M*A*T*H COLLOQUIUM

Wednesdays 4 p.m. • Darwin 103 • Coffee, Tea & Cookies @ 3:45

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

Aug 30 **Mathematical Representations of Tropical Trees and Implications for Ecology** — **Lisa Bentley, Biology Department, Sonoma State University**

The variety of tropical tree forms underlies the structure and function of tropical forests. While a descriptive basis exists to explain tree form, quantitative descriptions linked to mechanistic processes are lacking. This talk will discuss: 1) advances, gaps, and future directions in developing mathematical representations of tropical trees, and 2) implications for using these models to understand the fates of trees and forests under a changing climate and anthropogenic pressure.

Sept 6 **Mathematics for Watershed Sustainability** — **Martha Shott, Sonoma State University**

The practices of estimation and math modeling can be powerful tools for managing valuable environmental resources. In this talk, we discuss how fundamental mathematical concepts are integrated into SSU's interdisciplinary freshman learning course Science 120: A Watershed Year. These mathematical principles can deepen our understanding of the surrounding Russian River watershed, improve our approach to promoting the health of this environment, and assist us in solving relevant problems in resource management and sustainability.

Sept 13 **Computational Applications in Hurricane and Climate Modeling (or The Journey From Real Theory to Real World)** — **Aaron Donahue, Lawrence Livermore National Laboratory**

In late August of 2012 a group of computational scientists are hunkered down writing a report which will determine how the city and the state will prepare and respond to the approaching hurricane Isaac which is set to make landfall along the Louisiana coastline. Running complex computational models on large high-performance computing clusters, scientists are able to predict where the storm will be the most destructive and more importantly the extent of flooding due to storm surge. The unspoken heroes, working behind the scenes, are the differential equations that make it all work. This talk will discuss the development and application of computational models. From a purely mathematical theory to execution to real world phenomena on high performance computing platforms; with a particular focus on hurricane storm surge modeling and climate prediction.

Sept 20 **Analysis of Cancer Genomic Data Using Computational Algebraic Topology** — **Javier Arsuaga, University of California, Davis**

Genomic technologies measure thousands of molecular signals with the goal of understanding essential biological processes. In cancer these molecular signals have been used to characterize disease subtypes, cancer pathways as well as subsets of patients with specific prognostic factors. This large amount of information however is so complex that new mathematical methods are required for further analyses. Computational homology provides such a method. We have developed a new homology based supervised method that identifies significant copy number changes in the tumor genome. We applied this method to a set of breast cancer patients with known molecular subtype. The talk will end discussing possible extensions of this approach.

Sept 27 **Reasoning and Proofs in School Mathematics** — **Jeong-Lim Chae, Sonoma State University**

Communities of mathematics education agree that reasoning and proofs are essential aspects of school mathematics, but many people still remember that their mathematics learning was memorizing unrelated formulas and regurgitating answers to given problems. Some argue that mathematics beyond basic operations is useless in real life and mathematics should not be required for all students. In this talk, I will discuss how reasoning skills progress toward proofs in school mathematics and how to integrate mathematical proofs in teaching without the burden of formality and rigor. Finally, I will discuss the role of teachers in promoting reasoning and proofs so that their students can understanding mathematics better.

Oct 4 **Euler's Formula and The Birth of Topology** — **Maia Averett, Mills College**

In this talk I would like to illustrate the underlying philosophy and goals of algebraic topology by looking at a specific example in its historical context. Euler's polyhedral formula is often considered to be one of the first theorems of algebraic topology and its underlying idea gave birth to the philosophy that drives algebraic topology. I will begin by explaining in broad terms what the goals of topology are. Then I'll cover a bit of history to place Euler's formula in its appropriate context. We'll explore and generalize Euler's formula and finally, we'll use the generalization to study two-dimensional objects called surfaces. This talk is intended to be accessible and interesting for undergraduates at all levels.

Oct 11 **Polyhedra Doing Calculus** — **Federico Ardila, San Francisco State University**

I will introduce you to two beautiful polyhedra, and show you that they know how to perform two interesting calculus computations.

Oct 18 **Real Infinite Series: Pre-algebra Through Calculus II** — **Kirby Bunas, Santa Rosa Junior College**

In this talk, I will present an assortment of interesting and fun real infinite series examples and proofs, at levels ranging from pre-algebra through second semester calculus. While much of the material builds upon infinite series topics taught in first year calculus, we will also explore a few ways that real infinite series could, in theory, be introduced much earlier in the mathematics curriculum.

Oct 25 **Gerrymandering and Geometry** — **Greg Morre, Santa Rosa Junior College**

Following the 2020 United States Census, congressional representation will be re-apportioned among the states. Then congressional districts within each state must be re-drawn. Gerrymandering is the process of manipulating district boundaries to favor a particular outcome of an election. In order to prevent gerrymandering, most states require that electoral districts are compact. However, compactness is rarely defined. We will discuss different strategies used to gerrymander. Then we will examine how mathematics can be used to measure compactness and detect gerrymandering.

Nov 1 **Mathematical Relationships in Chemistry & Their Connections with Student Understanding of Chemical Concepts** — **Jennifer Whiles Lillig and Carmen Works, Chemistry Department, Sonoma State University**

Math is a daily component of every chemist's existence. Trends in our field, particularly the emerging roles of big data and data science, make a fundamental understanding of math even more important in our careers. However, for a student of chemistry, math can become a daunting obstacle when trying to connect a mathematical calculation to its chemical meaning. We will discuss common student stumbling blocks seen across standard chemistry curriculum including mathematical-chemical relationships in reaction kinetics, biological buffers, and the molecular absorption of light. We hope to provide a platform for discussion that can support mathematical understanding for chemistry majors and potential mathematics applications for math students.

Nov 8 **Math Bistro III** — **Bill Barnier, Professor Emeritus, Sonoma State University**

The menu includes mathematical appetizers for the hungry mind and main dishes from Chefs Euclid, Diophantus, and others. Specials of the day will include $\sqrt{2}$ and Diophantine equations.

Nov 15 **Exploring Egyptian Fractions** — **Mike Nakamaye, University of New Mexico**

Ancient Egyptian cultures expressed fractions using (distinct) unit fractions. For example they might have written 2/5 = 1/3 + 1/15. In addition to having practical applications for fair division problems, this interesting way of writing fractions raises many interesting mathematical questions which we will explore:

- How do you write a "regular" fraction as an Egyptian fraction?
- Can you write every fraction as an Egyptian fraction?
- How many unit fractions do you need to express 4/n for an arbitrary whole number n?

Nov 29 **Lessons Learned From Writing Mathematics Assessments** — **Jessica Balli, Callahan Consulting**

Teachers spend hours crafting lesson plans that strike a balance between procedural fluency, conceptual understanding, and application in mathematics. However, when it comes to assessments, they are often collecting very limited information about what their students know. During this presentation we'll learn how an SSU graduate is working with local schools and districts to improve assessment practices by providing students with opportunities to problem solve, reason, and model with mathematics.

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