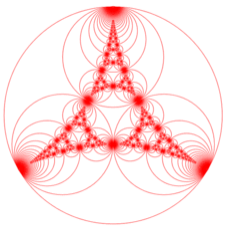
Goodsell Gazette

Carleton College *24 October 2016*
Northfield, MN 55057 *The newsletter for the Carleton mathematics and statistics community* *Vol. 35, No. 05*

Mathematics and Statistics Colloquium



Take What You Have Gathered from Coincidence: Understanding and Using Randomness
Matthew Richey
Professor of Mathematics
St. Olaf College

Friday, November 4, 3:45 - 4:45 p.m. Weitz Cinema

What does it mean to be random? We all encounter randomness every day -- it is part of how we talk about the weather, sports, and even love. Despite being so familiar, randomness has proven to be an elusive idea to pin down. Even mathematicians have struggled to define randomness, leading to competing and sometimes conflicting definitions. Whatever it is, randomness is a driving force behind many modern computational algorithms. These algorithms -- the Metropolis Algorithm, Markov chain Monte Carlo Methods, and others -- use randomness as the secret ingredient that makes it possible to tackle famously difficult problems such as the Traveling Salesperson Problem and image reconstruction. Using many pictures (and even a few Bob Dylan references), this lecture will reveal the historical quest to define randomness and illustrate how randomness allows us to solve many of today's most challenging applied mathematics problems.

Carleton Funded Fellowships

The Office of Student Fellowships is beginning to solicit students for Carleton-funded fellowships for projects to be conducted during 2017 summer or winter breaks, as well as for various externally funded fellowships. There are a few upcoming Informational Meetings for a some of these opportunities. The Fellowships Office has resources with which to fund students from all class years.

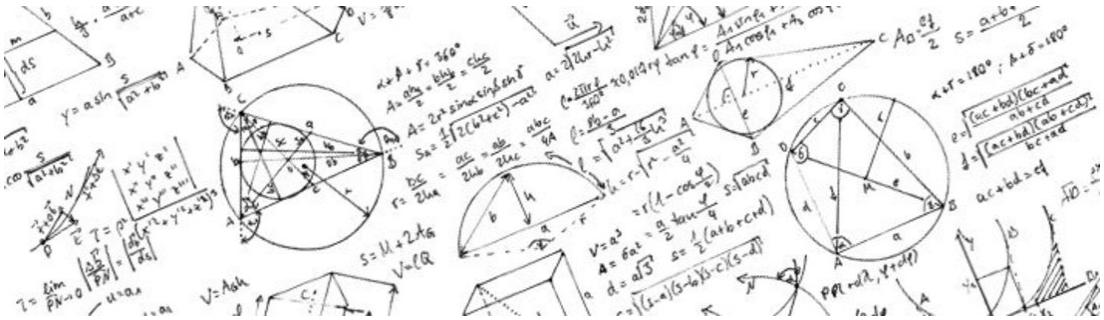
Wednesday, October 26th, 5:30 - 6:30 PM in Weitz 236 - Summer Funding Opportunities (Carleton-funded) Information Meeting.

Friday, October 28th, 12 Noon - 1:00 PM in Weitz 131 - Boren Scholarship Information Meeting.

Monday, November 7th, 4:30 - 5:00 PM in Leighton 236 - Davis Projects for Peace Information Meeting.
Repeated on: Thursday, Nov 10th, 12:15 - 12:45 PM, Leighton 236

Special Edition: What's the Math and Stats Department Teaching Next Term?

Have you checked your registration number yet? Made a list of classes you're hoping to take next term? Let the course descriptions below guide you into an adventurous winter term within the Carleton Department of Mathematics and Statistics! There's something for everybody, from probability to abstract algebra and from differential equations (which may be called ordinary but are, in fact, truly neat) to a 10-week lecture series by the Carleton faculty-- find out more below.



