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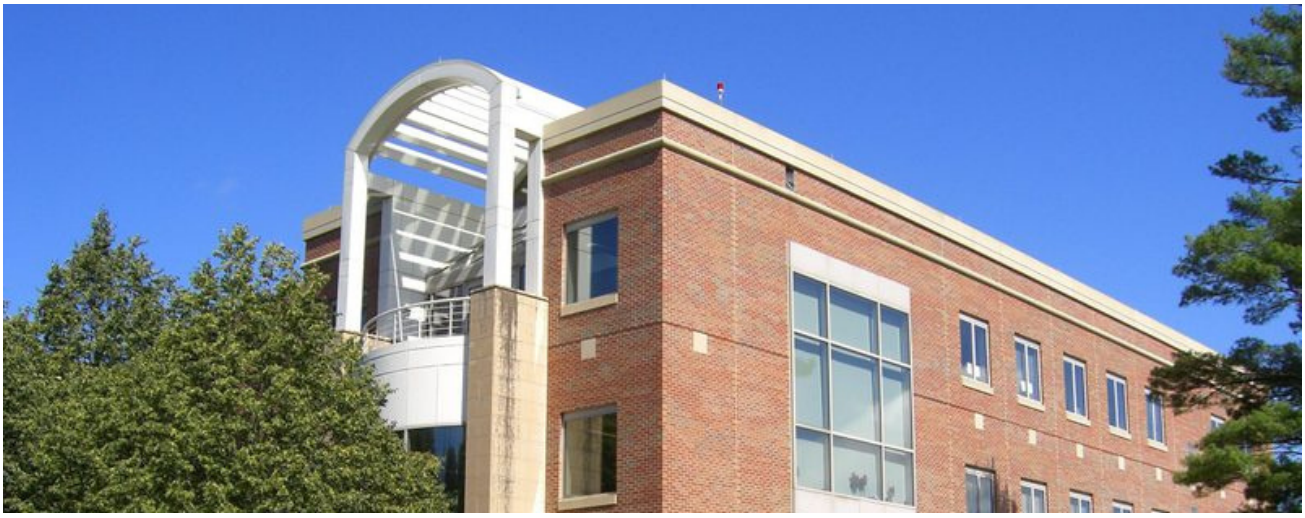
GOODSELL GAZETTE



IN THIS ISSUE

Comps Talks

Come support your friends and classmates in their comps talks next week! Individual talks will take place on **Tuesday, October 31, Thursday, November 2**, and **Friday, November 3**. Take a look at what they'll be speaking about below, then be sure to stop by and support them while they demonstrate what they've learned; you're likely to learn something new yourself as well!

Tuesday, October 31

Title: An Introduction to the Hyperreals
Speaker: Varun Saini
Time: 2:30-3:00pm
Location: CMC 301

Abstract: In this talk, we will delve into the intriguing realm of the hyperreals, an extension of the reals that introduces infinitesimals and unlimited numbers into the core of real analysis. Historically, various mathematicians utilized vague notions of infinitesimals in their calculations, defined informally as quantities smaller than any nonzero real number. By the 19th century, however, infinitesimals were replaced by the ε−δ definition of limits to more rigorously represent a variable becoming “infinitely close” to a given value. Our discussion will specifically revolve around the construction and implications of the hyperreal numbers. We will discuss the transfer principle, an incredibly powerful tool that facilitates the seamless translation of statements concerning the hyperreals into equivalent statements pertaining to standard real numbers. As we will see, studying the hyperreals provides us with a “limitless” set of nonstandard tools that offer intuitive approaches for studying real analysis.

Title: Strategy Proof Voting Mechanisms
Speaker: Aryan Arora
Time: 3:00-3:30pm
Location: CMC 301

Abstract: We examine the existence of strict strategy-proof voting mechanisms. Using Arrow's impossibility theorem we prove any strict strategy-proof voting mechanisms must be dictatorial. Then all non-dictatorial voting mechanisms are manipulable: at least one voter has an incentive to vote against their sincere preferences in order to improve the outcome of the voting procedure from their vantage. Finally, we extend the results of the Gibbard-Satterthwaite theorem to voting mechanisms where voters cast cardinal rather than ordinal rankings of the alternatives.

