UNIVERSITY OF MICHIGAN
Department of Mathematics

Seminar & Events Bulletin: Math Club

01-01-2013 to 06-30-2013

Thursday, January 17, 2013

4:00pm-5:00pm **Math Club** -- Matthew Satriano (Univ. of Michigan) *The Four Squares Theorem* -- Nesbitt Room

Thursday, January 24, 2013

4:00pm-5:00pm **Math Club** -- Hester Graves (IDA) *Drawing and the Projective Plane* -- Nesbitt Room

Thursday, January 31, 2013

4:00pm-5:00pm **Math Club** -- David Speyer (Univ. of Michigan) *Unsolvability of the quintic equation* -- Nesbitt Room

Thursday, February 07, 2013

4:00pm-5:00pm **Math Club** -- Jinho Baik (Univ. of Michigan) *Longest Monotone Subsequences* -- Nesbitt Room

Thursday, February 14, 2013

4:00pm-5:00pm **Math Club** -- Alexander Duncan (Univ. of Michigan) *Undecidable Problems* -- Nesbitt Room

Thursday, February 21, 2013

4:00pm-5:00pm **Math Club** -- Mark Conger (Univ. of Michigan) *Mathematics of Card Shuffling* -- Nesbitt Room

Thursday, February 28, 2013

4:00pm-5:00pm **Math Club** -- Igor Kriz (Univ. of Michigan) *The Beauty of Statistical Tests* -- Nesbitt Room

Thursday, March 14, 2013

4:00pm-5:00pm **Math Club** -- Selim Esedoglu (Univ. of Michigan) *Math in Computer Vision* -- Nesbitt Room

Thursday, March 21, 2013

4:00pm-5:00pm **Math Club** -- Daniel Erman (Univ. of Michigan) *Hilbert's Third Problem* -- Nesbitt Room

Thursday, March 28, 2013

4:00pm-5:00pm **Math Club** -- Scott Schneider (Univ. of Michigan) *The Banach-Tarski Paradox* -- Nesbitt Room

Thursday, April 04, 2013

4:00pm-5:00pm **Math Club** -- Daniel Fiorilli (Univ. of Michigan) *Prime Number Races* -- Nesbitt Room

Thursday, April 11, 2013

4:00pm-5:00pm **Math Club** -- Hala Shehadeh (Univ. of Michigan) *Convexity* -- Nesbitt Room

Thursday, April 18, 2013

4:00pm-5:00pm **Math Club** -- Charlie Doering (Univ. of Michigan) *The Paradox of Enrichment* -- Nesbitt Room

Abstracts

Math Club
Thursday, January 17, 2013, 4:00pm-5:00pm
Nesbitt Room
Matthew Satriano (Univ. of Michigan)
The Four Squares Theorem

It is a remarkable fact that every integer can be written as a sum of four squares. We will present a geometric proof. It uses Minkowski's convex body theorem, which we will explain.

Math Club
Thursday, January 24, 2013, 4:00pm-5:00pm
Nesbitt Room
Hester Graves (IDA)
Drawing and the Projective Plane

Some geometry we study was inspired by the needs of artists, and this includes projective geometry. This talk has three parts: an overview of the projective plane from a mathematical point of view; a short history of point perspective as used by Renaissance artists; and finally some math and drawing exercises to do (no artistic ability required) that bring the two together.

Math Club
Thursday, January 31, 2013, 4:00pm-5:00pm
Nesbitt Room
David Speyer (Univ. of Michigan)
Unsolvability of the quintic equation

As you may have heard, there is no formula to express the roots of a fifth degree polynomial in terms of its coefficients, using the operations of addition, subtraction, multiplication, division and n-th root extraction. By watching how the roots of the polynomial $z^5 - z - t$ move in the complex plane as the parameter t varies, we will be able to see that no such formula exists

Seminar & Events Bulletin: Math Club

01-01-2013 to 06-30-2013

Math Club
Thursday, February 07, 2013, 4:00pm-5:00pm
Nesbitt Room
Jinho Baik (Univ. of Michigan)
Longest Monotone Subsequences

A so-called ``well known theorem" states that in any permutation of {1, 2,..., n^2+1}, there exists a monotone subsequence of length at least n+1, either increasing or decreasing. In 1961 Stan Ulam raised the problem of determining the distribution of the longest increasing subsequence of a random permutation. In 1972 Hammersley wrote a fascinating essay on this problem: "A few seedlings of research." We discuss this problem and research it led to in probability and statistical physics.

