



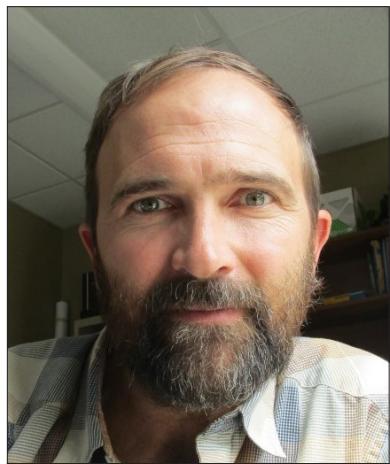
Mathematical

Sciences

SPRING 2020

Professor Matt Roscoe Receives Prize from the Museum of Mathematics

By Fred Peck



Matt Roscoe

Professor Matt Roscoe was awarded first runner-up in the 2019 Rosenthal Prize for Innovation and Inspiration in Math Teaching. The prestigious prize is awarded by the Museum of Mathematics in New York City, following an international competition. The prize celebrates innovative math lessons for elementary and middle school students. Prof. Roscoe

accepted the award with his family at a ceremony at the Museum on January 7, 2020.

Prof. Roscoe's lesson is titled, "Building the City of Numbers: An Exploration of Unique Prime Factorization." Prime factorization is traditionally taught using symbols. Roscoe's lesson turns prime factorization into a construction project. He explains: "Students collectively build the prime factorizations of each whole number 1-100 as a tower of blocks, each block representing a prime. These towers are then placed on a 10-by-10 grid numbered from 1 to 100."

Roscoe describes the resulting "city of numbers" (pictured on page 3) as a "pedagogically inviting object." The bright colors and physical design are simply begging to be explored, and students joyfully comply by finding patterns in the arrangement. For example, students have discovered and explored the following patterns:

Continued on page 3

UM Math Faculty Authors: Steele and Bardsley

By Mark Kayll

Continuing a legacy stretching back to the era of long-time department Chair N.J. Lennes (1874-1951), the last few years witnessed the appearance of two new math books by UM faculty. In 2016, Springer published *Algorithms for Data Science*, by Brian Steele, John Chandler, and Swarna Reddy. The lead author is a professor in our department while the coauthors are both former UM students. 2018 saw the publication of *Computational Uncertainty Quantification for Inverse Problems* by Professor John Bardsley. This monograph appeared in the Computational Science and Engineering series of SIAM, the Society for Industrial & Applied Mathematics.

Both works fall in the broad realm of applied mathematics, and both touch on stochastic themes, i.e., on probabilistic ideas. Another common thread is the high prominence of algorithms in the authors' approaches. In the earlier book, these are conveyed through the Python

Continued on page 3

Vera Myers 1926-2020

We are sad to report that Vera Myers passed away on February 23. She was a long-time adjunct faculty member in the department. She earned a bachelor's degree in mathematics from Bryn Mawr College and a Master's from Ohio State University. In 1952, she and her husband, Bill Myers, moved to Missoula, where he had been hired as an assistant professor. Vera Myers taught in the department intermittently over many years as an adjunct faculty member, before she and her husband retired in the late eighties. You can read more about her impressive life in the obituary in the [Missoulian](#), and in a profile of Bill Myers that appeared in the [Fall 2000 Newsletter](#).

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Notes from the Chair

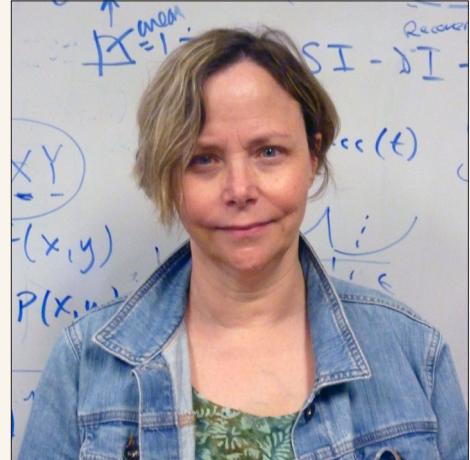
By Emily Stone

Greetings from Missoula! I hope everyone has survived the COVID shutdown okay, so far. We had a very interesting semester, what with switching to remote learning at Spring break. I am really proud of how our faculty and students rose to the occasion. We were able to make the transition during the week of Spring break, which I think sets a record compared to some higher ed institutions. After the first week of fumbling with cameras and problems with internet access in some of our more remote locations, we were off and running, more or less seamlessly. We did everything remotely, from classes, office hours, advising, testing and group meetings. We all got very used to joining Zoom meetings with a checkerboard of faces on our screens, seeing everyone's living room, or what background they had chosen, and watch cats, dogs and kids wander in and out of the shot. I can't thank everyone enough for making my job so easy during this difficult time. Students, faculty and staff were reliably cheerful and ready to make all kinds of adjustments, on the fly most of the time! Just goes to

show how Montana folks really shine in adversity.

