Spring 2012 76th 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

Jan 25 **Permutation Patterns and Patience Sorting: Sophisticated Combinatorics from a Simple Card Game** **Isaiah Lankham, Simpson University**

The study of permutation patterns (and in particular permutations avoiding such patterns) has become an increasingly hot research topic because of its many applications to fields ranging from Algebraic Combinatorics to Statistical Learning Theory. In this talk we begin with a gentle introduction to permutation pattern and then discuss how they naturally arise when studying a simple (yet mathematically sophisticated) card game called Patience Sorting. Originally introduced in the 1960s as a sorting algorithm, Patience Sorting can also be viewed as an idealized model for the extremely popular card game Klondike Solitaire, which is also known as Patience.

Feb 1 **How to Untie a Knot (And Become Ruler of the World)** **Thomas Mattman, California State University, Chico**

The legend of the Gordian knot held that whoever untied the knot would become the ruler of the world. Alexander the Great fulfilled the prophecy by going on to conquer Persia (in other words, most of the known world) after dealing with the famous knot. We will discuss Alexander's method for untying knots and how research connecting mathematics and physics has given new insight into Gordian numbers. The talk will also feature some square knot dancing.

Feb 8 **Tic-Tac-Toe on a Torus** **Maia Averett, Mills College**

As most of us learned after a few games on the school bus, the only way to win at classic Tic-Tac-Toe is if your opponent is inexperienced or makes a mistake. This often makes for a rather boring game! In this talk, we'll see how the game changes when we play Tic-Tac-Toe on boards that wrap around interesting surfaces, such as a torus, cylinder, Klein bottle, and Möbius band!

Feb 15 **The Rocket Equation** **Victoria Schoennagel, Aerojet**

Propulsion specialists use the rocket equation for everything. At this talk, basic propulsion concepts and the use of the rocket equation will be covered. Various job assignments I've had in the Aerospace industry will be discussed along with an actual fault scenario in a mission control room where quick decisions were made using a flow model.

Feb 22 **Student Projects from Mathematica Class** **Elaine Newman, Sonoma State University**

You thought Mathematica could only take derivatives and integrate? Come see the amazing student projects from the Fall 2011 Mathematica class, Math 180.

Feb 29 **Where Can Mathematics Take You? All Over the World** **Deborah Hughes Hallett, University of Arizona and Harvard University**

Many people study mathematics for its beauty; others study mathematics because it open doors to many professions. In this talk we will look at the ways mathematics is used in fields that impact the lives of millions. Examples will include the use of differential equations to curb the spread of an infectious disease, such as SARS, and what statistical models can tell us about the impact of climate change on civil war.

Mar 7 **Taxicab Geometry** **Kimberly Elce, Sacramento State University**

We all know that the shortest distance between two points is a straight line. This fact is useful for birds, but not very useful for a taxicab driver. In a world where taxis must stay on the streets, geometry looks very different. Using this taxicab geometry we will explore bisectors, paths between points, circles, and more. We will find that some known facts from Euclidean geometry are drastically altered, whereas some ideas remain the same. Geogebra will be used to help visualize our explorations.

Mar 14 **Do you value the value of π?** **Aba Mbirika , Bowdoin College**

In 1897, the Indiana House of Representatives unanimously passed a bill that would decree the value of π to be equal to 3.2, and they sent it to the Senate for final passage. Thankfully, due to an intervention by a mathematics professor who happened to be in the court building at the time of the Senate's first reading of the bill and his successive coaching of the senators, the Senate decided to indefinitely postpone this ridiculous bill. Why is π not equal to 3.2? Can you math majors "defend" π? Should the State try to decree that it equals some absurd value? In honor of π day today, we will arm ourselves with this defense. Also in honor of today's date, we will talk about some intriguing facets of π that lead to its ubiquity in mathematics.

Mar 21 **The Sigma Ordering of the Braid Groups** **Emille D. Lawrence, University of San Francisco**

The braid groups have been an interesting field of study in low-dimensional topology and algebra since Emil Artin introduced the notion of a braid in the 1920s. Over the years it has been discovered that the braid groups play a useful role in knot theory, robotics, theoretical physics, and a variety of other areas. In 1992, Patrick Dehornoy proved that the braid groups were left-orderable. We will spend most of our time talking about groups and defining the braid groups. We will also discuss what it means for a group to be orderable. Finally, we will define the "sigma ordering" of the braid groups, a long overdue merger between braid groups and orderable groups.

Mar 28 **No talk– Spring Break**

Apr 4 **The Frequentist and/or the Bayesian Paradigm(s)** **Scott Nickleach, Sonoma State University**

Close to three centuries ago, the British mathematician Thomas Bayes formulated (yet never published) what has come to be known as Bayes' theorem. In doing so, he essentially solved a problem of inverse probability, and provided a method of incorporating new information as events unfold into existing probabilistic beliefs. His contribution ultimately provided a groundwork that would lead to an entire paradigm in the field of statistics, one which generally bears his name. In this talk, we present an overview of the two paradigms of modern statistics, namely the Frequentist and the Bayesian. The Bayesian paradigm has recently received great rejuvenation as computational capability has become increasingly available. We will present some examples that utilize a very well known computational Bayesian technique known as Markov Chain Monte Carlo (MCMC).

Apr 11 MATH FEST **Random Graphs, Ramanujan Graphs** **Alon Amit, Facebook**

For many theoretical and practical questions concerning graphs, the best known answers are achieved - somewhat paradoxically - by probabilistic methods. It is not uncommon that a graph selected at random is "better" for a given purpose than any graph we are capable of constructing explicitly. We will discuss a few examples of this intriguing paradigm, first discovered by Erdős and Renyi. We will then switch to talk about a peculiar outlier: the amazing Ramanujan graphs and the deep mathematics related to their explicit constructions.

Apr 18 **Networks and Mathematics** **Stephen Devlin, University of San Francisco**

A network (or graph) is simply a bunch of dots connected by lines. Many interesting problems in epidemiology, evolutionary biology, and even the ranking of sports teams can be studied from a perspective that highlights an underlying network structure. In this talk we will give examples, explore some mathematical tools for dealing with networks, and consider a few situations where understanding the network structure can bring new insights to a problem.

Apr 25 **Some Irrationals I Have Known** **John Martin, Santa Rosa Junior College**

From the time they were discovered by the Pythagoreans, irrational numbers have puzzled and fascinated mathematicians. In this talk we will examine the history of these numbers and the impact they've had on our concept of infinity.

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