I'd Rather Go to Mathcamp

By Brenda Fine

Last winter, Wellesley assistant professor Mira Bernstein, then a postdoctoral fellow at Berkeley and a co-worker of mine during the previous summer, brought to my attention a series of advertisements that were running in the popular teen magazine *Seventeen* as part of an aggressive anti-drug campaign. One of them featured a photograph of a teenaged girl whose crush had just offered her some (unspecified) sort of illicit substance. The full-page ad suggested a variety of ways for the girl, and others in her position, to express indignation regarding this offer, but one stood out as particularly damning: "I'd rather go to Mathcamp than smoke a joint!"

Camper Pradeep Mouli peers out from a Zometool Cage. Photo by Chris Tuffley.

George Hart puts the finishing touches on a camper's makeshift Zome home. Photo by Chris Tuffley.

Although the ad was soon pulled, there is no denying that it reflected a popular mindset among its audience of teenagers — and, indeed, among the public at large. Advertisers can hardly be blamed for capitalizing on this phenomenon. When a million ads fail to quell the argument that marijuana has its therapeutic uses, one might as well take advantage of the fact that mathematics is all but universally regarded as bad medicine.

Nevertheless, one particular segment of the market was conspicuously overlooked by the designers of this advertising campaign: the participants and staff (graduate student "mentors," who teach, and undergraduate "junior counselors," who handle nonacademic work) at the real-life Mathcamp, where Mira Bernstein and I spend our summers.

Mathcamp was founded in 1993 on a wing and a prayer by Dr. George Rubin Thomas, who recognized that teenagers interested in mathematics often lacked the resources — and the camaraderie — necessary for them to thrive as mathematicians. Under the direction of Dr. Thomas, Dr. Mira Bernstein, McGill postdoctoral researcher Dr. David Savitt, and a host of dedicated counselors and instructors who thrive on hundred-hour, math-filled workweeks, every year enthusiastic young mathematicians can interact with spirited university math students and professors from around the world. The camp itself migrates from summer to summer, and over the years has found temporary homes in Vancouver, BC, Seattle, WA; Toronto, ON; Wellesley, MA; and, most recently, in Waterville, ME, where Colby College hosted 115 gifted high school students and nearly three dozen staff and visiting speakers.

Far from being a chore for the staff and a punishment (or a pretense for turning down joint-smoking potential dates) for the campers, Mathcamp is an oasis of exciting mathematics and people who can relate to that excitement. Indeed, the energy and enthusiasm for mathematics that staff and campers alike bring to the camp environment is palpable. For five days a week during the five-week camp, students can choose courses tailored to their backgrounds and interests from a packed schedule that includes classes on all sorts of subjects. Some courses, including linear algebra, number theory, fractals, real analysis, projective geometry, and topology, are taught over the course of several weeks, and introduce students to the rigors of university level mathematics while incorporating fun applications that students aren't likely to see as undergraduates. Other classes are one-time affairs that cover more whimsical topics such as *False Proofs* (students are challenged to find the flaws), *Van der Waerden's Theorem* (whose instructor, Mathcamp mentor Julian Gilbey cautioned, "If you are afraid of big numbers, don't take this class!"), and *Hats and Codes* — Mira Bernstein's presentation of an unexpected synthesis of Hamming codes with a problem about guessing the color of one's hat. (See the November issue of FOCUS.)

Mathcamp's goal isn't to give students the credits (or even the knowledge) that they'd otherwise obtain in their high school classes — after all, most of our campers aren't any more interested in doing even *more* high school mathematics than are any of their less-mathematically-geared classmates. Instead, Mathcamp aims to show campers awe-

inspiring results, connections between seemingly unrelated branches of mathematics, and overall "cool math".

By and large, students seem to think that we've succeeded. Even though attendance in classes is not mandatory and the atmosphere at the camp is very informal and relaxed, every hour of every day is a flurry of mathematical activity. Much of this activity takes the form of problem sets and class notes, but a large proportion of it involves solving Rubik's Cubes and building structures out of Zometool, a geometrical construction tool. Moreover, mathematics permeates nearly every aspect of the camp. One might not think that an a cappela group could possibly have much to do with math, but in the hands of counselor Ari Nieh, the *Mathcamp Contrapositones* — whose repertoire included the song "Nonabelian", written by mentors Chris Tuffley and Mary Pat Campbell and sung to the tune of Simon and Garfunkel's "Cecilia" — produced the quintessential marriage of mathematics and music.

