



ΓΟΟΔΣΕΛΛ ΓΑΖΕΤΤΕ

Carleton College

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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 12 in CMC 206 starting at 3:30 pm. 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 12 --- CMC 206

Title: Brownian Motion

Speaker: Andrew Roy

Time: 3:30

Abstract: Brownian motion was first described in 1827 by Robert Brown as he observed the erratic movement of particles of pollen suspended in water. It is a continuous-time, continuous-space stochastic process modeling random movement with expected value 0 and variance equal to the time it's been moving. The first half of my presentation will build the intuition of Brownian motion and describe its properties. The second half will discuss several variations on Brownian motion and their applications. Among these applications are NBA game prediction, animal tracking, and brain imaging.

Title: Random Walks on the Integers

Speaker: Nick Reeves

Time: 4:00

Abstract: A random walk is a sequence of random movements on some mathematical space. Consider a point on the number line that begins at zero. At each instance, a coin is flipped. If the outcome is heads, the point moves up one unit on the number line. If the outcome is tails, the point moves down one unit on the line. We can view this situation as a game in which a gambler bets one dollar for each coin flip over a series of coin flips. After the game concludes, the final location of the point on the line represents the amount of money that the gambler has won or lost in the game. In this talk, I will cover some of the derivations that help us answer questions about the properties of simple random walks. I will also introduce an application of simple random walks in the form of the Gambler's Ruin problem.

Title: Latent Class Analysis

Speaker: Jez Bigornia

Time: 4:30

Abstract: Latent Class Analysis (LCA) is an unsupervised statistical learning technique used to cluster categorical indicator variables. The technique is useful in classifying types of drinkers based on drinking behaviors and levels of depression in adolescents based on certain patterns, just to name a couple of examples. Furthermore, LCA allows us to calculate probabilities of an observation exhibiting a behavior given the class the observation falls in. In this talk, we will learn about the Latent Class model, how to fit it, what to infer and conclude from fitting the model, and how it compares to (and is better than) k-means clustering, another popular method of clustering like responses

Title: Bulgarian Solitaire: An Operation on Partitions of an Integer

Speaker: Jared Kannel

Time: 5:00

Abstract: Bulgarian Solitaire is a game in which you start with several piles of cards. On each turn, you remove one card from each pile and turn the cards you removed into a new pile. The game ends once you come across the same configuration of cards twice. This game relies on a function on partitions, which gives you a different partition of the same integer. In my talk, we will explore ways to predict the behavior of partitions under the Bulgarian Solitaire operator and learn about why you can always win the game. In addition, we will look at some theorems relating to the function.

Title: Macroscopic Behavior of Theta Neurons

Speaker: Lawrence Lin

Time: 5:30

Abstract: How do we understand a complex many-body system like the human brain? The human brain is made up of a complex network of neurons that can be modeled as a dynamical system. However, modeling the interaction of every neuron in our brain is virtually impossible, without massive computational expenses. In this talk, I am going to describe the basic features of a theta neuron network, then explain how we can use a clever method of the mean-field reduction of the network to find the desired reduced system. Furthermore, I am going to use the reduced dynamical model of the human brain to predict different macroscopic behaviors of the network of neurons. In this process, I will use bifurcation analysis to describe the three macroscopic states that the neurons can exist in.

Title: A Counterexample to Hedetniemi's Conjecture

Speaker: Sam Terwilliger

Time: 6:00

Abstract: In 1966, Stephen Hedetniemi formulated a graph coloring conjecture, stating that the chromatic number of the tensor product of two graphs was equal to the minimum of the individual chromatic numbers of the two graphs. For 53 years, attempts to both prove and disprove this conjecture were made, leading to a mirage of potential evidence and counter-evidence, yet the validity of the conjecture remained unknown. Finally, to much amazement, this past June the construction of a family of counterexamples was published! In this talk, I will describe the creation of this counterexample, touching on a variety of topics from the domains of graph coloring, graph products, and combinatorics.

Origami With Gail

When: Thursday, November 14th 4-5:30

Where: CMC 206

Aside from being the coolest person ever, Professor Gail Nelson has been known for three things: her love for the Cantor set, her distinguished musical abilities, and her origami skills. The department will be hosting an origami event where Gail will be teaching us how to make a buckyball out of post-it notes! We will be providing supplies and good company. Just bring yourself!

