

## Talk Abstracts 2009

**Name:** Syed Abdul Aziz  
**School:** Evergreen Valley College  
**Advisor:** Chung Wu Ho  
**Title:** *On Bertrand Paradox*

**Abstract:** Bertrand Paradox is a well-known paradox in the theory of probability. It is related to the problem of finding the probability for a random chord of a unit circle to be of a length greater than the square root of 3. There are three well-known solutions, all of which seem to be reasonable, yet these three solutions yield three different answers. Most authors believe that this is because the problem is not well posed. We contend that there is a more intrinsic way to resolve this difficulty.

**Name:** Allison Beckwith and Kyle Pounder  
**School:** St. Mary's College of California  
**Advisor:** Adam Lucas  
**Title:** *Stochastic Innovation as a Mechanism for the Evolution of a Scale-free Chemical Network*

**Abstract:** The network representations of many biochemical processes and structures have been shown to exhibit a scale-free topology. The existence of this topology has led to questions of how and why it might have formed; specifically, it is of interest to explore possible biochemical mechanisms for the evolution of scale-free (general) biochemical networks. One mechanism by which biochemical agents stochastically join to form networks based on shared resources is the focus of this discussion. Although this mechanism alone is not effective in creating scale-free networks, it is sufficient to create structures that resemble (and have the potential to become) scale-free networks.

**Name:** Sara Brodsky  
**School:** UC Berkeley  
**Advisor:** Ken Ribet  
**Title:** *Ramsey Theory and Accessibility*

**Abstract:** For a set  $D$  of positive integers, a sequence  $a_1 < a_2 < \dots < a_n$  is called a  $k$ -term  $D$  diffsequence if  $a_i - a_{i-1} \in D$  for all  $i \in \{2, \dots, k\}$ . For a positive integer  $r$ , a set of positive integers  $D$  is  $r$ -accessible if every  $r$ -coloring of the positive integers has arbitrarily long monochromatic  $D$ -diffsequences. The largest  $r$  such that  $D$  is  $r$ -accessible is called the degree of accessibility of  $D$ . I will briefly introduce the subject of Ramsey Theory and then discuss properties of accessibility and the accessibility of certain sequences, such as the prime and Fibonacci numbers.

**Name:** Erin Craig  
**School:** New College of Florida / UC Berkeley  
**Advisor:** Eirini Poimenidou / Mike Rose  
**Title:** *Cellular Automata Over Finite Groups*

**Abstract:** This talk will discuss one-dimensional cellular automata. We will first address automata over Abelian groups, and we will develop new binomial identities seen in Pascal's Triangle modulo a prime. We will then discuss automata over non-Abelian groups and develop a new method for their study, showing explicitly the case for a one-dimensional automaton with a simple update rule over the dihedral group.

**Name:** Kate Ellis  
**School:** CSU Stanislaus  
**Advisor:**  
**Title:** *Using Matrices to Simplify Problems in Optics*

**Abstract:** A neat trick using ray transfer matrix analysis to solve optics problems involving mirrors or lenses.

**Name:** Alma Gonzalez  
**School:** Sonoma State University  
**Advisor:** Jean Bee Chan  
**Title:** *Hyperbolic Circles are Circular!*

**Abstract:** In this talk we will discuss the Poincaré model for hyperbolic geometry. We will show that a hyperbolic circle in the Poincaré disk is really a Euclidean circle.

**Name:** Chad Griffith  
**School:** Sonoma State University  
**Advisor:** Jean Bee Chan  
**Title:** *A Krasnosel'skii-Type Theorem Involving  $P$ -superarcs*

**Abstract:** Exploring  $P$ -Superarcs in the plane. A  $p$ -superarc is a convex arc  $A(x,y)$  with end points  $x$  and  $y$  such that  $A(x,y)$ , except for  $x$  and  $y$ , is outside of the interior of the triangle with vertices  $p$ ,  $x$ , and  $y$ , but inside of the convex sector bounded by rays  $py$  and  $px$ . The conjecture is: given a fixed point  $p$  in the plane and a compact simply connected set  $S$  in the plane not containing  $p$ , and if every three points in  $S$  can see some point in  $S$  by  $p$ -superarcs, then there exists a point  $k$  in  $S$  such that every point  $x$  in  $S$  can see  $k$  by some  $p$ -superarc.

**Name:** Steven Kadow and Kristen Roland

**School:** Sonoma State University

**Advisor:** Scott Nickleach

**Title:** "R" You Waiting? – A look into server waiting times

**Abstract:** Using the program R, we will be simulating and finding the solution for the average waiting time for legitimate users accessing a server. The question was posed about how to optimize the number of servers needed to minimize the waiting time. Both legitimate users and hackers are fighting for the "serving spots." To add to this confusion, the servers have the ability to switch and either purge or keep the hackers in queue. We will be looking at a simplified version of this problem. Using Monte Carlo simulation technique, we will find the average waiting time for legitimate users.

