Fall 2014 81st 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

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Aug 27 **Adventures of a Mathematician: the Power Math Gives to the Curious Mind in any Endeavor** — **Dale Trockel, UC Davis & CODAR Ocean Sensors**

Math gives us the power to solve everyday problems as well as very specialized complex problems. The more mathematical tools we possess the more we can do. I will tell my story as a developing mathematician and how math can change the way we see and interact with the world around us. First, we will see how trigonometry and linear algebra can be used to track subjects of interest through a video. We will then apply calculus to the design of new surfboard construction ideas through 3D printing. Finally, we will see how partial differential equations can be simplified, using the definition of a derivative, allowing us to solve the complicated Navier Stokes equations on a computer and simulate fluid motion.

Sept 3 **From Triangles to Elliptic Curves** — **Bill McCallum, University of Arizona, Illustrative Mathematics**

Can two non-congruent triangles have the same area and the same perimeter? Can you find two such triangles with the additional requirement that they are Heron triangles (triangles with rational area and perimeter)? These simple questions lead into an investigation which starts with high school algebra and geometry and culminates in number theory research being done today. The journey includes a beautiful formula for the area of a triangle, Heron's formula, and an exploration of rational points on elliptic curves. We'll explore some of these questions together, and at the end of the talk every member of the audience will be allowed to take home their own Heron triangle.

Sept 10 **Beauty Lies in the Eyes of the Math Holder** — **Shirley Yap, CSU East Bay**

When you go to art museums with non-abstract art, chances are that you're not optimizing your viewing experience. Does this mean that there's an optimal way to look at a painting? In fact, there is, and mathematics can show you how. In this talk, you'll learn how traditional and modern geometry can help you give a literal interpretation of the phrase "You don't see things as they are, you see them as you are."

Sept 17 **The Battleship Game** — **Rick Luttmann, Professor Emeritus, Sonoma State University**

We will discuss a simplified version of the game of "Battleship," which was the subject of Gabe McHugh's "Mathematica Project" presentation in last spring's M*A*T*H Colloquium series. This game will provide an opportunity to understand the principles of the mathematical field known as Game Theory, which uses low-level tools to analyze situations of conflict and competition such as those occurring in economics, criminal justice, romance, and warfare that are not at all recreational.

Sept 24 **The Power of Channel Coding in Real-World Wireless Communications** — **Kaelly Farnham, Keysight Technologies**

Today almost everybody has a cell phone and we all expect to be able to communicate instantly. The infrastructure of wireless communication systems required to run all our cell phones is increasingly complex. At the root of all of this complexity lies the beauty of some simple algebra. Algebraic coding theory is fundamental to wireless communication systems. This talk will introduce the basic concepts of channel coding, a way to encode data in a communications channel that adds patterns of redundancy into the transmission path in order to lower the error rate. We will also focus on Low Density Parity Check (LDPC) error-correcting algorithms and show how they are used today by engineers who are designing cell phones to transmit data in high-speed environments across noisy channels.

Oct 1 **Hypatia of Alexandria: Her Mathematics and Herstory** — **Edith Mendez, Professor Emerita, Sonoma State University**

In her time, Hypatia was the leading mathematician and philosopher in the Greek tradition. Then she was murdered by a Christian mob in 415. Was this because of her mathematics teaching? ... Or her work and preservation of earlier mathematical works? ... Or her philosophy? ... Or her gender? ... Or her allies and enemies? What has happened to her reputation and her story in the 1600 years since? What can we learn from herstory?

Oct 8 **Using the S-curve in Banking** — **Cora Neal, Wells Fargo**

The S-curve, also called the logistic function, shows up in a variety of contexts, most commonly in capped population growth. This talk will explain how the S-curve helps determine the optimal number of bank branches needed to support a community. Through this process we'll learn a little about non-linear regression, census bureau geography designations, measuring curvature, retail distribution and the banking industry.

Oct 15 **Motivational Forces: An Introduction to Mathematical Physics** — **Andre Minor, Sonoma State University**

Mathematics taught in the classroom today was originally developed to answer questions about the world around us. Modeling the behavior of the forces of nature, for example, requires a mathematical structure that took generations to construct and has many questions that remain unanswered. In this talk we will remind ourselves how the content of a Calculus 1 course is related the physical sciences by discussing the development of mathematical physics and its influence on mathematics today.

Oct 22 **How Much Money Do Your Parents (or you) Need for Retirement? - An Introduction to Actuarial Math and Careers** — **Jim Daniel, Emeritus Director of Actuarial Studies, UT at Austin**

This student-oriented talk uses the title question to illustrate the kinds of analyses actuaries use, and then goes on to briefly describe actuarial careers and the road to getting an actuarial job. At most it uses college algebra, although it hints at basic ideas of probability.

Oct 29 **∞** — **Bill Barnier, Professor Emeritus, Sonoma State University**

From the Greeks on, infinity (∞) has been regarded with suspicion. However, mathematics without infinity is inconceivable. We will explore the history and utility of infinity and its really small cousin the infinitesimal.

Nov 5 **The Math of Rap and Hip-Hop** — **Helene Nehrebecki (SSU Alumna), Sierra College**

Have you ever asked yourself, "What's the math on rap?" Someone once asked me this question, so I decided to find out for myself and share the results. We will discuss the mathematics of music, particularly rap and hip-hop. Experiments performed by Pythagoras show how frequencies are intentionally made so people can enjoy music. Included will be a demonstration on measuring frequencies on a chromatic scale, ratios of major musical chords, the designing of instruments, a brief history of popular music, and the math behind hip-hop hooks and lyrics. COME FOR THE MATH, STAY FOR THE HIP-HOP!

Nov 12 **Bayes' Theorem: What is it Good For?** — **Katharine Grey, CSU Chico**

Statistical theory provides two different standards for statistical inference, the frequentist approach and the Bayesian approach. A frequentist bases inference for an unknown parameter on distributions derived from repeated sampling whereas a Bayesian bases inference on a posterior distribution which is derived from a combination of sample data and a prior distribution. This talk will give a brief introduction to Bayes' theorem and Bayesian statistics. A comparison of frequentist confidence intervals and Bayesian credible intervals will be discussed and an application will be given where Bayesian credible intervals outperform frequentist confidence intervals.

Nov 19 **A Perspective on Applied Mathematics through Problems** — **Edward Tavernetti, UC Davis**

Numerical methods are an interesting and extremely applicable component of a modern education that not only helps bring mathematics to life, but is becoming increasingly important to scientific progress. In this talk I will give an account of my personal development in this area by looking at several example problems, methodologies and solutions. The problems will be selected from my coursework as an undergraduate and graduate student, as well as my teaching and dissertation research. Topics will include things like: fractals, chaos, financial mathematics, biomedical, space and many other engineering applications. No mathematical prerequisites are necessary.

Nov 26 **Thanksgiving—No Talk**

Dec 3 **Last Week of Instruction—No Talk**

DEPARTMENT OF MATHEMATICS AND STATISTICS

❖ Phone: (707) 664-2368 ❖ Fax: (707) 664-3535 ❖ www.sonoma.edu/math ❖

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