



Sonoma State University Department of Mathematics and Statistics
presents a series of informal talks open to the public

"The first thing to understand is that mathematics is an art." -Paul Lockhart

Every Wednesday at 4:00pm in Darwin 103. Coffee, Tea & Cookies at 3:45pm in Darwin 103.

Phone: (707) 664-2368 www.sonoma.edu/math

Series supported by Instructionally-Related Activities Funds

- August 29** **The Cow Problem of Narayana Pandita, a Fibonacci-like Problem from Fourteenth Century India** **Dean Gooch, Santa Rosa Junior College**
The Cow Problem of Narayana Pandita involves the growth of a cow population over twenty years. These cows are able to have their own female calves in the fourth year of their life. I will investigate the series solution used to solve this problem by fourteenth century Indian mathematicians and look into finding a recurrence relation to solve this problem. Extensions of this problem will also be examined.
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- September 5** **Mathemagical Tricks** **Jay Cummings, Sacramento State University**
Most magic tricks amaze by the subtle use of small lies: a well-practiced sleight of the hand, or equipment with a deceptive property. Others, though, require no lies at all—they are self-working tricks, relying only on the magic and mystery that is inherent in mathematics. In this talk I will demonstrate several mathematical tricks for you, and will show you how (most) of them are done.
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- September 12** **Analysis Meets Arithmetic** **Ken Jacobs, Northwestern University**
One of the first things we learn about in arithmetic is that every real number can be written in decimal expansion. Years later, we learn in calculus that lots of functions can be written as Taylor series. These two topics, typically learned years apart, are strikingly similar, and the analogy between them motivated Kurt Hensel to introduce p-adic numbers. In this talk, we'll explore Hensel's construction and the beautiful mathematics that have since unfolded.
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- September 19** **StateSong: Algorithmic Conversion of Biometric Data into Music** **Robert Joseph, MediMuse LLC, Inventor of StateSong Tech**
Supposing, for instance, that the fundamental relations of pitched sound in the science of harmony and musical composition were susceptible to of such expression and adaptation, the engine might compose elaborate and scientific pieces of music of any degree of complexity or extent." - Ada Byron, 1st computer programmer (mathematician, musician, developer of machine algorithms). Leveraging algorithms such as Markov Chaining, StateSong technology convert the bodies state-data to state-song; these being "biological musical compositions" that, when fed back into the body of origin can induce ones targeted better states; ie, as calm, learning, second wind, meditation, alert, joy, and happiness.
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- September 26** **Identifying Car Acceptability Using C5.0 Decision Trees and Rules** **Ruby Suarez, Sonoma State University**
The C5.0 decision tree algorithm and rule learners are two machine learning methods that also make complex decisions from sets of simple choices. Decision tree learners are powerful classifiers, which utilize a tree structure to model the relationship among the features and potential outcomes. Decision trees are built using a technique called recursive partitioning, also known as divide and conquer which splits the data into subsets which then split into even smaller subsets until the algorithm determines the data within the subsets are sufficiently homogenous. The data used is the Car Evaluation Data Set from the UCI machine learning website. (<https://archive.ics.uci.edu/ml/datasets/Car+Evaluation>.) I will be using the C5.0 decision tree algorithm to classify the car acceptability with four class level. This dataset has 6 attributes which are Buying Price with four class levels, Maintenance Price with four class levels, the number of Doors with three class levels, Person capacity with three class levels, the size of luggage boot with three class levels, and the estimated safety of the car with three class levels.
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- October 3** **Math Indispensable in Diagnosing Concussion** **Joseph P. Leahy, Chase Chiropractic Health and Sports Enhancement**
I have been working with the SF 49ers for over 15 years now, and recognized a major problem with head injuries that were not really diagnosed, and certainly not treated. Players were having MTBI (mild traumatic brain injury) and were developing CTE (encephalopathy of the brain). Symptoms were difficult to endure, and could be fatal in the long run in some cases. We needed a better analysis of the data, one that reflected the nature of the mind/brain. In this talk, we will reveal advances and techniques in this area that could not have been done without mathematical analysis.
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- October 10** **Re-presentation and Multiple Representations** **Kevin Moore, University of Georgia**
