Archived Colloquia
2011/12

October 26, 2011: David Strong (Pepperdine University)

Title: ***An Interesting Pattern in a Fixed Point Problem and a New Identity in a Combinatorics Problem*** (Flyer)

Abstract: Part 1 of the talk: The Sinkhorn-Knopp Algorithm for transforming a positive matrix into a unique doubly stochastic matrix leads to the fixed point problem $x = (AT(Ax)^{(-1)})^{(-1)}$, where (-1) is the entry-wise inverse. I'll discuss some basic properties of solutions, including for non-positive and complex matrices, and I'll describe some interesting patterns that arise in looking at solutions of special cases.

Part 2 of the talk: Every evening before "Wicked" was performed at the Pantages Theater in Hollywood, a pre-show lottery drawing was held. Thirteen lucky persons would have their names drawn, and be able to buy front row seats at a very low price. Each person could buy two tickets, which means that if more than half of a groups members had their names drawn, they would have access to more lottery tickets than they need. Thus two groups of patrons could team up with each other with the agreement that if either group gets more tickets than needed, they would allow the other group to buy those extra lottery tickets. The question then is what the optimal size group is with which to team up? The answer isn't terribly surprising, but it is mathematically interesting, and leads to a new combinatorial identity.

October 28, 2011: Janko Gravner (University of California, Davis)

Title: ***Digital Snowflakes*** (Flyer)

Abstract: Six-sided ice crystals that fall to earth in ideal winter conditions, commonly known as snowflakes, have fascinated scientists for centuries. They exhibit a seemingly endless variety of shape and structure, and are mysteriously symmetric and mathematical in their designs. To this day, snowflake growth from molecular scales, with its tension between disorder and pattern formation, remains puzzling in many respects. With emphasis on computer-generated pictures and movies, the talk will review a few mathematical models of snow crystal dynamics, and discuss their contributions to mathematics and to the understanding of real snowflakes.

March 16, 2012: Matthias Beck (San Francisco State University)

Title: ***Enumeration of Golomb Rulers*** (Flyer)

Abstract: A Golomb ruler is a sequence of distinct integers (the markings of the ruler) whose pairwise differences are distinct. Golomb rulers, also known as Sidon sets and B2 sets, can be traced back to additive number theory in the 1930s and have natural applications, e.g., to phased array radio antennas, x-ray analysis of crystal structures, and error-correcting codes. More recently, they have attracted research activities on existence problems, such as the search for optimal Golomb rulers (those of minimal length given a fixed number of

markings). We will exhibit parts of the history and applications of Golomb rulers, and introduce a counting function $\mathrm{gm}(t)$ for the number of Golomb rulers with $m+1$ markings and length t. Our main result is that $\mathrm{gm}(t)$ is a quasipolynomial in t which satisfies a combinatorial reciprocity theorem, i.e., we will give an interpretation for evaluations of $\mathrm{gm}(t)$ at negative integers t.

April 19, 2012: Carol Meyers (Lawrence Livermore National Laboratory)

Title: ***Downsizing the US Nuclear Weapons Stockpile and Modeling an Intelligent Adversary*** (Flyer)

Abstract: We discuss two topics that I have worked on at Lawrence Livermore National Laboratory, which give a sense of the breadth of the mathematical work that is done at a national lab. The first of these involves using optimization techniques to assess policy options for downsizing the US nuclear weapons stockpile. We discuss consolidation of the weapons complex in general, and our implementation of a mixed-integer linear programming model that is currently being used to evaluate policy alternatives. The second topic addresses mathematical methods for modeling an intelligent adversary, and how techniques from the field of artificial intelligence can be used to solve such problems. Using the crime of money laundering as a motivating example, we specifically seek to address the gap between the theory and practical application of such methods.

May 4, 2012: Erica Flapan (Pomona College)

Title: ***Mirror Image Symmetry from Different Viewpoints*** (Flyer)

Abstract: In this lecture I will give examples of mirror image symmetry in various contexts, from music to poetry to sports to people and finally to molecules. I will explain why it is important to know whether a molecule has mirror image symmetry, and present examples of molecules that are symmetric or asymmetric from different viewpoints. Finally, I will explain what "topology" is and why topological asymmetry is the deepest type of asymmetry. No background in chemistry or mathematics is necessary to understand the lecture.