FALL 2007

M*A*T*H COLLOQUIUM

67th SERIES

WEDNESDAYS 4 P.M. DARWIN 103

Coffee, tea, and cookies at 3:45

THE MATHEMATICS DEPARTMENT OF SONOMA STATE UNIVERSITY PRESENTS A SERIES OF INFORMAL TALKS OPEN TO THE PUBLIC

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

Aug 29 **INTERLOCKING CHAINS** JULIE GLASS, MATHEMATICS DEPT. CALIFORNIA STATE UNIVERSITY EAST BAY

This talk will introduce the audience to some of the basic ideas used in the study of chains in the area of computational geometry. A *chain* is a collection of rigid bars connected at their vertices (also known as a linkage), which form a simple path (an open chain) or a simple cycle (a closed chain). A *folding* of a chain (or any linkage) is a certain reconfiguration obtained by moving the vertices. A collection of chains are said to be *interlocked* if they cannot be separated by foldings. This talk will explain some standard techniques using geometry and knot theory to address the problem of when linkages are interlocked. Finally, we will answer the question, "Can a 2-chain and a k-chain be interlocked?" This talk will be accessible to a broad audience.

SEPT 5 **THE JEWEL IN THE CROWN QUADRATIC RECIPROCITY** RICK LUTTMANN, MATHEMATICS DEPARTMENT, SONOMA STATE UNIVERSITY

We will discuss the Law of Quadratic Reciprocity, which Gauss famously described as the Jewel in the Crown, Number Theory, on the head of the Queen of the Sciences, Mathematics. The Law arises from the question: Which possible remainder can the perfect squares have when divided by any number *m?*

Pizza after talk

SEPT 12 **YEARNING FOR THE IMPOSSIBLE** JOHN STILLWELL, DEPARTMENT OF MATHEMATICS, UNIVERSITY OF SAN FRANCISCO

Many of the most important concepts in mathematics were once thought to be impossible; for example, irrational and imaginary numbers, infinitesimals, points at infinity, the fourth dimension, and curved space. Thus it seems that yearning for the impossible can be fruitful, but why? Kolmogorov once wrote (in his diary, 14 September, 1943): "At a given moment there is only a fine layer between the 'trivial' and the impossible. Mathematical discoveries are made in this layer." This talk will review some of the close encounters with the impossible on which mathematics thrives, with illustrations of the impossible in the art of Escher, Magritte, and others

SEPT 19 **ONLINE HOMEWORK IN MATHEMATICS COURSES** MICHAEL SCOTT, DEPARTMENT OF MATHEMATICS, CSU MONTEREY BAY

Many universities are supplementing mathematics courses with online homework. The speaker will discuss issues using an online homework system in a mathematics course and student interaction with the system. How data generated by the online system can be used to evaluate student achievement in the course will also be examined.

SEPT 26 **A PIECE OF π** JOHN MARTIN, MATHEMATICS DEPARTMENT, SANTA ROSA JUNIOR COLLEGE

Through the ages the ratio of the circumference of a circle to its diameter, which we call π, has fascinated mathematicians and non-mathematicians alike. In this presentation we will explore the history, mysteries, and the controversies surrounding this famous number **Pizza after talk**

0CT 3 **A PUZZLE OF KEYS AND A PROBLEM IN GRAPH THEORY** SARAH MERZ, UNIVERSITY OF THE PACIFIC

In 1979, Frank Rubin posed the following puzzle in Recreational Mathematics: *Professor X, who is blind, keeps keys on a circular key ring. Suppose there are a variety of handle shapes available that can be distinguished by touch. How many shapes does Professor X need to use in order to keep n keys on the ring and still be able to select the proper key by feel?* Generalized as a graph theory problem, this puzzle has been well studied. We will discuss this problem as viewed in the setting of directed graphs

OCT 10 **SENSORY INPUT PROCESSING IN THE BRAIN** MARTY BANKS AND JOHANNES BURGE, VISUAL SPACE PERCEPTION LABORATORY, UC, BERKELEY

We use several sources of sensory information when estimating properties of the environment. For example, the eyes and hands both provide relevant information concerning an object's shape. The eyes estimate shape using binocular disparity (differences in the images to the two eyes) and pictorial cues (also used by painters). The hands supply shape information by means of tactile and proprioceptive cues. How does the brain combine these inputs to make sense of the environment? We explore this and related questions via experimentation and mathematical models.