At the end of the camp, our students' most common complaint about their five-week stay isn't "too much math," as might be the case with most teenagers, but rather "scheduling conflicts" — that is, too much *cool* math for them to experience all at once. When I polled the Mathcamp alumni for ideas for this article, one camper, high school senior Tracy Lau from Burnaby, British Columbia, enthused about two of her favorite aspects of the camp: "freedom" and "math all day long without ridicule." The juxtaposition of those two items speaks volumes about the level of motivation and love of their subject that our campers bring with them. Even professional mathematicians are struck by the camp environment: after visiting the camp in 2000, Yale Professor Serge Lang declared Mathcamp to be "the largest concentration of intelligence and math freaks" he had ever seen — and that's in some five decades of work in the field.

Professor Lang is but one of dozens of visiting professors who have enjoyed a symbiotic relationship with the many budding mathematicians at the camp. This past summer, full-time mathematical sculptor and Zometool expert George Hart spent a week with the campers, staying up until all hours to help them construct elaborate "Zome homes". Dr. John Conway joined us for a week from Princeton to talk about...well, all things mathematical. His morning lectures covered everything from tangles (demonstrated visually by some volunteer campers who didn't mind getting tied up in knots — literally) to the mathematics of rainbows — and that's without even getting into the dozens of topics that came up while campers had lunch with the camp's celebrity mathematician.

Junior Counselor Megan Guichard makes a mathematical fashion statement. Photo by Chris Tuffley.

Junior counselor Dan Zaharopol accompanies a crew of campers down the Kennebec River. Photo by Chris Tuffley.

Other visitors shared their expertise in fields indirectly related to mathematics. University of Cambridge physics postdoctoral fellow Sanjoy Mahajan taught a handful of classes about approaching physics problems through order of magnitude analysis. His other classes, on analysis of data, will ensure that a few dozen students will never read the newspaper in quite the same way again. And Assistant Professor Hany Farid from Dartmouth shared his research and knowledge of image processing and computer vision to some campers who now have reason to wonder what's behind that digital photograph of Albert Einstein.

But that's just what goes on during the week — and it's not even the half of it: a myriad of impromptu games ranging from Capture the Flag to bridge to Scrabble to Ultimate Frisbee peppered the Colby campus for the duration of the camp. Weekends (Sunday and Monday at Mathcamp) are reserved for nonmathematical fun, and this year we took full advantage of the beauty of Maine. One Monday found us whitewater rafting (and, in some cases, swimming) in the Kennebec river, and another was spent at Acadia National Park, where campers could choose to go kayaking, hiking, or biking. One camper, Jennifer Sheppard of Beaumont, Texas, commented to me at the Kennebec: "I've spent more time outdoors this summer than I ever have before." Indeed, this ain't your parents' math class — or even yours.

Sadly, all good things must come to an end. (Some, however, beg to differ — at one of Julian Gilbey's classes, a course dealing with methods of thinking, students brainstormed over the pros and

cons of having a *year-long* Mathcamp.) The final days of the camp are a high-adrenaline variant upon what the campers have come to experience during the first several weeks. Far from tiring of math, they do even more of it during the entire last night of camp, which features showings of math movies (this year's fare was the off-Broadway musical *Fermat's Last Tango*), additional math talks (including one on David Savitt's thesis, which he presented in response to some students' requests for "math talks [we] don't understand at all!" — rumour has it these students weren't let down), and a Mathcamp tradition — 30 proofs in 30 minutes (we managed 36, one of which was a thorough — modulo a couple of lemmas — proof of Fermat's Last Theorem). There's no requirement that the annual end of camp talent show involve math, but even then we can't resist. This year, a posse of campers presented a delightful skit about the camp, and I opted for the second year to take advantage of the only audience that would ever appreciate *The House With Too Many Perpendiculars*, a skit I wrote about a family living in a four-dimensional house.

Indeed, I, like the girl in the *Seventeen* ad, would rather go to Mathcamp than smoke a joint. But regardless of how well that anti-drug tack resonated with most young adults, I'm afraid that it sells Mathcamp woefully short. Camper Chintan Hossain of Wilmington, Delaware, described the camp as "by far the best five weeks" of his life — and it's a sentiment echoed year after year by campers who insist that there's *nothing* they'd rather do than go to Mathcamp. Personally, I've experienced no greater high than talking about conics in the projective plane to teenagers who can catch my enthusiasm — and I'll be returning in 2002 to get my yearly fix. ■

Brenda Fine is a graduate student in algebraic geometry at the University of British Columbia, and is counting the days until next year's Mathcamp.

For more information about Mathcamp, visit their web site at http://www.mathcamp.org or contact the organizers by email at info@mathcamp.org.