No past experience with origami is necessary. If you want to see an example of what we'll be doing, there is a buckyball in the glass case by the department's entrance. Bonus: she'll also share some cool math facts about the buckyball.

As If We Don't Have Enough Problems Already...

The annual NCS problem-solving contest will take place this year on Saturday, November 16, from 9am to noon. Participants will work in teams of up to three on ten problems, which are usually at a wide range of difficulty levels. Although there will likely be more than seventy teams competing from around the region (there may even be some in Canada), our part of the contest will take place here on campus. Before the contest, there will be bagels, cream cheese, and coffee from Tandem Bagels. If you are interested in participating, please let Rafe Jones know who will be on your team by Tuesday, November 12. If you want to participate but don't have a team, let Rafe know that too (the sooner, the better!) and he might be able to help you find others with whom you could form a team.

If you're interested in seeing what NCS problems are like, stop by our weekly problem-solving session on Wednesdays from 4:30-5:30 in CMC 328.

Upcoming Events

Week 9

Tuesday, Nov 12, 3:30-6:30pm

Comps Talks - CMC 206

Thursday, Nov 14, 4:00-5:30pm

Origami with Gail - CMC 206

Job & Internship Opportunities

Consumer Financial Protection Bureau's Office of Research: 2020 Summer Pathways Interns

The Consumer Financial Protection Bureau's (CFPB) Office of Research (OR) is currently recruiting

for 2020 Summer Pathways Interns. The Pathways Internship Program is a paid opportunity for current undergraduate and graduate students. Interns work directly with a seasoned member of our team on policy and research projects and are assigned to one project which they are expected to complete during the twelve-week program. Interns will be expected to work independently but will be provided necessary on-the-job training and mentorship to support them in their work. Details and application information can be found at <https://www.consumerfinance.gov/about-us/careers/current-openings/student-trainee-program-assistant-6x/> and <https://www.consumerfinance.gov/about-us/careers/current-openings/student-trainee-program-assistant-9x/>.

National Public Radio: Internships

This opportunity is brought to us by a Carleton alum, Martin Kaste '91 (MKaste@npr.org). Martin has talked to Carleton students in the past about working at NPR and is happy to do so again. He isn't directly involved in hiring for these internships, but he knows a lot about them if someone wants background info or advice. Find more information at <https://www.npr.org/about-npr/181881227/want-to-be-an-npr-intern>.

Problems of the Fortnight

To be acknowledged in the next *Gazette*, solutions to the problems below should reach me by noon on Tuesday, November 19.

1. Consider two ants crawling along grid lines in the coordinate plane, as follows: At time $t = 0$, the ants start at the points $(2019, 0)$ and $(0, 2019)$. In between any two successive integer times, each ant crawls either one unit to the right or one unit up, each with probability $\frac{1}{2}$. For example, at time $t = 1$ the first ant will be either at $(2020, 0)$ or at $(2019, 1)$, and those positions are equally likely. At time $t = 2$, the first ant will be at $(2021, 0)$ with probability $\frac{1}{4}$, at $(2020, 1)$ with probability $\frac{1}{2}$, and at $(2019, 2)$ with probability $\frac{1}{4}$. Unless and until they meet, the two ants are completely unaware of each other, and their random “decisions” (for each unit of time, whether to crawl up or to the right) are independent. What is the probability that the ants will (ever) meet?

2. In this problem we consider real-valued functions f , defined for all real numbers, with the property that $f(f(x)) = -x$ for all x .

- a) Does a continuous function with this property exist? If so, give an example; if not, show why not.
- b) Give an example of a function with this property whose graph, with the exception of points with integer values of x , consists only of straight line segments.

Alas, as of this writing no student solutions to the problems posed October 25 have arrived; both John Snyder and “Auplume” did solve the first problem, but nothing at all has come in regarding the second problem. It’s a busy time of the term, but if you’re finding it a bit chilly out, why not take a break inside, find a comfortable corner and/or a friend, and contemplate a problem?

- Mark Krusemeyer



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