2005 Conference Schedule

* denotes talk is accessible to high school students

9:00-10:00: Registration-Atrium
10:00-10:30: Breakfast and Introduction-Atrium

Session 1	Probability **Room 1106**	Interdisciplinary **Room 1111**
10:30-10:45	Nick Stanek	Tom Cochran
10:50-11:05	Ostrowski & Sowell	Jonathan Hobson
11:10-11:25	Keith Edenfield	Bruckman & Hall
11:30-11:45	Mike Klauss	Kelly Smith

Session 1	Calculus **Room 1120**	COMAP **Room 1062**
10:30-10:45	Katharine Boyd	CONTINUOUS
10:50-11:05	Keiko Miyahara	CONTINUOUS
11:10-11:25	Paul Havens	CONTINUOUS
11:30-11:45	Paul Havens	CONTINUOUS

Session 2	Calc/Analysis **Room 1106**	Applied Math **Room 1111**
11:50-12:05	Melissa Marshall	Lauren Gruenebaum
12:10-12:25	Aaron Pollack	Richard Guthrie
12:30-12:45	Adam Ronyak	David Gohlke
12:50-1:05	Sarah Yurco	Steve Dinda

Session 2	Math History **Room 1120**	COMAP **Room 1062**
11:50-12:05	Joe Teter	DISCRETE
12:10-12:25	Janine Zambo	DISCRETE
12:30-12:45	Timothy Brintnall	DISCRETE
12:50-1:05	Jason Slaby	DISCRETE

1:10-2:00: Lunch-Atrium

Session 3	Linear Algebra **Room 1106**	Discrete Math **Room 1111**
2:00-2:15	Mike Smith	Joe Kolenick
2:20-2:35	Nicole Cunningham	Anthony Macko

Session 3	Special Topics **Room 1120**	COMAP **Room 1062**
2:00-2:15	Maria Salcedo	INTERDISCIPLINARY
2:20-2:35	Ted Stadnik	INTERDISCIPLINARY

2:35: Closing Remarks-Atrium

Abstracts

Tom Cochran
How SMART is Your Geometry?
Youngstown State University
Advised by: Dr. J. Douglas Faires

In a talk geared toward anyone interested in mathematics education, I will give a brief demonstration of some of the capabilities of a SMART Board and show how different geometry softwares can be used in parallel with them. Technology in classrooms at all levels should be taken advantage of and this talk will scratch the surface of the growing number of innovations available to educators.

Nicole Cunningham
Comparing the Eigenvalues of the Products of Two Matrices
Youngstown State University
Advised by: Dr. J. Douglas Faires and Dr. Angela Spalsbury

Suppose that A and B are two matrices. Even when both products AB and BA are defined, it is seldom the case that these products are equal. In fact, if A is an $n \times m$ matrix and B is an $m \times n$ matrix, the products AB and BA are not even of the same type. In this talk we consider the eigenvalues of these products and see that the products are not as dissimilar as they first appear.

Keith Edenfield
Crazy Dice
Youngstown State University
Advised by: Dr. Thomas Smotzer

When you roll a standard pair of 6-sided dice, there are 11 possible outcomes, with a certain probability of occurrence for each possible result. This is called the probability distribution. Now it turns out that you can take two 6-sided dice and put different positive integers on them in such a way that the probability distribution is the same as for two standard dice. We will solve this problem by considering generating functions.

David Gohlke
On the Orbit of Mercury
Youngstown State University
Advised by: Dr. Tabak

I will talk about the precession of the orbit of Mercury, and the deviation of the orbit from what is predicted by Newtonian mechanics. I will talk about the effects of the other planets, and hypothetical corrections to account for the advance of the orbit.

Lauren Gruenebaum
Benford's Law and its Application to the Detection of Accounting Fraud
College of Wooster
Advised by: Dr. Jim Hartman

Benfords Law deals with the frequencies with which digits occur in random numbers. The purpose of this talk is to outline both the history of Benfords Law and the development of the statistical derivation of the law. Furthermore, the laws relationship to accounting will be discussed in detail, and this application will be demonstrated though an examination of accounting data from the College of Wooster.

Richard Guthrie
Branch Between Chemistry and Mathematics
Ashland University
Advised by: Dr. Dence

A Branch Between Chemistry and Mathematics is a presentation based on an article found in Mathematics Teacher. This talk takes you through the process finding a short cut for solving to find the equilibrium concentration of an acid, involving the quadratic equation. This talk is a must see for those interested in both Mathematics and Chemistry.

Paul Havens
Radishes
Lakeland Community College
Advised by: Carl Stitz

In this presentation, I will explore the occurrence that the derivative of the area of a circle is it's circumference. Using this idea, I will derive radius-like relationships, or "radishes," for regular and irregular polygons, and I will also begin to explore radishes for higher dimensional objects.

Mike Klauss
Probabilities and Statistics in Baseball
Cleveland State University
Advised by: Dr. John Holcomb

This presentation will focus on three aspects of statistics and probability in baseball:

1. How statistics can be deceiving, involving Simpson's Paradox.
2. The likelihood of hitting streaks.
3. A model for predicting how many games a World Series will last.

