Goodsell Gazette

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Mathematics and Statistics Colloquium

The Math/Stats Colloquium Series will be held virtually on Tuesday, May 4, from 4:00 pm --- 5:00 pm, with an informal "tea" held before the talk at 3:30 pm, where you can drop by and connect with others in the Math/Stats Department.

We are pleased to welcome Dr. Anthony VÃ¡rilly-Alvarado (Rice University). The Zoom details will be sent out via the mast-interest mailing list, so be sure you are on the list!

Title: Perfect Cuboids and Magic Squares of Squares

Speaker: Anthony VÃ¡rilly-Alvarado (Rice University)

Abstract: A perfect cuboid is a box such that the distance between any two corners is a positive integer. A magic square is a grid filled with distinct positive integers, whose rows, columns, and diagonals add up to the same number. To date, we don't know if there exists a perfect cuboid, or a 3 x 3 magic square whose entries are distinct squares. What do these problems have in common? Secretly, they are both problems about rational points on algebraic surfaces of general type. I believe there is no such thing as a perfect cuboid or a 3 x 3 magic square of squares, and I will try to convince you that geometry suggests this is so.

Get to know the Math/Stats Department!

With summer looming just around the corner, we asked the folks in the math/stats department to name their favorite vacation or leisure destination. We hope this will give you some ideas of places to visit over summer break. (We may have to pull the faculty who didn't respond out of their offices and force them to take a vacation!)

Adam:
Door County WI; Grand Marais MN.

Laura:
Glacier, Badlands and Rocky Mountain National Parks, any bikeable road, and Maneki Restaurant in Seattle.

MurphyKate:
Wales, Chequamegon National Forest, Iceland, swimmable rivers, and bluffs.

Caroline:
Edisto Island, SC; Bronte Beach, Sydney, Australia; Isle of Skye, Scotland.

Andy:
Orcas Island, WA; Glacier National Park; North Shore of Lake Superior; Chicago, IL;
Portland, ME.

Josh:
have loved to visit: Turkey; dream of visiting: Iran.

Deanna:
I love to go to the National Parks. Congaree in South Carolina was a delightful surprise this spring.

Mark:
1) (by a wide margin) Canadian Rockies; 2) Cascades, more generally the Pacific Northwest;
3) (but not in summer) Canyons of Utah and Arizona; 4) Appalachians (in particular, the Presidential Range); 5) Minnesota "Arrowhead" (the corner of the state between Lake Superior and the Canadian border).

Steve:
Places I've been to: Glacier National Park, Colorado (Aspen Area), Seaside Heights (NJ).
Dream vacation: Riding some of the Tour de France route.

(Rescheduled) Mathematics and Statistics Colloquium

Dr. Knudson's colloquium talk has been rescheduled to Thursday, May 13 from 4:00 pm - 5:00 pm, with an informal "tea" held before the talk at 3:30 pm where you can drop by and connect with others in the Math/Stats Department. The Zoom details will be sent out via the mast-interest mailing list, so be sure you are on the list!

Title: An MCMC Convergence Diagnostic: Are We There Yet?

Speaker: Christina Knudson ('09); University of St. Thomas

Abstract: Gelman and Rubin's (1992) convergence diagnostic is one of the most popular methods for terminating a Markov chain Monte Carlo (MCMC) sampler. Since the seminal paper, researchers have developed sophisticated methods for estimating variance of Monte Carlo averages. We show that these estimators find immediate use in the Gelman-Rubin statistic, a connection not previously established in the literature. We incorporate these estimators to upgrade both the univariate and multivariate Gelman-Rubin statistics, leading to improved stability in MCMC termination time. An immediate advantage is that our new Gelman-Rubin statistic can

be calculated for a single chain. In addition, we establish a one-to-one relationship between the Gelman-Rubin statistic and effective sample size. Leveraging this relationship, we develop a principled termination criterion for the Gelman-Rubin statistic. Finally, we demonstrate the utility of our improved diagnostic via examples (including a Titanic survival model with Jack and Rose).

About the speaker: Christina Knudson graduated from Carleton College in 2009 with a degree in mathematics. She earned her PhD in statistics from the University of Minnesota in 2016. She is currently an assistant professor of statistics at the University of St. Thomas in St. Paul, MN.

