Fall 2015 83rd Series

M*A*T*H COLLOQUIUM

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

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

"Mathematics is the process of turning coffee into theorems" Paul Erdös

Sep 2 **The Apotheosis of Trig: Measuring to the Stars** **Rick Luttmann, Sonoma State University**
We work our way up beginning from the size of the Earth; then the sizes and distances of the moon, sun, and other planets; then the distances of nearby stars, and then other stars in our galaxy; finally the distances of remote galaxies. (Along the way we infer the speed of light.) Most of our calculations are done by using trig -- but also a little physics.

Sep 9 **Modeling DNA Unlinking** **Mariel Vazquez, University of California Davis**
Multiple cellular processes such as replication, recombination, and packing change the topology of DNA. The cell uses enzymes to control topological changes. We use techniques from knot theory and low-dimensional topology, aided by computational tools, to study the specific action of such enzymes. I will illustrate the use of these methods with examples drawn from my ongoing study of DNA unlinking after replication in bacteria.

Sep 16 **Summer Math Research in Thailand** **Martha Shott, Sonoma State University**
This summer, Dr. Martha Shott and two Sonoma State math majors traveled to Chiang Mai, Thailand as part of the LSAMP Global Awareness Program. In this talk, you'll hear more about this LSAMP summer program, the two research projects investigated by the students, the International Mathematical Olympiad, and some general tidbits about our international experience.

Sep 23 **What is Geometry? A Walk through Mathematical Spaces** **Kathryn Mann, University of California Berkeley**
When many people think of geometry, they envision some high-school curriculum involving properties of triangles. Who would suspect that geometry, in its various forms, is actually a very lively field of research mathematics today -- and one with diverse applications! The modern geometer translates problems from other areas of math (or even physics) into the language of spaces and distances, in order to apply geometric reasoning. In this talk, I'll show you how to think like a geometer, and I'll introduce you, through models and pictures, to some of the wonderful abstract spaces that we work and play in.

Sep 30 **Statistical Network Models** **Elizabeth Goss, San Jose State University**
When using statistical models for network data, we would like to know the goodness-of-fit of the model (i.e., how well the model fits the data). This question has proved particularly challenging even for relatively simple classes of network models, as it currently requires sampling graphs with the same sufficient statistics (e.g., number of edges, number of triangles, degree sequence, etc) as the observed network. In this talk, we will introduce statistical network models, goodness-of-fit testing, and its connection to computational algebraic geometry.

Oct 7 **How Normal are Normal Numbers?** **Joseph Conrad, Solano Community College**
Earlier this year, we celebrated Super Pi Day and we reveled in the fact that pi has been computed to trillions of digits. Why would anyone compute this many digits? One reason the digits of pi are studied is to investigate their randomness. What does this mean and how is it measured? This talk discusses the notion of normal numbers which was developed as a way to try to understand the distribution of digits in a real number.

Oct 14 **Mathematics Education and the Death of Creativity** **Morgan Fjord, Fusion Academy Marin and SSU Math Alum**
Secondary mathematics education in the US is in a sorry state. Students are tested too much and learn too little, and they are expected to memorize formulas and recite them upon request. My job is to entertain my students with the awesome applications that exist in math. In this talk we will be exploring the impact of the Common Core State Standards and how we can further develop students' capacities for creativity and critical thinking in the modern age.

Oct 21 **Parking Functions & Friends** **Matthias Beck, San Francisco State University**
A parking function is a sequence $(x_1, x_2, \ldots, x_n)$ of positive integers that, when rearranged from smallest to largest, satisfies $x_k \le k$. We will learn the illustrative reason for the illustrative reason for the term parking function. A beautiful theorem due to Konheim and Weiss says that there are precisely $(n+1)^{n-1}$ parking functions of length n. We will hint at a proof of this theorem and illustrate how it allows us to connect parking functions to seemingly unrelated objects, which happen to exhibit the same counting pattern: a certain set of hyperplanes in n-dimensional space first studied by Shi, and a certain family of mixed graphs, which we introduced in recent joint work with Ana Berrizbeitia, Michael Dairyko, Claudia Rodriguez, Amanda Ruiz, and Schuyler Veeneman.

Oct 28 **Bootstrapping: A New Tool for an Old Test** **Jeff McLean, Sonoma State University**
George Cobb claimed that the standard introductory statistics course, employing methods of statistical inference based on the normal distribution, was "an unwitting prisoner of history." These methods were once necessary since much simpler approaches, such as bootstrapping, were computationally out of reach. I'll discuss how methods of inference were developed before the computing power of today and then demonstrate how the process of bootstrapping capitalizes on visual learning and allows you to "see" key concepts of statistical inference.

Nov 4 **New Perspectives to Computer Vision from Algebraic Geometry and Optimization** **Serkan Hosten, San Francisco State University**
Computer vision is a field where algorithmic linear algebra makes real world applications possible. Now, algorithmic non-linear algebra is making inroads to this exciting field. The new ideas are coming from a mix of two seemingly separate areas of mathematics, namely, algebraic geometry and optimization. This talk will survey these fresh ideas.

Nov 11 **No Talk—Veteran's Day**

Nov 18 **Predicting Academic Success: Results from the SSU Track the Pack Survey** **Heather Smith, Department of Psychology, Sonoma State University**
A population survey of 615 second and third year SSU undergraduates who began their career at SSU showed that students' goals and backgrounds predicted classroom engagement and self-reported GPA. Importantly, students' perceptions of campus climate predicted additional variance for both outcomes. In contrast to students' goals and backgrounds, students' campus climate perceptions could be more amenable to change. For example, students' campus climate perceptions were shaped by both experiences and observations of group-based mistreatment by faculty and other students.

Nov 25 **No Talk—Thanksgiving**

Dec 2 **A 4-Dimensional Graph has at Least 9 Edges** **Roger House, Software Developer and Student of Mathematics**
The dimension of a graph is the minimum n such that the graph has a representation in R^n with every edge of length 1. In 1991 Paul Erdős posed this question: If a graph is 4-dimensional, what is the minimum number of edges it must have? This talk will answer Erdős' question in such a way that even if you've never heard of a graph, you'll understand the result.

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Talks may change: Please confirm with the Department of Mathematics and Statistics