Phil 236: Philosophy of Mathematics: Methodology and Practice
Instructor: Douglas Marshall
Time: 3a
What is the relationship between a mathematical proof and our understanding of the result that it proves? Do some mathematical proofs manage to explain their results in addition to merely establishing them? How does mathematical knowledge grow? We will begin to address these questions by reading Imre Lakatos's classic text, /Proofs and Refutations/, along with reactions to Lakatos. We will then examine other philosophical accounts of mathematical thought and understanding sensitive to the history and practice of mathematics. This course has no formal prerequisites, and it satisfies the Writing Rich and Humanistic Inquiry Requirements. For a fuller course description, see http://people.carleton.edu/~dmarshall/PHIL236_CourseDescription.pdf

Math 206: A Tour of Mathematics
Instructor: Many of us
Time: Fridays only, 6a (3:30-4:30)
Are you considering a math major, but wonder what mathematics is all about? Maybe you're curious as to what research in mathematics even means. Are you already a major who would enjoy some fresh perspectives on, and new insights into, the math you love? Join us for a series of lectures on a variety of mathematical topics, with emphasis on exciting ideas, concepts and results rather than depth in a particular area. This course is offered anually, and you are allowed to register for it twice, in consecutive years: there should be no overlap with the 2016 Tour.

Math 236: Mathematical Structures
Instructor: Rafe Jones
Time: 5a
Prerequisite: Math 232 or permission of the instructor
This course is an introduction to the heart ---and the skeleton---of mathematics. We'll study set theory, formal logic, and axiomatic systems, which are the solid building blocks of mathematical arguments. We'll learn about techniques for discovering (or inventing) proofs, common methods of proof, and how to write good proofs; these are the tissues that tie the building blocks together. And we'll study some fascinating problems and results that

everyone should know, such as the many sizes of infinity; these are the vital organs, the vibrant inner parts. Math 236 is the first course that suggests what being a math major (as opposed to a math user) is all about. If you are considering majoring in math, then this course should help you decide. This course is also a prerequisite for many upper-level mathematics courses, so taking it gives you the keys to a whole new mathematical world.

Math 241: Ordinary Differential Equations
Instructor: Rob Thompson
Time: 3a
Prerequisite: Math 232 or permission of the instructor
Differential equations are a fundamental language used by mathematicians, scientists and engineers to understand and describe processes involving continuous change. In this course we will study differential equations from both a practical and theoretical point of view. Our focus will be on developing differential equation models from natural laws and exploring the mathematical ideas that arise within these models. We'll study examples like mechanical vibrations, lasers, insect outbreaks, competition and cooperation of species, language coexistence, superconducting circuits, and much more!

Math 245: Applied Regression Analysis
Instructor: Andy Poppick
Time: 2a
Prerequisite: Math 215 (or equivalent) or 275

Statistical modeling is one of an applied statistician's core responsibilities. Mathematically, the term â,¬Å“statistical modelÃ¢â‚¬Â generically refers to a family of probability distributions on a sample space. Regression models are statistical models that relate the distribution of a response variable to the value(s) of one or more predictor variables. But these relatively simple definitions elide crucial practical questions: How do I build a regression model? Is my model a good description of my data? What do I mean by "good"? What do I want to use my model for? Can I answer substantive questions with my data and model, and can I accurately quantify my uncertainty? Can I make predictions with accurate uncertainties? Can I build a better model? In this course, we'll think through these and other hairy questions in the context of realistic data analyses. The course covers linear regression models for continuous response variables (ordinary linear regression) as well as regression models for binary response data (logistic regression). The emphasis will be on model building, model checking, and statistical inference. We will make frequent use of R for both exploratory analyses and model estimation. Statistical writing and communication will, additionally, be a central component of the course.

Math 265: Probability
Instructor: Laura Chihara
Time: 3a
Prerequisite: Math 211
If the "immortal monkey" randomly strikes keys on a keyboard for eternity, what is the probability that it will eventually produce the complete works of Shakespeare? If in a small town, out of 12 accidents that occurred in June 1986, four of them occurred on Friday the 13th, would this confirm your hunch that "13" is unlucky?

Probability is a fundamental branch of mathematics and is the foundation for all methods of statistical inference. In this course we will use the tools of counting and calculus to model random events, compute probabilities, and have lots of fun with balls in urns, poker hands, and coins and dice (fair or otherwise).

