problem Solving contests sparked friendly competition among teams and intense collaboration within teams. On the weekends we competed in relay competitions on the quad where each team was given three math problems, and a runner would run solutions to a grader and get new problems for the correct answer. The annual Mathcamp Puzzle Hunt was a 36-hour team experience of much puzzle solving and little sleep. These group activities helped us realize our different strengths, as well as just how much we could relate to each other's excitement and curiosity about mathematics.

Doing a research project is always an option at Mathcamp. Every year there is a sign-up list of intriguing topics and corresponding advisors, but you can also create your own topic. In 2003, a few of my

*Each year, Mathcamp is held on a different college campus. The 2007 site will be Colby College, ME.

friends and I selected a project under the guidance of Mathcamp's director, Mira Bernstein. We were to investigate the behavior of the Fibonacci numbers mod *n*, which basically means looking at the sequence of remainders formed from dividing the Fibonacci numbers by a given number. We looked at the relationship between this given number and the period of sequence of remainders. To get enough data to analyze, we created a computer program that would divide the Fibonacci numbers by each number from 2 to 200, and then record the period. At first it seemed like a very random function, but we soon found patterns and were able to prove them (with some hints from Mira). Eventually we were able to come up with formulas for all *n*. We presented our results at the annual project fair at the end of the camp.

So what did we do when we weren't doing math? Nights and weekends were always full of activities—on the condition that they followed Mathcamp's rules:

(1) Be excellent to each other.
(2) Don't do stupid stuff.
(3) No fire.
(4) Don't divide by zero. (Except under staff supervision.)

Rule zero is often included: Be nice to [insert host college here].

After class and homework, we spent hours playing games and creating our own. Mafia and Contact (a word game) were frequent favorites, along with chess, bridge, set, and every other type of card game imaginable. We played soccer, Frisbee, theater games, and lots of ping-pong. We went on field trips every weekend, including rock climbing, touring the Tacoma Glass Museum, and hiking in the mountains. We participated in a Mathcamp tradition called the IL (Interactive Literature), where we were all assigned characters with objectives and acted impromptu to see the drama unfold. The last night was filled with activities including the Mathcamp talent show, a midnight game of capture the flag, and a few last classes like Math Until We Die. The only thing that made leaving Mathcamp 2003 less painful was the prospect of Mathcamp 2004.

Mathcamp students participate in a relay competition on the quad.

More Challenge, More Fun

At the time I didn't believe it was possible, but Mathcamp 2004 was even better than 2003. I took more challenging classes and sought out the professors when I didn't understand a concept. Cookies and Math, an extra-help office hours time, was introduced in 2004, which definitely helped me learn more and connect with professors and other students in my classes. One week, my friend Sara and I (we were known as "Sara squared") spent every Cookies and Math with the Symmetric Polynomials professor because we loved her class but always needed some clarification.

The campers in 2004 were always ready to do something new. We organized a tennis tournament, multiple games of capture the flag, trips into Waterville, a cross-dressing day, and outdoor dances. I was editor-in-chief of the Mathcamp yearbook in 2004, which was quite an education in organization, collaboration, and lack of sleep. In 2004 we were constantly applying math to life, like the night we diagrammed all the Mathcamp drama using number wheels (a notation used in modular arithmetic). By the end of Mathcamp 2004, I knew that I probably wouldn't come back as a camper, but I was already thinking about becoming a junior counselor when I was older.

Coming back to public school after Mathcamp was very difficult. Wanting the energy and passion for learning that I'd felt at Mathcamp, I started exploring private schools, and eventually went to Phillips Exeter Academy for two years because of its strong math program. The lessons I learned at Mathcamp helped me succeed at Exeter and explore my passions further. Mathcamp taught me how to work with others on a difficult problem and also how to tackle a problem by myself. Mathcamp taught me that math isn't a series of right answers and facts to memorize; it's a vast, multi-dimensional world to discover. I learned that math is everywhere you look, providing a forever expanding universe of ideas to explore for their own sake. ■

Sara Sheehan graduated in June from Phillips Exeter Academy, where she was co-captain of the PEA math club and ran cross country. This past summer, Sara was an assistant at the AwesomeMath Summer Program. She is now a freshman at Harvey Mudd College, where she is pursuing a joint math/computer science major.