M·A·T·H COLLOQUIUM
SONOMA STATE UNIVERSITY

DEPARTMENT OF MATHEMATICS & 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 on Zoom
Phone: (707) 664-2368   **www.sonoma.edu/math**

AUG 26

An Introduction to Epidemics on Graphs
Bori Mazzag, Humboldt State University

The COVID-19 epidemic has intensified interest in mathematical epidemiology, and some basic terminology has even entered the public discourse. I will begin this talk by providing an overview of a basic infectious disease model (the SIR model), and its dynamics. Then, I will describe an extension of this basic framework, in which we consider how a disease might spread in a population in which social connections determine which individuals interact. We will investigate ways in which the predictions of the basic SIR model change when they are propagated on a network. Finally, time permitting, I will describe a question that I plan to study this academic year with two undergraduate research students, using a similar framework of dynamics on graphs.

SEPT 2

A Random Walk in the Career of an SSU Statistician
Elizabeth Mannshardt, Environmental Protection Agency

SSU Math Majors - what do you want to do with the rest of your career? That question continues to challenge and excite me! From finance to paleoclimate, extreme storms to satellite algorithms, and machine learning to environmental policy, my career as an SSU Math/Stat graduate has been full of exciting opportunities and new adventures. My favorite aspect of being a statistician is the variety of projects that we get to work on. I will talk about several projects and interesting collaborations with scientific colleagues across academics, industry, and government. This talk will cover my experiences working in the financial and consulting industries; doing academic research in environmental statistics and climate change; teaching university classes covering topics from Stat 101 to graduate specialty courses; and working in the federal government as both an environmental statistician and as a manager of an analytics IT division.

SEPT 9

A Case for Ranked-Choice Voting
Rick Luttmann, Sonoma State University

There are many methods of determining the will of an electorate, but the system in widespread use in this country (the "Plurality System") is just about the worst. Though it has been shown mathematically that there is no perfect system ("Arrow's Impossibility Theorem"), the family of Ranked-Choice Voting systems have many advantages. We will consider two of these: APS ("Average Placement Score", based on the ideas of Jean Charles de Borda of France) and IRV ("Instant Runoff Voting", first suggested by Thomas Hare of England). By comparing them thoroughly, we will see why APS is by far the superior method.

SEPT 16

How Can Statistics Help Us Understand Population Food Habits?
Ayona Chatterjee, California State University, East Bay

How much we eat, what is safe to eat—these questions are relevant to everyone. In this talk we discuss how statistics help answer these questions, and give a preview to the world of Dietary Risk Assessment. Dietary data are collected to study dietary habits of a population and for food safety assessment. Dietary studies also provide decision-makers with guidelines in formulating programs to educate people on their eating habits and to evaluate effectiveness of such programs. We will briefly touch on ideas of 'zero inflation,' 'extreme values,' 'probabilistic Bayesian models,' and 'mixture models.' We will also talk about the future for Dietary data analysis using machine learning tools.

SEPT 23

A Virtual Summer at Lawrence Berkeley National Laboratory
Jessica Da Silva, California State University, Stanislaus

Lawrence Berkeley National Laboratory (LBNL) has several research programs for undergraduates and faculty. In this talk, we will explore an image processing project I worked on through the Visiting Faculty Program with my two undergraduate students and a laboratory scientist. In particular, we focused our efforts on image segmentation which partitions an image into its structural components. Our team developed and incorporated a hypergraph model into a pre-existing graph-based image segmentation algorithm. Our journey through this project was tough, considering we needed to learn C++ as beginner coders, but it paid off as our preliminary results are promising.

SEPT 30

@ 4pm: Radiation Detection in Nuclear Engineering
Grey Batie, University of California at Berkeley

Statistics and probability are integral components of radiation detection: from the stochastic nature of radioactive decay, to nuclear cross sections and the types of radiation interactions in matter. By leveraging these concepts, radiation detectors are fabricated to maximize how efficiently we can detect, quantify and even localize radioactive material. This presentation will briefly discuss these topics and how it relates to the author's research in nuclear safeguards and national security.