Math 275: Introduction to Statistical Inference
Instructor: Bob Dobrow
Time: 4a
Prerequisite: Math 265

Last year, in exit interviews with Carleton seniors, a common statement by math majors was "I wished I had taken statistics." For those of you who have taken Probability, now is your chance! Statistics can be thought of as the science of data. Statistical inference uses the tools of calculus and probability to draw conclusions from data --- often messy, incomplete and ambiguous --- about real-world problems. The German poet Goethe once wrote: "All theory is gray, my friend. But forever green is the tree of life." In this class, in addition to being introduced to the basics of statistical theory, students will explore case studies (green and otherwise) drawn from the environment, politics, public health, biology, and many other disciplines. The statistical software R will be introduced and used throughout. Note that Math 275 is offered this year in both winter and spring terms.

Math 280: Statistical Consulting
Instructor: Katie St. Clair
Time: Thursdays only, 2/3c
Prerequisite: Math 245 and Instructor Permission
Students will work on data analysis projects solicited from the local community. We will also cover the fundamentals of being a statistical consultant, including matters of professionalism, ethics and communication.

Math 312: Elementary Theory of Numbers
Instructor: Mark Krusemeyer
Time: 3a
Prerequisite: Math 236 or permission of the Instructor
For thousands of years, number theory has fascinated professional and amateur mathematicians alike. (Some of the amateurs, such as the 17th-century lawyer Fermat and the modern-day theoretical physicist Dyson, are not to be underestimated!) Our old friends, the integers, have many beautiful and subtle properties, and quite a few mysteries about them still go unsolved; some spectacular open questions will be mentioned in this course. There will be opportunities for "experimental discovery"Â (and, if practicable, subsequent proof), perhaps using technology. Meanwhile, the main focus of the course will be on some of the striking and important properties of the integers that are well understood. Some of these, long regarded as "pure" mathematics without any conceivable practical use, have in recent decades found important applications in such fields as computer science and cryptography. For example, we'll see how credit card numbers and other confidential information can be sent securely over an insecure channel (for example, over the Internet), and why many people are hoping that the factorization of large numbers will continue to be a difficult computational problem.

Math 321: Real Analysis I
Instructor: Helen Wong
Time: 5a
Prerequisite: Math 236

Why do the techniques we use in calculus work the way they do? In this course we will take a close look at the theory behind those problems you did way back when. Everything in calculus is in some way based on looking at things up close, that is, taking a limit. For the most part, in calculus you saw examples and problems where things work out well. However, one really needs to proceed with caution. For example, there are times when interchanging the order of operations defined by limits give different results. In order to understant why this can happen, we will be taking a very close look at limits and these objects we call functions of a real variable. Issues surrounding these functions appear in many different places including differential equations, complex analysis, dynamical systems, and probability. This course is highly recommended for anyone considering grad school, whether it's in math or statistics.

Math 352: Topics in Abstract Algebra
Instructor: Eric Egge
Time: 2a
Prerequisite: Math 342 or permission of the instructor

If you like abstract algebra, and especially if you like group theory, then this is the course for you. In abstract algebra you saw that the zoo of finite groups includes creatures from a variety of habitats. In this course we will develop the representation theory of finite groups, which means we will study how finite groups can appear as groups of invertible linear transformations (matrices). This will enable us to use linear algebra, on even more levels than you might expect, to learn a surprising amount about the structures of various finite groups. Along the way we will prove the Sylow theorems, which include a partial converse to Lagrange's theorem, we'll solve some fun puzzle-like problems involving objects called character tables, I'll explain why 612 is my least favorite number, and I'll tell you about the time I took a class in which just one homework problem was assigned -- a problem with 1000 parts. This course will have no overlap with the version of Math 352 offered last spring, on Galois theory. So even if you took that course, you can take this one, too.

Problems of the Week

This is a special edition, so there are no problems this week! However, if you're interested, take a peek at last week's problems or even some from further back-- there are several back issues out near the whiteboard on the second floor of the CMC.

Editors: ***Saahithi Rao, Stephen Kennedy***
Problems of the Week: ***Mark Kruesmeyer***
Web & Subscriptions: ***Sue Jandro***