What about good things that happened? Well, we completed our 7 year "self study" this year, and received glowing reviews from our outside evaluator, Professor Phil Kutzko. In his report he says, "First and foremost, this Department is an absolute gem. It could serve as a model for what [a] math sciences department at a public university of its size should look like." Our faculty won awards: Fred Peck won the College Cox award for teaching, Lauren Fern was honored as a Montana University System Teaching Scholar, and Matt Roscoe was 1st runner up for the 2019 Rosenthal Prize for Innovation and Inspiration in Math Teaching. Ke Wu and Fred Peck are submitting a new NSF-STEM proposal, which brings together UM, Salish Kootenai College, Montana Technological University (formerly Montana Tech), and Blackfeet Community College.

This last reminds me of our role as agents of change in the world. The Black Lives Matter movement has brought this to the forefront of our minds, but it has always been there



as part of our mission in higher education. Success in school, and success in math, in particular, is a strong predictor of success in life in general. Bringing that success to a wider and wider audience, is a critical step to bringing equity to marginalized groups in our society. Education is the key to freedom, a freedom where the worth and dignity of every human life is respected and celebrated.

Best wishes for a safe and productive summer!

Emily F. Stone

Honor Roll of Donors

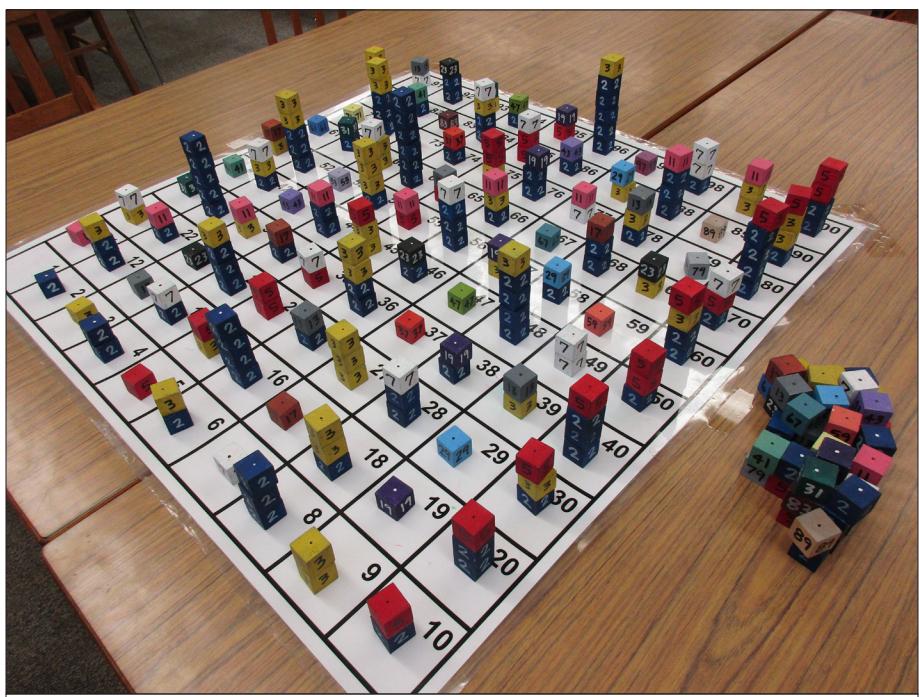
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Matt Roscoe (continued from page 1)

- The 2's and 5's are arranged in columns.
- The tallest towers tend to have 2's.
- 2's, 3's, 5's and 7's are only factors that ever appear more than once in a given number. 2's and 3's are the only factors to appear more than twice in a given number.
- The 3's and the 11's are arranged diagonally.
- The 7's are arranged like a knight's move in chess.

Each time a pattern is discovered, Roscoe asks, "I wonder why?" Here is where the real power of the lesson is revealed. As students explore and explain their patterns, they gain a deep appreciation for the multiplicative structure of the integers.