Math Club
Thursday, February 14, 2013, 4:00pm-5:00pm
Nesbitt Room
Alexander Duncan (Univ. of Michigan)
Undecidable Problems

Informally, a problem is undecidable if is impossible to write a computer program to solve it. Many surprisingly elementary questions in mathematics turn out to be undecidable. I will outline how we know such problems exist and give several examples from different branches of mathematics.

Math Club
Thursday, February 21, 2013, 4:00pm-5:00pm
Nesbitt Room
Mark Conger (Univ. of Michigan)
Mathematics of Card Shuffling

How many times should you shuffle a deck of cards to mix the cards? In 1992 Dave Bayer and Persi Diaconis wrote an influential paper on the problem. The news media reported that their answer was "seven." This talk will explain the mathematics behind their result, and will also describe generalizations of it.

Math Club
Thursday, February 28, 2013, 4:00pm-5:00pm
Nesbitt Room
Igor Kriz (Univ. of Michigan)
The Beauty of Statistical Tests

I will discuss the rather beautiful and striking properties of the normal (Gaussian) distribution, and why it plays such a prominent role in statistics. I will relate the multivariable Gaussian distribution to finding the principal axes of an ellipse. Then I discuss the mathematics behind two famous statistical tests: the chi-squared test and the Student t test. (The talk is informal, no knowledge of probability theory is assumed.)

Math Club
Thursday, March 14, 2013, 4:00pm-5:00pm
Nesbitt Room
Selim Esedoglu (Univ. of Michigan)
Math in Computer Vision

Teaching computers to "see" has enormous potential for applications (in medicine, defense, etc.), but turns out to be immensely challenging. Even the task of discerning a foreground object from the background turns out to be enormously hard. I will discuss some of the approaches to this question, and give a flavor of the mathematics involved.

Math Club
Thursday, March 21, 2013, 4:00pm-5:00pm
Nesbitt Room
Daniel Erman (Univ. of Michigan)
Hilbert's Third Problem

In 1900 David Hilbert proposed a famous list of 23 open problems. The third problem asked: Given two polyhedra of equal volume, can you always cut the first one into finitely many pieces (with scissors) and reassemble the pieces to form the second? This problem was the first of these problems to be solved, by Hilbert's own student Max Dehn. The answer was ``No'' . I will discuss a modern, simplified version of Dehn's proof.

Seminar & Events Bulletin: Math Club

01-01-2013 to 06-30-2013

Math Club
Thursday, March 28, 2013, 4:00pm-5:00pm
Nesbitt Room
Scott Schneider (Univ. of Michigan)
The Banach-Tarski Paradox

In 1924, Banach and Tarski proved that any bounded solid region in 3-space can be decomposed into finitely many pieces that can be rearranged using Euclidean isometries to produce any other bounded solid region desired. As it is often put, "a pea can be chopped up and reassembled to produce the sun." I will present this paradoxical result and discuss the extent to which the Axiom of Choice can be blamed for it.

Math Club
Thursday, April 04, 2013, 4:00pm-5:00pm
Nesbitt Room
Daniel Fiorilli (Univ. of Michigan)
Prime Number Races

We will start with a historical introduction to the Riemann zeta function and its connection with prime numbers. this work began with Euler, followed later by Riemann. We will then talk about Chebyshev's assertion that there seem to be more primes of the form 4n+3 than of the form 4n+1. Are there? We will present some surprising facts about such prime number races.

Math Club
Thursday, April 11, 2013, 4:00pm-5:00pm
Nesbitt Room
Hala Shehadeh (Univ. of Michigan)
Convexity

A convex set is a set which contains all line segments connecting any two of its points. This notion of convexity is surprisingly important and it appears in a wide variety of pure and applied topics, especially optimization. I will give examples of convex sets, convex functions and convex functionals and will show how many problems, when viewed in the right set of variables, become convex optimization problems that are easy to solve.

Math Club

Thursday, April 18, 2013, 4:00pm-5:00pm

Nesbitt Room

Charlie Doering (Univ. of Michigan)

The Paradox of Enrichment

Mathematical models in ecology describe the dynamics of interacting populations such as distinct species competing for common resources, predator-prey systems, and more complex systems like food chains and food webs. You might generally expect that higher fertility habitats would be capable of sustaining larger population levels, but some models show that this may not always be so. In certain situations increasing resource levels can lead to dynamical instabilities producing large population variations and, eventually, the extinction of one or more of the species. The lesson? Be careful what you wish for ... more is not always better!