The Apotheosis of Trig: Measuring to the Stars

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.

Modeling DNA Unlinking

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.

Summer Math Research in Thailand

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 insights about our international experience.

What is Geometry? A Walk through Mathematical Spaces

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.

Statistical Network Models

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.

How Normal are Normal Numbers?

Earlier this year, we celebrated Super Pi Day and we reveled in the fact that pi has been computed to trillions of digits. Who could 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.

Mathematics Education and the Death of Creativity

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.

Parking Functions & Friends

A parking function is a sequence \((s_1, s_2, \ldots, s_n)\) of positive integers that, when rearranged from smallest to largest, satisfies \(s_j \leq j\). We will learn the illustrative reason for the term parking function. A beautiful theorem due to Konheim and Weiss says that there are precisely \((n+1)^n\) 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 Henriques, Michael Daryko, Claudia Rodriguez, Amanda Ruiz, and Schuyler Veeneman.

Bootstrapping: A New Tool for an Old Test

Jeff McLean, Sonoma 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.

New Perspectives to Computer Vision from Algebraic Geometry and Optimization

Serkan Hosten, San Francisco State University

Boostrap calculations are done by using trigonometry so that we can get a quick and dirty answer. 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 us to “see” key concepts of statistical inference.

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.

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.

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 Erdős

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