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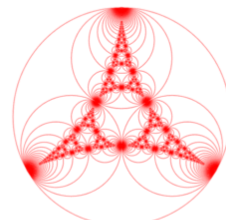
A QuIRKy Talk?



If you like data science, or just want to know more about it, then you might be interested in the talk below, which is being sponsored by the Carleton QuIRK (Quantitative Inquiry, Reasoning, and Knowledge) initiative.

Speaker: Tim Hesterberg, Google
Date/Time: Monday, October 30, 7:00 p.m.
Location: Weitz Cinema

Statistics and Big Data at Google

Abstract: Google lives on data. Search, ads, YouTube, Maps,...-they all live on data. I'll tell you stories about how we use data, how we're experimenting to make improvements (yes, this includes your searches), and how we adapt statistical ideas to do things that have never been done before. No statistics background necessary.

Game Night Extravaganza!

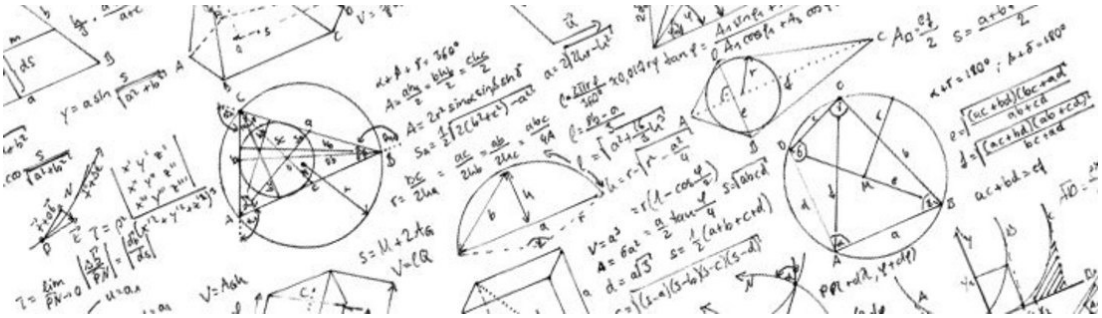
Thursday, October 26, 7:00 - 9:30 p.m., 6th Floor Lounge, Regents Hall, St. Olaf College

The St. Olaf Math Club has challenged YOU to come enjoy a night of fun and games and meet your future friends across the river. Parking will be available behind Tomson Hall next door. Need a ride (or have space to help ferry people)? Send an email to Adam Loy aloy@carleton.edu and we'll help get you there and back.

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.



Math 206: A Tour of Mathematics
Instructor: Many of us
Time: Fridays only, 6a (3:30-4:30)

Are you considering a math or stats major, but wonder what those disciplines are all about? Maybe you're curious as to what research in mathematics or statistics even means. Are you already a major who would enjoy some fresh perspectives on, and new insights into, the subject you love? Join us for a series of lectures on a variety of mathematical and statistical topics, with emphasis on exciting ideas, concepts and results rather than depth in a particular area. This course is offered annually, and you are allowed to register for it twice, in consecutive years: there should be no overlap with the 2017 Tour.

Math 236: Mathematical Structures
Instructor: Rafe Jones
Time: 4a
Prerequisite: Math 232 or permission of the instructor

This course is an introduction to the mathematician's route to certainty: mathematical proof. 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 mathematical truths that everyone should know, such as the many sizes of infinite sets. Math 236 is the first course in our curriculum whose primary goal is to teach you how to write proofs. Because proofs are how mathematical truth is established, it will give you the keys to a whole new mathematical world - not to mention the necessary prerequisite for a slew of upper-level mathematics courses.

Math 241: Ordinary Differential Equations
Instructor: Sam Patterson
Time: 4a
Prerequisite: Math 232 or permission of the instructor

The language and tools of differential equations are used by mathematicians and scientists to describe and understand the world. In this course we will study ordinary differential equations from both a practical and theoretical point of view. We will see how mathematical models are developed from natural laws and used to study physical systems, including classical examples such as falling objects, mass-spring systems, pendulums, and predator-prey models. Using ideas from calculus and linear algebra, we will develop methods for solving differential equations when we can, and learn how to gain understanding even when we can't. In fact, most differential equations cannot be solved explicitly in terms of known functions, so we will develop techniques for qualitative analysis and numerical approximation. We will learn how mathematicians approach ordinary differential equations using a combination of theory, computer computation, and computations by hand.

Math 245: Applied Regression Analysis
Instructor: Laura Chihara
Time: 3a
Prerequisite: Math 215 (or equivalent) or 275

On the night of January 27, 1986, engineers at Morton Thiokol teleconferenced with engineers and managers at the Marshall Space Flight Center and Kennedy Space Center to determine whether it was too cold (31 F) to launch space shuttle Challenger. Data from previous flights seemed to suggest that temperature had an effect on the integrity of the O-ring seals on the booster rockets, but the final recommendation was to launch the Challenger on schedule. Could a statistical analysis of the pre-accident data predicted the catastrophic failure of the shuttle? In this class, we will investigate the Challenger data and in general, learn statistical model building and model checking techniques. We will use the software package R to aid in the modeling.

