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Comps Talks

Come support your friends and classmates in their comps talks next week! Individual talks will take place Tuesday, November 1 at 3 pm and Thursday, November 3 at 4 pm, both in CMC 206. 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, November 1 — CMC 206

Title: Applying Classification Methods to Predict Hit Probability in Baseball
Speaker: Sam Kim
Time: 3:00 - 3:30 pm

Abstract: In 2022, MLB player Ronald Acuña hit a ball that travelled 409 feet at a launch speed of 109 MPH and a launch angle of 25 degrees. This ball would have been a home run in most stadiums, with a hit probability of 98%; however, the defender made an amazing leaping catch at the wall, making this "perfect" hit result in an out. On the other hand, in another game, Charles LeBlanc also hit a ball that travelled 409 feet at a launch speed of 109 MPH, this time with a lunch angle of 24 degrees. This batted ball did result in a home run, with it also receiving a hit probability of 98%. If they were hit essentially exactly the same, why did Acuña's batted ball result in an out, while LeBlanc's resulted in a home run? Currently, hit probability is calculated by Major League Baseball to be a model that contains launch speed and launch angle. It is of interest to create a new model that identifies as many additional factors that can possibly predict hit probability, such as whether they are the home team, whether they are a righty or lefty, the defensive team, where the game is being played, etc. We will find these models through 3 different classification methods: Logistic Regression, Generalized Additive Models, and Random Forests. These models and methods will then be compared and contrasted, ultimately revealing a final model that best predicts hit probability in Major League Baseball.

Title: Stommel's Box Model of Ocean Circulation
Speaker: Alise Pedersen
Time: 3:30 - 4:00 pm

Abstract: In this talk, we explore the fundamental process of ocean circulation by investigating Stommel's box model. Ocean circulation allows energy to be transported around the world and preserves Earth's

examination of autonomous differential equations, dynamical systems, equilibrium states, stability and bifurcations.

Title: Optimal Stopping in Stochastic Differential Equations: When to Sell a Financial Asset under Uncertainty
Speaker: Ton Meesena
Time: 4:00 - 4:30 pm

Abstract: In many fields, such as economics, finance, and computer science, optimal stopping problems arise when it comes to determining the best time to execute a specific action to maximize utility under uncertain conditions. For example, when should someone sell a commodity or stock in a volatile market to make the most money? When should a company stop searching for new employees? Or, when should a person stop hunting for jobs? In this study, we rigorously formulate the problem of when to sell assets and devise a provably-optimal selling strategy that maximizes expected profit.

Title: Error Processing for Linear Block Codes
Speaker: Lane Maitland
Time: 4:30 - 5:00 pm

Abstract: Our lives depend on communication, but our methods are prone to errors. Coding theory illustrates how the encoding and subsequent error processing of messages improve the reliability of communication. In this presentation, we explain the Hamming[7,4] code, which we utilize to demonstrate how generator matrices and check matrices execute the tasks performed by an encoder and error processor, respectively. We show that the minimum distance of a block code determines error-correction and error-detection capabilities, and we reveal how the error probability impacts the chance of successful message transmission with a block code.

Title: Introduction to Category Theory and its Applications
Speaker: Josiah Misplon
Time: 5:00 - 5:30 pm

Abstract: Throughout our mathematical journeys, we may encounter a variety of mathematical structures, such as sets, groups, vector spaces, graphs, and manifolds. For each of those mathematical structures, we find a connected relation. For sets, we have functions, while, for vector spaces, we have linear transformations (and so on). Because these relations have similar notions of identities and compositions, we can create categories: a more general mathematical structure consisting of instances of mathematical structures and relations. I will discuss categories, their corresponding relation (called a functor), and the Yoneda Lemma, a consequential result of category theory, with applications to linear and abstract algebra.

Thursday, November 3 — CMC 206

Title: Random Knots and Their Distribution in the Petaluma Model
Speaker: Katrina Li
Time: 4:00 - 4:30 pm

Abstract: Randomized knot models are developed from different perspectives and for various purposes. In search of more knots in the infinite space of knots and understanding the properties they tend to have,

specific knot type generated by the random n-petal Petaluma Model and shows that these probabilities decay to zero as n grows, which implies that the n-petal model represents at least exponentially many distinct knots. In addition, a similar phenomenon extends to 2-component links of the Petaluma Model.

Title: Ramsey Theory: Finding Patterns and Defying Chaos
Speaker: Daisuke Yamada
Time: 4:30 - 5:00 pm

Abstract: Ramsey Theory is a branch of Combinatorics that studies the appearance of order and pattern in a combinatorial structure. It proves that "complete disorder is impossible," allowing us to recognize some extent of pattern residing within a chaotic combinatorial structure through colorings. This talks begins with introduction to the basic concepts and definitions in Ramsey Theory. It subsequently builds up to three important results of the theory, respectively known as Ramsey Theorem, Van der Waerden's Theorem, and the Hales-Jewett Theorem, each of which exhibits the existence of patterns in different combinatorial structures. As it progresses, I provide some proofs to the simplified versions of the three main theorems.

Title: An Introduction to Markov and Hidden Markov Models with Applications
Speaker: Zhihan Yang
Time: 5:00 - 5:30 pm

Abstract: Markov and Hidden Markov models are simple probabilistic models for sequences and have been widely used in many fields, including time series analysis, genetics, language modeling, and speech modeling. This talk provides a short introduction to these two models and is divided into three sections. The first section describes frequentist and Bayesian inference for Markov models with an application in language modeling. The second section thoroughly discusses the relationship between limiting, stationary, and visitation distributions of Markov models and how this theory inspired Google's PageRank algorithm for ranking websites. The third and last section is dedicated to Hidden Markov models; it explains the forwards-backwards algorithm for latent variable inference and the expectation-maximization algorithm for frequentist parameter inference. Due to the time limit, Bayesian parameter inference for Hidden Markov models via variational inference is not included in the talk; a reader interested in this topic is encouraged to read our paper.

Title: (Five Ways in Which) The Fourier Inversion Formula Implies the Fundamental Theorem of Algebra
Speaker: Yilong Song
Time: 5:30 - 6:00 pm

Abstract: This talk presents five particular ways to prove the fundamental theorem of algebra. What these five ways have in common is the usage of the Fourier inversion formula. To provide a self-contained while easily intelligible account of these proofs, we first introduce the two theorems, supply a suitable amount of background knowledge behind them, prove the Fourier inversion formula given the background knowledge, and proceed to presenting four direct proofs. For the fifth proof, we show that the Fourier inversion formula also implies Liouville's theorem, of which the fundamental theorem of algebra is famously a consequence.

Job, Internship, & Other Opportunities

Entrepreneurship Fellow - Venture for America, due Tuesday November 1.

Summer Research in Math/Stats/CS - Institute for Defense Analyses, Center for Communications Research, apply by Monday November 14.

Culture & Field Experience Internship - RBC Wealth Management, apply by Tuesday Novemeber 15.

Technology Early Careers Development Program Internship - Cigna, apply by Tuesday November 17.

Technology Early Career Development Program (Full-Time) - Cigna, apply by Tuesday November 17.

Software Internship - Ball Aerospace, apply by Friday November 18.

Technical Consultant - Huron Consulting, apply by Thursday December 29.

Visit the Carleton Career Center with any questions and for further opporunities.

Upcoming Events

Week 8

Tuesday November 1, 3:00 - 5:30pm
Individual Comps Talks — CMC 206

Thursday November 3, 4:00 - 6:00pm
Individual Comps Talks — CMC 206

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