**Name:** Kris Kilpatrick

**School:** CSU Chico

**Advisor:** Sergie Fomin

**Title:** *Rotational Flow of Non-Newtonian Fluids: A Viscoelastic Model*

**Abstract:** We study the rimming flow of a viscoelastic film on the inner surface of a hollow horizontal rotating cylinder. Assuming that the Reynolds number is small and the liquid film on the wall of the cylinder is thin, the simple lubrication theory is applied. For the steady-state flow of the Convected Maxwell fluid the mathematical model reduces to a nonlinear ordinary differential equation regarding the film thickness. We show that the liquid viscoelasticity changes the flow structure. In particular, the singularity, which was observed for pure viscous liquids within the same lubrication approximation, can be eliminated due to liquid elasticity. It is also shown that the elastic feature of the fluid leads to the non-symmetric shape of the polymeric film. For the viscoelastic fluids that can be characterized by the higher Deborah numbers, the region with maximal thickness of the film shifts down to the bottom of the horizontal cylinder. This non-symmetric distribution results in a longer period of stabilization of the flow to the steady state regime. We performed a detailed numeric analysis of the model and revealed some critical regimes which are specific only for viscoelastic liquids. Using the method of perturbations, the approximate analytical solution of the governing equation is also found.

**Name:** Alex Kudlick

**School:** UC Berkeley

**Advisor:** Jan Reimann

**Title:** *Context and Solutions for Maharam's Problem*

**Abstract:** Maharam's problem is one of the many equivalent forms of the Control Measure Problem, which was recently solved in 2006. My research provides background information on the problem, including the topics of absolute continuity, submeasures, and the Cantor Space.

**Name:** Viviana Medina  
**School:** CSU Stanislaus  
**Advisor:** John A. Rock  
**Title:** *Financial Aid Incentives for Math Teacher Candidates and Math CSET Options*

**Abstract:** There are many financial aid incentives for undergraduate students who plan on pursuing a career in teaching secondary math. There are also three options for obtaining the credential to teach math at the middle and high school level. These topics will be covered.

**Name:** Patrick Midgley and Anna Espitallier  
**School:** Sonoma State University  
**Advisor:** Cora Neal  
**Title:** *Creating Ideal Conditions for Ideal Cheese*

**Abstract:** A nonlinear regression analysis exploring the key factors which influence the variance in cheese. Conducted for Cowgirl Creamy located in Petaluma, California.

**Name:** MinhDuc T Nguyen  
**School:** Evergreen Valley College  
**Advisor:** Chung Wu Ho  
**Title:** *Cyclic Numbers in a Base  $b$*

**Abstract:** A number  $N = a_1a_2\dots a_k$  in base  $b$  is said to be a cyclic number, where  $a_1, a_2, \dots, a_k$  are the digits of  $N$ , if when  $N$  is multiplied by  $1, 2, \dots, k$ , the digits of each of the products is a cyclic rotation of those of  $N$ . There many unsolved problems connected with cyclic numbers. We will establish certain properties of such numbers.

**Name:** Nicholas Normandin  
**School:** San Francisco State University  
**Advisor:** Mariel Vazquez  
**Title:** *Construction of Lattice Knots from the Gauss Code*

**Abstract:** We use knot theory to model the properties of circular DNA as well as some DNA-protein interactions. We use the Gauss Code to represent circular DNA as an array of numbers. Given the Gauss code for minimal knot diagram, we aim to generate the corresponding knot in the simple cubic lattice ( $Z^3$ ). In this talk I will present an algorithm to generate these knots, and will illustrate it using the software Knotplot.

**Name:** Colin O'Haire  
**School:** Sonoma State University  
**Advisor:** Jerry Morris  
**Title:** *Fermathematics: Life and Times of Pierre de Fermat*

**Abstract:** It is no secret that Pierre de Fermat is an alluring mathematician. Not only was he an amateur mathematician, he was a very influential amateur mathematician. This talk is about his life, times and mathematical ideas.

**Name:** Kristen Roland

**School:** Sonoma State University

**Advisor:** Cora Neal

**Title:** *Quantifying a Question – A Student's Story of Consulting*

**Abstract:** When clients come to a consultant, they often have data but are unsure of what questions to ask. A consultant's job is to interpret the problem, quantify the question, and provide answers. The SSU Financial Aid Office approached the SSU Department of Mathematics and Statistics with a question about the way they disbursed limited funds. This talk will be about the non-quantitative problem posed to our consulting group and our attempt to answer it.

**Name:** Stefanie Wang

**School:** St. Mary's College of California

**Advisor:** Jim Sauerberg

**Title:** *The Distribution of Digits of Prime Numbers in Binary*

**Abstract:** The distribution of prime numbers is thought to be random. Hence, if the primes are written in base  $b$ , we would expect the digits in their base  $b$  expansions to occur with equal frequency. This seems not to be the case; in fact, for each  $b$  the smaller digits seem to be more prevalent.

**Name:** Holly Wright

**School:** Sonoma State University

**Advisor:** Ben Ford

**Title:** *Visualizing Complex Mapping with Color*

**Abstract:** Visualizing functions of complex numbers is difficult because it requires four dimensions. Conventional practice uses a graph of the domain and a graph of the image to do this. By using color we can see some of the subtle changes in the complex field under a function.