Sometimes, the students' patterns surprise Prof. Roscoe. Recently, a student made this observation: "The 2's go in waves." The student explained that if one looks at consecutive even numbers, the factors of 2 follow a peculiar pattern. Every-other even number has only one 2 in it, and the others all have multiple 2's. The "wave" pattern is: one 2, multiple 2's, one 2, multiple 2's.



Matt Roscoe's City of Numbers. (Building it requires lots of computations, not an easy task for many of the students. If one looks closely, one can see that a few of the towers are not built correctly. Can you find them?)

"I wonder why."

Professor Roscoe has taught the lesson to students and teachers across the state. Often, teachers explain that this is the first time they have truly understood prime factor-

Continued on page 5

Faculty Books (continued from page 1)

programming language and the statistical package R; Dr. Bardsley turns to the programming platform MATLAB as his computing environment of choice. Many of the actual computer codes in both books are easily available for their readers, either in-text or, in Prof. Bardsley's case, as downloadable text-files on SIAM's support website.



Perhaps a testament to the high value placed on quality math teaching at UM, both Steele and Bardsley had pedagogical motivations. In the first, we find the quote "The text is eminently suitable for self-study...", while the second's Preface asserts, "... I wrote the book to be learned from."

With the first book now having been published for sufficient time, several reviews are available. But its highest honor to date is no doubt the seven-page treatment it garnered in the Bulletin of the American Mathematical Society [Vol. 56 (2019), 143-149, by Richard and Nicholas De Veaux]. Here is a brief snippet from their favorable review: "What the book does deliver is a broad set of hands-on tutorials on topical data sets that will give students needed practice in the process of data science. The breadth of the algorithms and examples, such as the real-time analysis of twitter feeds, the large-scale American health survey, and the look at PAC political spending, will be of interest to students of data science."

Congratulations to Professors Bardsley and Steele (and coauthors, Drs. Chandler and Reddy) for their new and substantial contributions to the mathematical literature. ♦

Spring 2020 Scholarship and Award Winners

Joseph Hashisaki Memorial Scholarship

Kenton Ke

The Adams Scholarships

Junior: Burkleigh Yost

Senior: Kenton Ke

Anderson Mathematics Scholarship

Cory Emlen

Mac Johnson Family Scholarships

Esther Lyon Delsordo Michael McKelligott
Jethro Thorne

Merle Manis Award

George Glidden-Handgis

Undergraduate Research Scholars

Natalie Cole Cory Emlen
George Glidden-Handgis Kenton Ke
Martín Romero Andi Wainwright
Burleigh Yost

Undergraduate Tutorial Scholar

Martín Romero

N.J. Lennes Competition

Alex Shepherd (1st) Haley Wilson (2nd)

William Myers Mathematics Scholarship

Anastasia Halfpap

Graduate Student Distinguished Teaching Award

Daniel Gent

Caleb Huber

Graduate Student Summer Research Awards

Ian Derickson Dakota Gray
Shurong Li Van Magnan
Mohsen Tabibian

Carolyn and Johnny Lott Elementary Education Scholarship

Haley VonGoedert

John A. Peterson Mathematics Education Awards

Kyra L. Mycroft Mielle Posey Hubbard
President's Senior Recognition Awards
Kit Fieldhouse Ian Gonzales
Denise LaFontaine Kyra Mycroft
Catherine Rigby



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For information on other ways to give, please contact Suann Lloyd: suann.lloyd@supportum.org or by phone at 406-243-2646 (or call toll free 1-800-443-2593).

Degree Recipients 2019-20

Bachelor Degrees

Cassidy Alexander
Andrew Bedunah
Kit Fieldhouse
Ian Gonzales
Mielle Hubbard

Ian Jedd
Denise LaFontaine
Juyeon Lyu
Matthew Malloy
Kyra Mycroft

Songyue Qiu
David Rich
Catherine Rigby
Witley Sampson
Makayla Sanders

MA in Mathematics

Daniel Gent

Dakota Gray
Caleb Huber

Ian Kit Nicolas

MA in Teaching School Mathematics

Shunteal Jessop

Cara Lokken-Frandsen

MS in Data Science

Megan Finley

Tony Mayer

Van Tran

Doctoral Degrees

Rick Brown - Advisor: John Bardsley
Semivariogram Methods for Modeling Whittle-Matérn Priors in Bayesian Inverse Problems

Quy Cao - Advisor: Katia Smirnova
Methods for Analyzing High Dimensional Data with Applications to the Wearable and Microbiome Data Analysiss

Jacob Downs - Advisor: Jesse Johnson
The Application of Contemporary Numerical Methods to the Modeling, Analysis, and Uncertainty Quantification of Glacier Dynamics

Kevin Palencia-Infante - Advisor: Jen Brooks
A Natural Rank Problem for Homogeneous Polynomials and Connections with the Theory of Functions of Several Complex Variables

Matt Roscoe (continued from page 3)

ization, beyond a symbol manipulation procedure. Teachers have been so taken with the lesson that they have produced their own sets to use.