@ 4:50pm: MY Experiences Being Black and Trans in Physics+
Grey Batie, University of California at Berkeley

Grey Batie, a queer black transgender doctoral student, discusses their experiences within academia, and how they've carved out a space for themselves and their unique identities. Topics include micro-aggressions, imposter syndrome, burnout, mental health, and suggestions for how to make the STEM fields a place where everyone feels comfortable, seen, and respected. This session is open to anyone and everyone!

OCT 7

Multi-Scale Modeling of Yeast Colony Prion Phenotypes
Suzanne Sindi, University of California at Merced

Prion proteins are responsible for a variety of neurodegenerative diseases in mammals, including Creutzfeldt-Jakob disease in humans. Most mathematical models of prion dynamics have focused either on the protein dynamics in isolation, or on prion dynamics in a population of cells by considering "average" behavior. Both approaches fail to recreate observed properties of prions in organisms. We develop physiologically relevant mathematical models by considering both the prion aggregates and their host organism. We validate our models and infer parameters through carefully designed experiments. We'll discuss two recent results. First, an adaptation of an existing model to a stochastic context, producing the first successful amplification of an aggregate—a key component of prion disease. Second, in recent individual-based simulations, we study how the organization of a yeast population depends on the division and growth properties of the colonies.

OCT 14

Modeling Turbulent Particle-Laden Flows
Sara Nasab, University of California at Santa Cruz

Particle-laden flows appear in many fields, from biology and chemical engineering to geophysical and astrophysical applications. They are two-phase flows, consisting of a dispersed phase (such as sediments, droplets, or particles) interacting with a continuous carrier phase. These flows are complex to model, combining two challenging topics of fluid mechanics: turbulence and multi-phase flows. In this talk, I will look at how the effect of particle inertia (size of the particle) causes the clustering of particles within the flow. To do so, I will introduce the mathematical equations that make modeling these systems possible, and then, present the simulations in which we investigate these systems.

OCT 21

Using Mathematics and Statistics to Understand Disease
Erica Rutter, University of California at Merced

Mathematical biology involves developing and applying mathematical and statistical techniques to better understand biological phenomena. In particular, we not only want to create mathematical formulations that describe the physical world around us, but we also want these mathematical formulations to be able to make accurate predictions. In this talk, I will showcase a variety of mathematical research in describing disease dynamics -- from COVID-19 to cancer, and from the cellular level to the population level. What effect does wearing masks have on the spread of COVID-19? Why and how do tumors become resistant to treatment? These are some questions we can explore using mathematics.

OCT 28

From Grandmasters to Google Search (and Back): The Mathematics of Rating and Ranking
Steve Devlin, University of San Francisco

Rating and ranking problems are ubiquitous. Who is the best chess player in the world? Which is the best team in college football? Which web pages are most relevant to my query? Who is the best candidate for city council (or President)? These are all hard questions without a ground-truth to use in evaluating answers. In this talk we will explore some of the rich mathematics that has been developed and applied to rating and ranking problems. In the process we'll uncover a surprising connection between two of the best-known and widely used methodologies.

NOV 4

Noticing Connections Among Productive Struggle and Resources to Promote Equitable Learning
Christin Herrera, Chico State University

In this talk we will share how in a mathematics content course, we address the Principles to Actions (NCTM, 2014) call to develop preservice teachers' (PSTs) teaching practices that support productive struggle, while simultaneously employing humanizing pedagogy in K-12 mathematics classrooms that builds upon students' multiple mathematical knowledge bases (Turner et al., 2012). We will engage you in a "noticing for equity" task and then share connections that six PSTs noticed between teacher actions and use of resources that support productive struggle and promote equity.

NOV 11

Veterans' Day - No Colloquium

NOV 18

Counting Klein Bottles
Haydee Lindo, Harvey Mudd College

A Klein Bottle cannot be embedded in 3-dimensional space. So if you've ever seen a glass "Klein Bottle" in real life you can imagine it as the image of a continuous map from an actual Klein Bottle into 3-space. Are there other ways to map the Klein Bottle into real space? Do they look different? Are they actually different? In this talk, we'll discuss how many "different" ways a 2-dimensional compact space can be mapped into three dimensions by tracking the effects of immersions on tangent spaces.