

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 Erdős

- Feb 10 Untangling the World of Knots** **Cornelia Van Cott, University of San Francisco**
 You may think that getting knots in your shoelaces has absolutely nothing to do with mathematics, but the study of knots is part of an entire branch of mathematics. We will introduce the basic mathematical ideas and questions about knots, and we will study a set of building blocks for knots, called tangles.
- Feb 17 Graphs and DNA** **Larry Langley, University of the Pacific**
 Seymour Benzer's early look into the structure of viral DNA indirectly led to the foundations of the theory of interval graphs. We look at this historical connection between graphs and DNA as well as more modern applications.
- Feb 24 Primes - Orchids in the Garden of Numbers** **Wulf Rehder, San Jose State University**
 We'll take a stroll in the garden of numbers with special attention to primes and ask: How are the prime numbers arranged (or distributed) amongst the integers? How rare are they, how far apart have they been planted, and how regular and/or how chaotic is their layout? On our way we'll view the Prime Number Theorem, pay our respect to Riemann and his famous function (and hypothesis), and present a recent and very surprising result about prime gaps.
- Mar 3 Central Limit Theorems in Probability Theory: Old and New** **Craig Tracy, UC Davis**
 The classical central limit theorem of probability theory goes back to de Moivre and Laplace. It is a cornerstone of probability theory and finds an immense number of applications ranging from Maxwell's kinetic theory of gases to the distribution of scores on calculus exams. (In the popular literature it goes under the name of the "bell-shaped" curve.) A key assumption in this theory is that the underlying random variables are independent, or at most, weakly dependent. In many contemporary stochastic models this assumption of weak dependence fails; and hence, the classical central limit theorem does not apply. This talk will review both the classical central limit theorem and recent progress for the case of strongly dependent random variables. Applications of the emerging new theory will be briefly discussed.
- Mar 10 Student Projects from *Mathematica* Class** **Elaine Newman, Sonoma State University**
 You thought *Mathematica* could only take derivatives and integrate? Come and see the amazing student projects from the Fall '09 *Mathematica* class, Math 180.
- Mar 17 People Like Us: When do feelings of deprivation lead to collective action?** **Heather J. Smith, Sonoma State University**
 Social scientists have employed the concept of relative deprivation (RD) to explain phenomena ranging from poor physical health to participation in collective protest and susceptibility to terrorist recruitment. One of the most important conceptual distinctions within RD theory is the distinction between individual and group relative deprivation. Group relative deprivation (GRD) refers to an undeserved collective disadvantage whereas individual relative deprivation (IRD) refers to an undeserved individual disadvantage. First, I will draw upon a quantitative literature review of over 194 RD studies from sociology, political science, health, clinical and social psychology to show why this distinction predicts qualitative different reactions to RD. Second, I will use data from a mail survey of university faculty members to illustrate how different specific emotional reactions to group inequities in faculty pay and benefits are related to collective action and organizational loyalty.
- Mar 24 Mathematical Modeling** **Brigitte Lahme, Sonoma State University**
 Students from last semesters Mathematical Modeling class will present some of their projects. In this class we investigate real world problems by developing and analyzing appropriate mathematical models using tools from differential equations, recurrence relations and statistics.
- Apr 14 A Survey of Random Matrices** **Estelle Basor, American Institute of Mathematics**
 Random Matrix Theory (RMT) is the study of random matrix ensembles, that is, sets of $N \times N$ matrices with corresponding probability distributions. For some classical ensembles, statistical information about the matrices for large N can be nicely described. For example, for Hermitian matrices one might count the number of eigenvalues in an interval or ask for the distribution of the largest eigenvalue. This talk will describe these and similar topics. Only a knowledge of linear algebra is required.
- Apr 21 The Incomparable Bernoullis and a Marvelous Spiral** **John Martin, Santa Rosa Junior College**
MATH FEST The Bernoulli family dominated the mathematical scene during the closing years of the seventeenth century and throughout most of the eighteenth. Its two most famous members, Jacob and Johann, were brothers and bitter rivals. In this talk, we will explore the accomplishments of this remarkable family and examine some of the reasons behind their personal feuds.
- Apr 28 Kirkman's Schoolgirl Problem** **Izabela Kanaana, Sonoma State University**
 In 1850, the Reverend Thomas P. Kirkman proposed the following problem, which is generally known as "Kirkman's Schoolgirl Problem": "Fifteen young ladies in a school walk out three abreast for seven days in succession: it is required to arrange them daily, so that no two shall walk twice abreast. In this talk, we will analyze this problem and talk about Kirkman's contributions to the field of combinatorial designs.
- May 5 Stochastic Calculus and its Role in Financial Engineering** **Scott Nickleach, Sonoma State University**
 Just when you finally get a firm grip on Riemann integrals, you run into something called a Lebesgue Integral. And then just when you have those down, you might well encounter any of numerous other types, including one called the Itô integral. This talk comprises an introductory presentation on stochastic calculus and Itô integrals, and applications pertaining to financial engineering. In particular, we examine how the solution of a certain stochastic differential equation leads to a Monte Carlo simulation approach to estimating the value of plain vanilla stock options.
- May 12 What is π ?** **Bill Barnier and Edie Mendez, Sonoma State University**
 How long has it been known that the ratio of the circumference to the diameter of a circle is constant? How and when was it proved that this ratio is the same for all circles? We will consider this ratio from the perspective of ancient sources, Euclid, Archimedes, calculus, and more.



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