Thursday, November 2

Title: An Introduction to Algebraic Number Theory
Speaker: Alistair Pattison
Time: 2:00-2:30pm
Location: CMC 209

Abstract: This talk will be a whirlwind introduction to the field of algebraic number theory with the goal of stating and unpacking (but not proving!) two important theorems: Dirichlet's unit Theorem and the finiteness of the ideal class group. Along the way, we'll cover things like the algebraic integers, cyclomatic fields, Dedekind domains, and generalizations of prime numbers.

Title: An Introduction to Ergodic Theory
Speaker: Andrew Hong
Time: 2:30-3:00pm
Location: CMC 209

Abstract: Picture your morning cup of coffee. You like your coffee with cream, so you pour some into your cup and begin to mix it in. Of course, you know that if you mix your cup enough, the cream will distribute evenly throughout the coffee (yum!). But why? Is there something special about the coffee, the act of mixing, or the cream? Ergodic theory addresses these questions in a more rigorous setting. It is concerned with the long-term behavior of dynamical systems—particularly, repeated transformations on a set. In this talk, we give an introduction to the field. We begin with a crash course in measure theory; one way to observe the behavior of a set after a transformation is by examining its measure, but we'll need something stronger than "length" to measure the size of more complicated sets. We then move to exploring characterizations of ergodic transformations and give some examples. With the basics of ergodic theory under our belt, we end with Birkhoff's Ergodic Theorem, formalizing our metaphor of coffee and cream.

Title: The Poincare Group and Wigner's Classification: The Representation Theory of Particle Physics
Speaker: Henry Bowman
Time: 2:30-3:00pm
Location: CMC 301

Abstract: Particle physics aims to describe the very small and the very fast by merging quantum mechanics and relativity. A cornerstone of particle physics is Wigner's Classification, which equates elementary particles to irreducible, unitary representations of the Poincare group. Since Wigner's Classification was first introduced more than 80 years ago, it has had major impacts on both particle physics and representation theory. This paper introduces the Poincare Group and Wigner's Classification from basic group theory principles within the context of relevant physics. Emphasis is placed on the unitary, irreducible representations of the group SU(2).

Title: The Simple Continued Fraction Expansion of e
Speaker: Alyssa Hopper
Time: 3:00-3:30pm
Location: CMC 209

Abstract: In Number Theory, continued fractions serve as valuable tools for approximating irrational numbers and verifying their irrationality. When studying his namesake constant e in the mid-eighteenth century, Euler proved that e has a simple and patterned infinite fraction expansion. In the early 20th century, French mathematician Charles Hermite presented a short, elegant proof of the continued fraction expansion of e. The proof emerged as an unintended secondary product of his work with the constant's transcendence. In my talk, I will walk us through Hermite's proof, which involves clever manipulation of infinite integrals, limits, and fundamental Number Theory concepts to stumble upon Euler's original result.

Title: Gridiron Fortunes: Analyzing the NFL Prospects of College Quarterbacks
Speaker: Chris Elliott
Time: 3:00-3:30pm
Location: CMC 301

Abstract: In this presentation, we delve into the world of predictive modeling to uncover the hidden dynamics behind a college quarterback's journey to success in the NFL. By analyzing a rich dataset of college quarterback statistics and NFL outcomes, we employ machine learning techniques and statistical analyses to identify key features that correlate with NFL success. Our predictive models offer insights into the likelihood of a college quarterback achieving stardom in the professional league, making them invaluable tools for player evaluation and draft strategy. We also address the challenges of model validation and adaptation in the ever-evolving NFL landscape, underlining the potential for data-driven insights to reshape the future of quarterback success in the league.