Welcome New Math and Stats Majors!

Majors have been declared, and the Mathematics and Statistics department would like to celebrate our new majors! If you are a new Math or Stats major, mark your calendar: our new majors event will take place on Tuesday May 11, 3:30-4:30pm. We'll give you special info on the majors and have some time to meet and greet with MAST faculty and old majors. Watch your email inbox for the invite and zoom info.

Professor Eric Egge named Associate Dean

Eric will be moving to Laird Hall this July to begin a three year stint as Associate Dean. Eric's many duties as Associate Dean will include being involved in managing academic division budgets, serving as Director of Undergraduate Research and helping plan for academic facilities. We wish Eric the best of luck as he begins his position in college administration, but will be looking forward to his return to teaching mathematics in the CMC!

Our New SDAs!

SDAs (Student Departmental Advisers) are students who serve two very important roles in the department. First, they help students navigate the math and stats majors and the math minor. Second, they organize a variety of social events and get-togethers around the department. We are thrilled to announce our new SDAs for next year are Bryan Boehnke, Shira Julie, Karryn Leake, and Yicheng Shen. Please join us in welcoming our new SDAs for 2021-22!

Budapest Semesters in Mathematics Summer REU

BSM is excited to offer a non-credit Summer 2021 REU online learning opportunity during this challenging time as our in-person study abroad program was canceled due to COVID-19. We are accepting applications from undergraduate students and recent graduates of North American Colleges and Universities in the Math Community to participate. Details and requirements can be found at https://www.budapestsemesters.com/bsm-reu-summer-2021-online-opportunity/.

Upcoming Events

Week 6

Tuesday May 4, 3:30-5:00pm
Anthony VÃ¡rilly-Alvarado Colloquium Talk - Zoom

Week 7

Tuesday May 11, 3:30-4:30pm
New Majors Event - Zoom

Thursday May 13, 3:30-5:00pm
Christina Knudson Colloquium Talk - Zoom

Problems of the Fortnight

To be acknowledged in the next *Gazette*, solutions to the problems below should reach me by noon on Tuesday, May 11.

1. Is it possible to arrange the numbers $0, 1, 2, \ldots, 15$ in a square pattern so that the sum of the four numbers in any 2×2 square within the pattern is the same? (For example, if you try starting the pattern as follows:

$$\begin{array}{cccc} 3 & 7 & 2 & 9 \\ 5 & 8 & a & ? \\ 4 & b & ? & ? \\ ? & ? & ? & ? \end{array}$$

you will find it impossible to finish: The four numbers in the upper left-hand corner add to 23, so you would need $7+2+8+a = 23$ and $5+8+4+b = 23$, which yields $a = b = 6$. But the number 6 can only occur once in the pattern, so this cannot be.) If it is possible, find a solution for which the smallest number adjacent (horizontally) to 0 is as small as possible. If it is not possible, show why not.

2. Let $y = f(x)$ be a polynomial of degree $d > 1$. For various points P in the plane, consider the points Q on the graph of the polynomial such that the tangent line at Q to the graph passes through P.

   a) Show that if d is odd, then for every point P there will be at least one such point Q (that is, there will be at least one tangent line to the graph that passes through P).

   b) Suppose d is fixed (not necessarily odd) but we allow any polynomial of degree d and any point P in the plane. What is the largest number of points Q that is possible? Note that to solve this completely, you should show why you can indeed get that number of different points Q, as well as that you cannot get any more.

(Note: Although I couldn't resist including both parts of this problem, the first part is already substantial enough that I would welcome solutions to only that part, and such solutions would be eligible for a B.B.O.P. prize.)

There were serious attempts by two different people, but so far no complete solution, for the first problem posed April 16; I would still be delighted to get a complete solution, whether from the aforementioned people or from (a) different solver(s). Sebastian Vander Ploeg Fallon gave an essentially correct solution to the second problem, and can arrange with Sue Jandro to collect a B.B.O.P. item. Good luck on the new problems, and enjoy midterm break!

- Mark Krusemeyer

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