Women in Mathematics Symposium
Saturday, April 25, 2009
Loyola Marymount University

Abstracts

Maia Averett: *A tale of two cohomology theories.*
A large part of homotopy theory is devoted to understanding cohomology theories as tools for understanding topological spaces. In this talk, I'll describe two cohomology theories and build a bridge between them.

Jen-Mei Chang: *Face Recognition on the Grassmannians*
Recent work has established that digital images of a human face, collected under varying illumination conditions, contain discriminatory information that can be used in classification. These collections of images correspond naturally to points on a parameter space, known as the Grassmann manidold (or Grassmannians), where well-established distance measures are available for classification. Thus, the problem of classifying faces is equivalent to classifying their corresponding points on the Grassmannians. An error-free result from the CMU-PIE database will be given and a natural extension to low-resolution images will also be discussed.

Adrian Duane: *Kepler Walls*
In this talk, we introduce a new family of combinatorial objects called Kepler walls. Roughly speaking, a Kepler wall is a wall built of bricks in which no two bricks are adjacent, and each brick below the top row is supported by a brick in the row above. Despite their unlikely definition, Kepler walls of unrestricted width are counted by binomial coefficients, as we will see by means of a constructive bijection. We will also see connections to other interesting and well-understood sequences, such as the Catalan and Fibonacci numbers.

Olga Korosteleva: *Bayesian Monitoring of Clinical Trials: Heart Valve Example.*
In a clinical testing of a new product, a required number of patients is predetermined statistically before the trial begins. The trial must continue until at least that many patients are enrolled in the trial. A Bayesian approach guarantees to reduce the required number of patients and to stop the trial earlier under the condition that the tested product is showing efficacy during interim analysis. An overview of Bayesian technique will be provided, and a numerical example of heart valve clinical trials will be considered. A knowledge of basic probability distributions is desired.

Chung-min Lee: *Optical Phase Reconstruction Using the Weighted Least Action Principle*
Optical phase reconstruction plays an important role in many technologies such as astronomy imaging, optical design and surface measurements. In 2004, Wolansky and Rubinstein proposed the Weighted Least Action Principle (WLAP) to describe the relationship between the directions of light rays and the intensity of a light wave. According to the principle, we can find the phase function of a light wave after solving a minimization problem with a nonlinear constraint. In this talk, I will discuss the optical phase

reconstruction problem, some background of WLAP, and give an outline of numerical methods using WLAP to reconstruct phase functions of light waves. I will also show some results from a numerical procedure and discuss some problems of the current method.

Florence Lin: *Dynamics of the molecular N-body problem: Applications of the classical and quantum geometric phases*
A classical geometric phase describes the net overall rotation of a molecular N-body system due to internal motions. Historically, the quantal geometric phase has described a net phase change in a wavefunction obeying the time-dependent Schrodinger equation. Each of these phase changes is expressed as the holonomy of a connection and has been observed (e.g., in computational studies of protein dynamics and in spectroscopic studies of triatomic molecules). Further, they are related by a classical-quantum correspondence.

Tanya Mills: *Elliptic Curves and the Weil Pairing*
Since the mid-1980s, elliptic curves have played an increasingly important role in cryptography. One area of interest uses pairings over elliptic curves in encryption schemes. This talk provides a brief introduction to one of those, called the Weil Pairing. After describing the basics of arithmetic on elliptic curves (in particular, that the set of rational points on an elliptic curve forms an abelian group), we define the Weil Pairing. There is an algorithm, originally proposed by Miller, which allows one to calculate this pairing. Further, we will see that the Weil Pairing can be applied to the field of cryptography.

Lerna Pehlivan: *No feedback card guessing for top to random shuffles*
There are 2n cards that are labeled 1 through 2n. The cards are put face down and in perfect order on a table. The cards are top to random shuffled m times and placed face down
on the table. Starting from the top the cards are guessed without feedback (i.e. whether the guess was correct or false and what the guessed card was) one at a time. We find a guessing strategy that would maximize the expected number of correct guesses.