OCT 17 **MODELING FOR FISHERIES ENGINEERING** JOEY HOWARD, M.S., P.E. AND BRAD HALL, M.S., P.E., NORTHWEST HYDRAULIC CONSULTANTS

Hydrodynamics, the science of moving fluids, serves as the basis for designing fisheries improvements. Both numerical and physical modeling are used to represent environmental conditions. In numerical modeling, equations governing the fluid flow – velocity and pressure are the key parameters – are solved numerically to find steady-state or time-variant conditions. One-, two-, and three-dimensional models are all useful. In physical modeling, principles of scaling and similitude help establish the relationship between parameters in a physical model and those in the real world. This talk will show examples of each approach and discuss their applicability and limitations.

OCT 24 **THE MATHEMATICS OF RSA ENCRYPTION OVER THE INTERNET** GLENN CAESAR, MATHEMATICS DEPT. SANTA ROSA JUNIOR COLLEGE

How is private information, such as credit card numbers, safely sent over the Internet? We will look at how RSA encryption uses Fermat's Little Theorem, prime numbers and the Chinese Remainder Theorem to protect such information from hackers.

OCT 31 **THE MATHEMATICS OF TRAFFIC JAMS** BEN FORD, MATHEMATICS DEPARTMENT, SONOMA STATE UNIVERSITY

Ever been stuck in traffic and wondered what caused the jam? While some seem to be caused by particular events – accidents, sights along the side of the road, etc. – many appear out of nowhere in otherwise smoothly-flowing traffic. We'll explore various models that are used to model traffic flow, and see if any of them can help you get around faster! **Pizza after talk**

NOV 7 **MATHEMATICS AND POPULAR CULTURE: THE USUAL SUSPECTS** CHRISTOPHER GOFF, MATHEMATICS DEPT. UNIVERSITY OF THE PACIFIC

Mathematics shows up on both the small and large screen, and not just in expected places, like the TV show *NUMB3RS* or the movie *A Beautiful Mind*. We also see unexpected characters with mathematical talent, such as Lindsey Lohan's Cady in *Mean Girls*, or Hex, voiced by Kristen Bell of TV's *Veronica Mars*, in the newly released *Flatland: the Movie*. This talk will discuss various Hollywood representations of mathematically talented individuals as well as the interplay between mathematics and popular culture. And then we'll watch clips from *Flatland*.

NOV 14 **CONTINUED FRACTIONS AND CACTUS** BEN LEVITT, DEPARTMENT OF MATHEMATICS AND STATISTICS, CALIFORNIA STATE UNIVERSITY, CHICO

This talk will provide an introduction to continued fractions and highlight some of the interesting patterns they reveal. We will learn how to write our own continued fraction approximations and see how simple arithmetic can be used to investigate unsolved problems in Number Theory. This will all, somehow, be related to cactus.

NOV 21 **THANKSGIVING –NO TALK**

NOV 28 **DO YOU USE DRUGS? DOES "NO" MEAN "NO"- OR DOES IT MEAN "YES, BUT NOT RIGHT NOW?** DAVID B. NEAL, MANAGER, STATISTICAL ANALYSIS, UNITED BEHAVIORAL HEALTH

Delve into the world of behavioral research and statistical modeling through a look at drug usage patterns for a sample of injection drug users and cocaine smokers not currently in treatment. This discussion will explore various statistical models suited for this type of data. **Pizza after talk**

MATHEMATICS DEPARTMENT

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Talks may change: Please confirm with the Mathematics Office before a specific talk