Math 265: Probability
Instructor: Andy Poppick
Time: 4a
Prerequisite: Math 210 or 211

We live in a world ruled by randomness and full of uncertainties. Probability gives us some tools to describe such a world. Fundamental to statistical modeling and inference, probability is also used throughout the sciences to model processes of an inherently random nature. In this course, we'll study the essential mathematics of probability theory and have fun solving applied problems.

Math 275: Introduction to Statistical Inference
Instructor: Adam Loy
Time: 3a
Prerequisite: Math 265

In probablility we assumed perfect knowledge of a population, and used this knowledge to grapple with properties of random samples. In statistics, we flip the script: we observe a random sample and wish to learn about the population. For example, we will discuss how to estimate the parameters for probability distributions based on data, rather than assuming they are known. This course uses probabilistic and computational tools to introduce statistical inference. While we will discuss the theory underlying these inferential methods, we will balance this theory with data-driven applications that illustrate how these methods are applied. Modern statistical practice also requires computation, so this class will introduce you to the R environment for statistical computing.

Math 280: Statistical Consulting
Instructor: Katie St. Clair
Time: Thursdays only, 2/3c
Prerequisite: Math 245 and permission of the instructor

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 285: Introduction to Data Science
Instructor: Katie St. Clair
Time: 1a
Prerequisite: Math 215 or Math 275

This course will cover the computational side of statistics that is not typically taught in an intro or methodology focused course like regression modeling. Most of data you encountered in your first (or second, or third, ..) stats course were contained in small, tidy .csv files with rows denoting your cases and columns containing your variables. The only messiness to this data may have been some missing values (NAs). We will start this course in data science by learning how to extract information from data in its "natural" state, which is often unstructured, messy and complex. To do this, we will learn methods for manipulating and merging data in standard and non-standard formats, data with date, time, or geo-location variables, text processing and regular expressions, and scraping the web for data. To effectively communicate the information contained in this data, we will cover data visualization methods (or, as statisticians often call it, EDA) that go beyond a basic histogram or boxplot, including methods for creating interactive graphics. We may also cover some modern computationally-intensive statistical learning methods. We will primarily use the stat software R in this course.

Math 295: Numerical Analysis
Instructor: Rob Thompson
Time: 5a
Prerequisite: Math 232

How can we best align two shapes or images? What do we discard if we can't store all of the information in a large data set? Can a computer identify a person's face? This course will be a journey through the mathematical theory of a variety of numerical algorithms for answering practical computational questions like the above. The two main themes will be linear algebra and optimization. We will learn about numerical methods for: solving linear systems of equations, predicting outcomes based on previous observations, finding or approximating eigenvalues and eigenvectors, and optimizing multivariable functions with and without constraints. Depending on the interest of the class, we'll also study techniques for solving ordinary and/or partial differential equations. Applications of these ideas will be explored whenever possible. This course will use MATLAB for implementation of algorithms (free student licenses will be available).

Math 331: Real Analysis II
Instructor: Gail Nelson
Time: 3a

Prerequisite: Math 321 or permission of the instructor

Now that you have mastered the ideas behind ε-δ proofs it is time to take advantage of your new skills. In this course we will look closely at the notion of integration. After a review of Riemann integration we will turn our attention towards other topics. More specifically, this course includes Lebesgue measure, the Lebesgue integral, an introduction to general measure theory, and Banach and Hilbert spaces. Not only is this your chance to "integrate" your knowledge of functions, it is also an opportunity to better your understanding of the legal interchange of limit operations. And if you know the instructor, it shouldn't surprise you if the Cantor set makes an appearance! The flavor of the course will be similar to a graduate-level course in analysis. If there is a possibility that you are headed for graduate school in mathematics or a related field, this course comes highly recommended.

Math 342: Abstract Algebra I
Instructor: Rafe Jones
Time: 2a
Prerequisite: Math 236 or permission of the instructor

Abstract algebra (not to be confused with elementary algebra, which you studied in high school or before) is a pillar of pure mathematics which supports a large body of work both within and outside of mathematics. Although most of abstract algebra was first studied for its intrinsic interest, ideas and results from the subject have also been applied in theoretical physics, in the design of error-correcting codes, in quantum chemistry, and even in the study of symmetry and artistic patterns like those in Escher's "Regular Division of the Plane" drawings. In this course we will study groups, rings, and fields, which generalize ordinary arithmetic systems like "clock arithmetic," matrix multiplication, permutations, and the set of real numbers, in the same way that abstract vector spaces generalize R^n. Along the way we'll see how a few simple axioms that encode "obvious" rules of arithmetic can give rise to both a remarkably rich theory and a zoo of fascinating examples.

Math 354: Topology
Instructor: Stephen Kennedy
Time: Tu/Thurs 2/3c
Prerequisite: Math 236 or permission of the instructor

The real line, the sphere, a two-holed torus and the Mandelbrot set are all collections of points, in each case, the same number of points. Topology is the branch of mathematics that studies how zero-dimensional points get together and arrange themselves into collections so strangely different. It's all about the arrangement. We'll approach the topic by asking ourselves questions; most of the class time and work of the course will be spent in small-group work sessions on problems and questions that we generate together. By the end you'll know, if you do not already, how a baseball is different from a doughnut and why you can't comb the hair on a coconut. (No light will be shed on why you might want a well-groomed coconut--just the futility of the desire.)

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, Liz Sattler***
Problems of the Week: ***Mark Kruesmeyer***
Web & Subscriptions: ***Sue Jandro***