Using multiple representations has long been an instructional tool believed to increase student learning. Yet, using multiple representations successfully can be a challenge to even the most seasoned mathematics instructor. Accordingly, researchers who have investigated the use of multiple representations to increase student learning have revealed mixed results. In this talk, using the function concept, I clarify potential issues with "using multiple representations" as typically framed. I describe how these issues can explain the mixed results typically found with using multiple representations. In doing so, I draw on my research group's work to illustrate a productive approach to "using multiple representations" that relies less on the type or number of representations and more on the act of re-presenting covariational relationships.
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- October 17** **Some Applications of the Combinatorial Nullstellensatz and the Discharging Method** **Sogol Jahanbekam, San Jose State University**
The discharging method is a tool in a two-step approach to inductive proofs of some problems in graph theory. It is used to prove that a global hypothesis guarantees the existence of some desirable local configurations. The Combinatorial Nullstellensatz is an algebraic tool in combinatorics and number theory. In graph theory it is applied to prove the existence of certain configurations or labelings in graphs. In this talk we briefly talk about these two techniques. We then apply them in some graph coloring problems.
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- October 24** **The Mathematics of Machine Learning** **Luis Serrano**
Machine learning is used for many exciting applications nowadays, including image recognition, voice and text processing, and even self driving cars. But what's behind all this? It's really just some simple mathematics, including linear algebra, calculus, and probability. In this talk, we'll go over the mathematics used in machine learning, with a special focus on neural networks, one of the most popular models out there.
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- October 31** **Polyhedra in Calculus** **Federico Ardilla, San Francisco State University**
I will introduce you to two beautiful polyhedra that arise in combinatorics, and show you how they can be used to perform two interesting calculus computations.
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- November 7** **Statistical Applications in Extreme Weather and Climate Research** **Jose Hernandez Ayala, Sonoma State University**
Statistical methods and models are widely used in weather and climate science research to explore issues such as global climate change modeling, frequency and magnitude of extremes (droughts, floods, heatwaves, etc.) and the spatial distribution, extent and variability of the impacts associated with powerful weather events like hurricanes. This talk will focus on exploring multiple statistical applications in extreme weather and climate research that include the use of multiple correlation tests, linear regression models, spatial interpolation techniques, principal component analysis, spatial overlay analysis and extreme value analysis. The statistical applications will be discussed in the context of their use in research that examines rainfall extremes in the tropics and their connections to hurricanes, floods and droughts.
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- November 14** **Apportionment and Gerrymandering** **Emille Lawrence, University of San Francisco**
The United States Census Bureau will conduct its next census in the year 2020. But why is this decennial count so important? Aside from allocating funds for municipalities to receive certain social services, the census is used for the apportionment (or division) of Representatives in the House. We will look at several different methods of apportionment that have been used over the years and some of the paradoxes that can arise therefrom. We will also discuss gerrymandering (the redrawing of district lines for ulterior motives) and some different measures for a district's "compactness".
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- November 21** **NO TALK — Thanksgiving Holiday**
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- November 28** **Metacognition and the Problem-Solving Process. How do Mathematicians do Math?** **Abigail Higgins, Sacramento State University**
Mathematicians are widely regarded as expert problem-solvers. But their ability to solve problems is not innate; it was honed over several years of practice. What does it mean to do mathematics? And how does one improve in the practice? We will investigate how mathematicians think about their thinking (i.e. metacognition) and how students can leverage similar metacognitive practices in their own problem-solving. Together, we will consider different problem-solving practices employed by mathematicians, discuss strategic applications of these mathematical habits, and practice applying these strategies to new problems.

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