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High energy, passion for teaching serves Gutekunst well

June 15, 2020 | By: Olivia M. Hall

Sam Gutekunst readily admits to being a little obsessed with the "Mean Girls" musical. When the May 2020 ORIE Ph.D. graduate taught ENGRI 1101, Cornell's introductory OR class, he presented the maximum-weight matching problem through matching kidney donors to recipients—and the less traditional example of recasting the Broadway show. All exams had a cover-page song quote (such as "I'm a lean, mean math machine…"), and at the end of the semester, past students were rewarded for their hard work with congratulatory video messages he had procured from two of the lead actresses. "It's maybe the silliest thing I've done at Cornell," Gutekunst says. It is also evidence of the Weston, Conn. native's creative approach to his work that has earned him rave reviews, not only from his students.

"Sam is a pretty amazing guy," says David Williamson, professor of ORIE and Gutekunst's advisor. "He's very high energy and does everything with a lot of positivity and enthusiasm." His advisee applies this verve to a whole range of activities, from multiple research projects to teaching, publishing, and extensive volunteering—all in service of effecting positive change through mathematics and engineering.

Take Gutekunst's work on gerrymandering, a topic that has received quite a bit of attention in the nation's courts and media in recent years—and is not actually his main dissertation focus but a side project. As a visiting faculty member with the Voting Rights Data Institute's 2018 summer undergraduate research experience, he was part of a small team examining whether the current

choice of merging Alaska's voting districts for the state legislature's upper house—one of about 15,000 options—constituted gerrymandering. He also co-authored an article on voting theory, won an INFORMS student writing prize for Operations Research V. Gerrymandering, helped facilitate workshops for teachers and faculty on how to include the subject in their classrooms, and, most recently, led three undergraduates in developing a math mini-textbook centered around gerrymandering for the prisoner distance education program of the non-profit Prisoner Express. (The team later won an "honorable mention" award for a poster they presented on the project at the Joint Mathematics Meetings.)

"Seeing the high-impact applications of mathematics has driven my interest in operations research," says Gutekunst, whose passion for the field was first sparked in a course with Susan Martonosi '99 at Harvey Mudd College, where he earned his B.S. in math in 2014. After exploring the discipline through research with different faculty members, including a project with Dr. Martonosi on disrupting terrorist networks with tools from graph theory, he found a home for the many facets of his interests at Cornell. "Most faculty have open door policies, and they are always willing to bounce research ideas, even if they're not your advisor," Gutekunst says. "For a field as interdisciplinary as OR, having easy access to such diverse, brilliant, and wonderful people is a huge benefit."

Gutekunst's own dissertation blends aspects of mathematics, computer science and data science to analyze theoretical and computational tools for the famous Traveling Salesman Problem (TSP). He has been looking at efficiently computable lower bounds that have emerged over the past two decades. With the help of semidefinite programming, these bounds have shown notable progress in numerical experiments. He has developed systematic methodology that shows that, in the worst case, these new bounds are can be arbitrarily off and hence will not directly improve on the established, simpler linear programming bound. "I think his research has been outstanding," says Williamson. "We have several journal publications coming out of his work already."

Gutekunst also found time to conduct research linking combinatorial and statistical objects and publish with Karola Mészáros, assistant professor in the math department. "I believe Sam is exceptionally rare in excelling in not just one but all aspects of the job of a mathematician," she says. "I was amazed to learn that on top of his research accomplishments he is also a keen and excellent teacher and mentor who cares deeply about being an educator—an inclusive and encouraging one—tapping into every possible resource to achieve his goals."

Besides enthusiasm for musical theater, those resources include five-pound bags of gummy bears and large quantities of goldfish crackers that help liven up collaborative office hours in an effort to not only engage students but provide them with valuable life lessons. “Coming to office hours helps them to find groups to work with, gets them in the habit of asking for help when they need it and hopefully motivates them to go meet faculty teaching their other courses,” Gutekunst explains. “There’s something really special about getting to teach first-year college students and helping set them up to thrive at Cornell and beyond.” His many additional volunteer outreach activities—teaching week-long courses to grade school students at the Canada/USA Mathcamp every summer, or helping to staff a Girls’ Adventures in Math contest at Cornell, for example—bring this excitement for learning and his field to an even younger crowd.

While Gutekunst was sad to leave Cornell—“I’ve made lifelong friends among both faculty and students,” he says—he is excited for the next chapter starting this fall. As the John D. and Catherine T. MacArthur Assistant Professor of Data Science at Bucknell University in Lewisburg, Pa., he will be able to balance his passions for both research and teaching. “This is such an exciting position,” Gutekunst says. “It’s exactly where I’ve been hoping to go post-ORIE.”

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