Title: An Introduction to Spatial Statistics Clustering Methods
Speaker: John Carragher
Time: 5:15-5:45pm
Location: CMC 209

Abstract: This talk explores the basics of spatial statistics, spatial statistics clustering methods including the G, F, K, and J functions, and applies these methods to a basketball data set. Findings include that shot patterns for both the 2001 - 2002 and the 2018 - 2019 NBA regular seasons are largely consistent with clustering and non-randomness. Both the methods and findings discussed will hopefully motivate further spatial analysis of NBA shot patterns.

Friday, November 3

Title: The Mathematics of Compressed Sensing
Speaker: Spencer Alvey
Time: 3:30-4:00pm
Location: CMC 209

Abstract: Have you ever used a phone that has voice or facial recognition? Have you ever needed a medical imaging? If so, you have encountered a process that most likely used a mathematical concept called compressed sensing. In short, we can use compressed sensing to acquire a sparse signal and reconstruct it in a more efficient manner than in traditional methods. This in turn greatly reduces the time and and resources necessary to complete tasks like facial recognition. In this talk, we will take a blend of linear algebra, optimization, and probability to build the mathematical framework that makes compressed sensing possible. As it progresses, we will give an overview of important topics such as the Restricted Isometry Property and how the regularization of a vector's 1-norm produces a unique solution to an underdetermined system to build to the ultimate conclusion of compressed sensing.

Title: Multilevel Generalized Linear Models Applied to Home Run Prediction in Baseball
Speaker: Steve Antrim
Time: 4:00-4:30pm
Location: CMC 209

Abstract: In the realm of baseball analytics, the challenge of accurately predicting home runs draws the attention of fans and experts alike. This study examines the intricacies of predicting home runs using multi-level generalized linear models (GLMs). The Lahman dataset utilized in this study offers a comprehensive view, encompassing a diverse range of players and eras in baseball history. The primary predictors in this model were the player's age and the era in which they played. The methods centered around the multi-level structure of GLMs, which accounts for nested data structures and allows for individual variability in home run performance. Results from the GLM demonstrated significant roles of both age and era in predicting home run counts. Notably, younger players in more recent eras were observed to have a higher likelihood of hitting home runs, reflecting shifts in training methods and game dynamics over the years. However, the model also showcased the importance of considering interactions and non-linearity to capture the multifaceted nature of the sport. While age and era stand out as vital predictors for home run output, the multi-level GLM approach provides a nuanced understanding of home run trends, allowing for accurate projections. The potential real-world implications of this model could help guide teams in player recruitment and training strategies.

Data Science REU Announcement

Starting Summer 2024, the Division of Biostatistics at the University of Minnesota, in collaboration with the Masonic Institute for the Developing Brain, will be hosting a **10-week Summer Research Experience for Undergraduates (REU)**, called Equitable Data Science in Adolescent Development. This 10-week REU is a paid, full-time position designed to give undergraduate students hands-on training and research experience in data science, statistical modeling and machine learning, and scientific communication. Topics on diversity, equity, and inclusion (DEI), and their role in data science form the foundations of this program, emphasized early through DEI modules and discussions. Students will analyze data from the Adolescent Brain Cognitive Development (ABCD) Study, the largest longitudinal study on adolescent development in the United States.

Our website contains more details about the program. If you know any undergraduate students who may be interested, please share this website with them, and please encourage them to apply. The deadline for applications is **31 January 2024**.

If you have any questions about this program, please email mfiecas@umn.edu.

Jobs, Internships, and Other Opportunities

Internships

Data Summer Internship
Coding it Forward. Due Monday, October 30.

2024 Actuarial Summer Internship
2024 Data Analyst Internship
Milliman. Due Tuesday, October 31.

2024 Undergraduate Summer Analyst – Statistics
Federal Reserve Bank of New York. Due Tuesday, October 31.

Jobs

Forestry GIS Database Fellow
MANO Project, an initiative of Hispanic Access Foundation. Due Sunday, October 29.

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