Fall 2010 73rd 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

Sept 8 **Polygon Arithmetic: Minkowski Sums and Differences** — **Jeffrey Doker, University of California, Berkeley**

Polygons and polyhedrons (collectively known as polytopes) are deeply studied throughout the field of combinatorics. Often it is useful to build complicated polytopes by adding a set of simpler ones, and this is done using a technique called Minkowski addition. This talk will be a practical tutorial on how to draw Minkowski sums (and differences) of polytopes, as well as a brief glimpse into some current research that relies on these tools.

Sept 15 **Johann Loschmidt and the First Scientific Estimate for the Size of Atoms** — **Jim Pedgrift, Sonoma State University**

In 1865 Loschmidt was able to estimate the size of an atom. This was the first scientifically reliable effort to do so. The work of Loschmidt has historical and philosophical interest, but it should also be of interest to beginning students of mathematics. With an understanding of some elementary statistics, a little algebra, and a little more geometry, we can fully appreciate Loschmidt's accomplishment. Before coming to the Colloquium, all math students should review how to find the volume of a sphere and cylinder, and understand (not solve) the problem of "sphere packing."

Sept 22 **Multiplication, War, and Some Related Two-Person Games** — **Kent Morrison, Cal Poly, San Luis Obispo and American Institute of Mathematics, Palo Alto**

The multiplication game of Ravikumar and the classic children's card game War are the starting points for an excursion into game theory. Using some intuitive probability and a bit of calculus, we analyze these games and look for the players' optimal strategies.

Sept 29 **Data, Analytics, and Decision Support** — **Marty Ellingsworth, ISO Innovative Analytics**

If you want a high salary, great job opportunities, and a long career, then find a way to be a valuable contributor to your company's competiveness to grow profitably and learn to help it adapt to change. Making good decisions is critical—making better decisions is what keeps you ahead in the game. No matter the industry or size of company, using data-driven decisions is a proven process to better understand complex systems and to better compete in business. The application of data-driven decisions utilizes a blend of academic disciplines based on the context of the situation, so this talk is focused on practice versus theory. We will discuss how to solve problems that measure, manage, and reduce risk, and discuss the process of technology change as it relates to the need for continuous learning. Deep technical knowledge is not required.

Oct 6 **The Curious Mascot of the Fusion Project—Meditations on Flexing, Dualizing Polyhedra**

Benjamin "Pete" Wells, University of San Francisco

The Fusion Project (FP) is a research program at the University of San Francisco that seeks to bring 7th grade math classes to the art of the de Young Museum (and vice versa). We also have our eye on the opportunities of new media for teaching middle school math. The Hoberman Switch-Pitch™ is the project's mascot. After an introduction to FP, we'll explore the static and dynamic symmetry of this curious, ancient shape. We'll also visit with other wild shapes in and out of cages.

Oct 13 **See the Story** — **Dana Zuber, Wells Fargo**

Who ever said that statistics should be the driest of all reading? A good graphic can tell a story, persuade, and even bring a tear to the eye. How can we use well-designed graphics in our everyday work to articulate complex, quantitative concepts that our audience will both read and understand? In this discussion we will talk about the importance of data visualization to bring numbers to life. We will cover the basic principles of data visualization that you can apply to your everyday analysis. And we will draw inspiration from some of history's best examples of data graphics to learn why a picture is worth a thousand words.

Oct 20 **Power Flow in the Electric Grid** — **Alexandra Von Meier, Department of ENSP, Sonoma State University**

Spanning entire continents, electric transmission and distribution systems are the largest human-made artifacts on the planet. Crucial to our everyday energy use, this infrastructure is also essential for any future strategy to mitigate climate change by replacing power from fossil-fuels with carbon-free resources. But the grid's capacity to transmit electric power is constrained in interesting and not at all obvious ways. In this lecture, Dr. von Meier will outline the power flow equations and explain why and how they need to be solved numerically, in a process that has only recently become feasible to perform on computers in near real-time. Assuming minimal prior knowledge, this talk will illustrate the use of Newton's method and a Jacobian matrix, along with introducing basic properties of alternating current and discussing how they are managed by grid operators. SSU's power curtailments on hot days will take on a whole new meaning after this talk!

Oct 27 **Using Optimization Techniques to Model Resource Allocation in Plants** — **Tom Buckley, Department of Biology, Sonoma State University**

Mechanistic models—those whose mathematical structures are based on physico-chemical processes—are often preferred in the study of living systems. However, they often include parameters that represent investments of limiting resources (e.g., nitrogen for muscle proteins or photosynthetic enzymes), and organisms vary those investments by regulatory mechanisms that are not well known. Optimisation modeling assumes that those regulatory mechanisms, whatever they are, maximize some quantifiable aspect of organismal function—based on the fact that they were shaped by forces of natural selection. This approach can be used to understand, predict and scale-up terrestrial carbon and water fluxes.

Nov 3 **Primes and zeros: A Million Dollar Mystery** — **Brian Conrey, American Institute of Mathematics, Palo Alto**

150 years ago, B. Riemann discovered a pathway to understanding the prime numbers. But today we still have not completed his vision. In this talk we will introduce Riemann's Hypothesis, one of the most compelling mathematics problems of all time, and describe some of its colorful history.

Nov 10 **Geometric Gems** — **Jean Bee Chan, Sonoma State University**

We will explore a few interesting ideas in elementary plane geometry. Some proofs will be presented. This talk is accessible to a general audience.

Nov 17 **A Pedagogical Excel Application of Cumulative Abnormal Returns** — **Michael Santos, Department of Business, Sonoma State University**

This talk uses Excel spreadsheets to introduce event study methodology. We will analyze the Hewlett-Packard Company's takeover of 3Com Corporation during 2009. First, we explain two common event study methodologies that use the cumulative abnormal returns (CARs) technique, a simple regression and arithmetic average as an application to the financial events. Second, we illustrate the CARs using Excel graphs to simplify the event study methods. This presentation will only require basic algebra and introductory statistics.

Dec 1 **Discrete Volume Computations for Polytopes: An Invitation to Ehrhart Theory** — **Matthias Beck, San Francisco State University**

Our goal is to compute the volume of certain easy (and fun!) geometric objects, called polytopes, which are fundamental in many areas of mathematics. Although polytopes have an easy description, e.g., using a linear system of equalities and inequalities, volume computation is hard even for these basic objects. Our approach is to compute the discrete volume of a polytope, P, namely, the number of grid points that lie inside P given a fixed grid in Euclidean space such as the set of all integer points. A theory initiated by Ehrhart implies that the discrete volume of a polytope has some remarkable properties. We will exemplify Ehrhart theory with the help of several families of polytopes whose discrete volumes are connected with some of our friends in various mathematical areas, such as binomial coefficients and Eulerian, Stirling, and Bernoulli numbers. This talk will be accessible to anybody who has finished the basic calculus and linear algebra courses. In particular, we will not assume that the audience knows the terms mentioned in this abstract, such as the concept of a polytope.

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