Professor Roscoe is known throughout the department and the state of Montana for developing lessons like The City of Numbers, which use innovative material design to produce pedagogically inviting objects that reveal deep mathematical structure. For example, he designed a set of quilt squares that lead students to understand symmetry groups, and a set of triangles that enable what he terms, "a constructive approach to trigonometry."

Professor Roscoe's innovative methods have earned him multiple teaching awards, including the Helen and Winston Cox Educational Excellence Award and the William Stannard Award for the Teaching of Undergraduate Mathematics in Montana. The Cox Award is awarded by

the College of Humanities and Sciences at UM, and is the College's longest-standing award. The Stannard Award is given by the Department of Mathematical Sciences at Montana State University, to recognize exemplary contributions to the teaching of mathematics across the state.

Roscoe explains, "I hope that my contributions to the field will be characterized by moving mathematics instruction toward a future where students experience mathematics as a venue for the expression of creativity, exploration and discovery."

For students at UM and across the state, that future is here today. The department is proud to have such an inspiring and innovative educator on the faculty. Congratulations Professor Roscoe!

For more information about the Rosenthal Prize and Prof. Roscoe's "City of Numbers" lesson, see: <https://momath.org/rosenthal-prize/> ♦



Department of Mathematical Sciences

Mathematics Building (MMAI01)

32 Campus Drive

Missoula, MT 59812-0864

Phone: 406-243-5311

Email: math@umontana.edu

Website: <http://hs.umt.edu/math>

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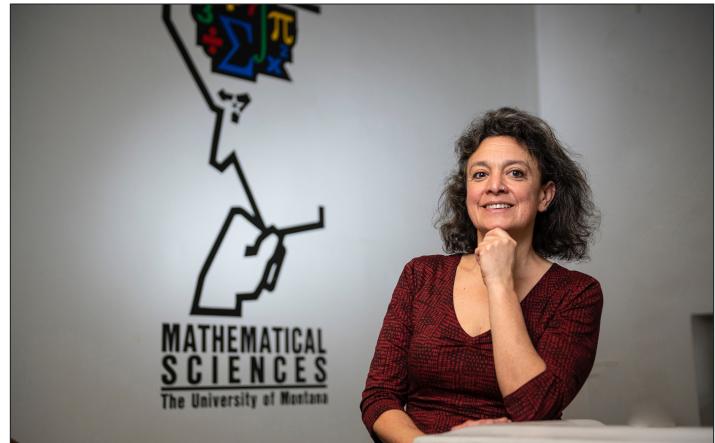
Lauren Fern Honored as a Montana University System Teaching Scholar

By Nikolaus Vonessen

Math Department Lecturer Lauren Fern, who also works for UM's Office for Student Success as the Student Success Coordinator for Mathematics, earned a high honor from Montana's Office of the Commissioner of Higher Education: She was named a Montana University System (MUS) Teaching Scholar! She belongs to the inaugural class of this new program, one of only twelve faculty from across the entire MUS (and one of only three from UM).

This new program recognizes faculty members who have made exemplary contributions to teaching and learning at an MUS campus. While it involves a small award for outstanding past performance, it is really meant to encourage recipients to share their pedagogical knowledge and expertise with other faculty members. When the awards were announced in late November, each MUS Teaching Scholar was asked to organize during the Spring 2020 semester a Faculty Learning Community to develop high-impact teaching practices to increase student success.

Lauren gathered a group of interested faculty teaching



Lauren Fern in the main entrance staircase of the Math Building, posing with our "Math Thinker"

introductory math classes, from our department, Missoula College, and Bitterroot College. They met throughout the semester, first in person and then via Zoom. One of the questions they discussed was how to design "low threshold high ceiling activities" that are on one hand accessible to students with a weak background and help them develop their skills, but that are also meaningful and challenging for better-prepared students, helping everyone in the class to get ahead.

Congratulations, Lauren! And thanks for doing this important work! ♦



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