SPRING 2007

M*A*T*H COLLOQUIUM

66th 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

Feb7 **Thinking In and Out of Context.** Eric Hsu, San Francisco State University
The speaker will discuss different ways that context affects student thinking and behavior, and consider some implications for teaching practice. Problems that are mathematically equivalent, but which are very different in difficulty due to details of their setting, will be examined. How does the strange context of school influence thinking in unexpected ways? [☺ Pizza after talk ☺]

Feb 14 **Some Hot Button Issues in Math Education.** Diane Resek, San Francisco State University
It may seem that there could be nothing very controversial about math education. You just put it out and people learn. However, what 'it' should be, how you 'put it out', and how to test what may have been learned are all very hot issues in the California Math War.

Feb 21 **Expanders and Superconcentrators and Ubiquity.** Prof. George Ledin, Computer Science, Sonoma State University
Graph theory has much to offer to wireless sensor networks. Pervasive computing or smart dust can be modeled as very large random, strongly regular, near perfect, graphs, connected independent dominating sets, and other interesting structures. This talk is an introductory survey of the status of sensor network technology and a quick guided tour to potentially promising graph models which can help understand and formalize the inherent computational security issues.

Feb 28 **The Algebra Textbook of abu Ja'far Mohammed ibn Musa al-Khwarizmi.** Dean Gooch, Santa Rosa Junior College
Who was Mohammed ibn Musa? His text, *Hisab al-jabr w'al-muqabala,* is considered to be the original algebra text. It is in fact the origin of the English word algebra. When, where, and why did he write this book? Did he write other works? Which mathematical traditions affected his ideas? How did his work influence modern mathematics? Some of the answers to these questions will be presented, many of which are surprising.
[☺ Pizza after talk ☺]

March 7 **Geometric Decompositions—Taking Figures Apart and Putting Other Ones Together.** Tom Sallee, University of California, Davis
Some geometric decompositions are easy converting a unit square into a 2 x ½ rectangle—and some are not at all obvious. The speaker will look at both real-world decompositions and some of the paradoxical ones like breaking a solid ball up and rearranging the pieces to get two solid balls the same size.

March 14 **Topological Analysis of Enzymatic Actions.** Mariel Vazquez, San Francisco State University
DNA topology is the study of geometrical (supercoiling) and topological (knotting) properties of DNA loops and circular DNA molecules. Certain enzymes such as DNA topoisomerases change the topology of circular DNA. The speaker will discuss the analysis of such enzymatic actions using knot theory and computational methods

March 21 **Complexity Revealed.** Ned Kahn, Sebastopol
An artist who draws his inspiration from physics, fluid mechanics, atmospheric science and mathematics, will present a series of videos of his kinetic artworks. "Kahn combines science, art and technology to integrate natural, human, and artificial systems, and his specific works emphasize natural elements, such as water, fire, wind and sand; how these behave independently, and how they interact." (From "An Aesthetic of Turbulence: The Works of Ned Kahn" by David Mather in *SARAI Reader 2006 Turbulence.*)

March 28 **Safe Sets and the Algebra of Four-Colorings.** Sean Lloyd, College of Marin
Mathematicians can be kept amused for hours trying to color the pictures in a coloring book with only four crayons. One approach to showing that this is always possible is to build four-colorable pictures from simpler ones by two operations: splitting a boundary edge in two with a new vertex and splitting a region in two with a new edge which joins pre-existing vertices. Of these two operations, it is only obvious that four-colorability is preserved by the first. The speaker will give two large classes of four-colorable maps preserved by the second operation but not necessarily the first. [☺ Pizza after talk ☺]

April 4 **Algebra is Required for High School Graduation—But What Algebra? What is Algebra?** Judy Kysh, San Francisco State University
The speaker will consider examples from school algebra and how it has changed (or not) over the past century, what are the big ideas of algebra, what from school algebra is necessary and useful, what might be more useful, and even of interest to more students? Algebra is often taught using a tell-and-practice approach. An example to illustrate how algebra is most often taught and how it might be taught more effectively will be demonstrated.

April 11 **Spring Break**

April 18 **The Plane Has More Points Than You Might Think.** David Eisenbud, Mathematical Sciences Research Institute (MSRI)
From the right point of view the circle, ellipse, parabola and hyperbola are not just related—they are the same! The speaker will explain some of their relations as sections of a cone, and then talk about how modern geometers have learned to understand them better by adding points of various kinds to the plane. [Math Festival dinner follows.]

April 25 **Some Unsolved Problems for Latin Squares.** Sherman Stein, University of California, Davis
A Latin square of order n is an n by n square consisting of n^2 cells. In each cell is one of the integers from 1 to n. Each row and each column has no duplications. (A Sudoku puzzle is an example of order 9, with extra conditions.) In 1779 Euler asked when you can find n cells, one from each column and from each row, that have different entries. We generalize this question, describe a few results, and invite mathematicians and computer programmers to explore this new area. .

May 2 **Function, Design, and Evolution of Gene Circuitry.** Michael Savageau, University of California, Davis
The physical basis for complex phenotypes is the context-dependent expression of the organism's genome. The regulation of many gene systems has been studied in detail, and the results have revealed an enormous diversity of molecular elements and circuits. The relationship of these variations in design to the phenotype of the organism requires a quantitative systems approach to elucidate these relationships. The first part of the talk treats the mathematical methods for characterizing and comparing the function of gene circuits**.**

May 9 **Is It Knotted?** Abigail Thompson, University of California, Davis
The speaker will describe some coloring problems and their relation to the problem of deciding whether a particular knot is really knotted. The idea of a probabilistic proof of knottedness will also be introduced. ("In mathematics, a knot is defined as a closed, non-self-intersecting curve that is embedded in three dimensions and cannot be untangled to produce a simple loop (i.e., the unknot)." *MathWorld*

May 16 **A Different Type of Approximation.** Bin Lu, California State University, Sacramento
In calculus, it is known that the main idea of Taylor polynomials is to approximate a given function at a particular point by a polynomial. As polynomials are very nice functions, it is not too hard to imagine they cannot approximate "nasty" functions very well. In this talk, a different kind of approximation, which often works better and efficiently, will be discussed. [☺ Pizza after talk ☺]

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