Joseph Kolenick
A Solution to an American Mathematical Monthly Problem
Youngstown State University
Advised by: Dr. Thomas Smotzer and Dr. Jacek Fabrykowski

Problem 11103 Proposed by Gregory Galperin and Hillel Gauchman, Eastern Illinois University, Charleston, IL in the American Mathematical Monthly

Problem: *Prove that for every positive integer n,*

$$\sum_{k=1}^{n} \frac{1}{k\binom{n}{k}} = \frac{1}{2^{n-1}} \sum_{\substack{k=1 \\ k \text{ odd}}}^{n} \frac{\binom{n}{k}}{k}$$

Anthony Macko
Cellular Automation and Traffic Flow
Cleveland State University
Advised by: Dr. John Holcomb

Cellular automation is a way of looking at complex systems in nature by breaking down these systems into discrete cells which all obey the same simple rules. By using this idea, it is possible to create a computational model that describes steady state traffic flow. Using this idea, traffic can be modeled without using complex differential equations, which would bog down a computers ability to give quick predictions of the flow of traffic given certain situations. We can use discrete mathematics to do the work of Differential Equations and Fourier Analysis.

Melissa Marshall
Title: A Beginners Guide to Cutting Cake
Youngstown State University
Advised by: Dr. Angela Spalsbury

Keiko Miyahara
Minimal Energy Flight Path for Homing Pigeons
Mount Union
Advised by: Dr. Thomas O'Malley

For a homing pigeon that must fly from a point A offshore to a point B on land, the path of minimum energy spent is shown to depend only on the ratio of the energy per mile needed to fly over land to the energy per mile needed to fly over water, and not on A or B, as long as B is sufficiently far from the point on land closest to A.

Amanda Ostrowski and Casie Sowell
Hypergeometric Probability
Cleveland State University
Advised by: Dr. John Holcomb

Lottery games are always stacked against youor are they? During our presentation we will investigate this question by taking a look at an electronic lottery game, Quick Draw. Using hypergeometric probability we will take a look at the probabilities of winning each game, as well as losing the $1.00 bet. We will also calculate the expected winnings for each game, and then determine which game is the most profitable for the state as well as the player.

Aaron Pollack
The Existence of Compositional Square Roots
Liberty High School and Youngstown State University
Advised by: David Pollack

For a given function f we say that g is a compositional square root of f if $g(g(x)) = f(x)$ for all x in the domain of f. We seek to determine when, for a given f, there is such a square root.

In this talk we resolve this question for continuous, bijective functions $f : R \to R$ with at most one fixed point. The results are:

1. If f is decreasing, then f has no continuous compositional square root.

2. If f is increasing, then f has a continuous compositional square root. In fact, f has compositional powers of all degree t, not only $t = \frac{1}{2}$. That is, there exists a one parameter family of continuous maps $f^t : R \to R$ such that
i) $f^0(x) = x$,
ii) $f^1(x) = f(x)$, and
iii) $f^{a+b}(x) = f^a(f^b(x))$.

Adam Ronyak
Binary Expansions, Distance, and Dynamics
Youngstown State University
Advised by: Dr. Roy Mimna

This talk will define the symbol metric space with regards to binary expansions. The relationship to symbol dynamics will be explored with an examination of the Morse sequence.

Maria Salcedo
A Knovice's Guide to Knot Theory
Youngstown State University
Advised by: Dr. Angela Spalsbury

Ever wonder what knot theory is all about? This talk will give a concrete introduction to why mathematicians study knots. This includes classification of knots, ties between knots and surfaces, and an overview of research of knotted ribbons that I conducted at a Research Experience for Undergraduates at California State San Bernardino.

Kelly Smith
The Role of Vaccination in the Control of SARS
Clarion University
Advised by: Dr. Beal

Utilizing ordinary differential equations in a dynamical system, this project explores pre-outbreak and during-outbreak vaccination as control strategies for SARS epidemics. We construct a mathematical model that includes susceptible, latent (traced and untraced), infectious, quarantined/isolated, recovered, and dead classes. Using data from the 2002-2003 SARS outbreak in Hong Kong (China), we predict the minimal necessary proportion of the population that needs to be successfully vaccinated prior to an outbreak to control an epidemic. The basic reproductive number, R_0, and uncertainty and sensitivity analysis is computed. The final epidemic size under different vaccination scenarios is estimated.

Michael Smith
Discrete Hermite Functions
University of Akron
Advised by: Dr. Dale Mugler

The connection between Hermite functions and Fourier analysis has been known for some time. The Hermite functions are eigenvectors for the continuous Fourier transform.
This presentation will examine the properties of a new set of discrete Hermite functions that have been found as eigenvectors for the Fourier matrix. One analogy is an iteration formula for the continuous case that has a similar form for the discrete case. The iteration formula produces a set of eigenvectors for the Fourier matrix that have properties very similar to those of the continuous Hermite functions.
Background on the continuous Hermite functions as well as new material on the discrete case will be given.

Theodore Stadnik
An Analytical Anomaly
Youngstown State University
Advised by: Dr. Jacek Fabrykowski

It is known that a there must exist a sequence of continuous functions defined on the interval $[0, 1]$ such that sequence diverges for each irrational and for each rational is bounded. In this talk an example of such a sequence is constructed. Facts about continued fractions are proven and used to analyze the example and similar sequences.

Nick Stanek
Ranking College Football Teams
Youngstown State University
Advised by: Dr. Thomas Smotzer

We investigate an algorithm that can be used to rank college football teams. The ranking system uses the Perron-Frobenius Theorem to rank teams based on probability estimates of each team defeating an opponent, where these probabilities are computed using outcomes of the games they played during the season. To use the theorem a matrix is created whose entries are based on actual game scores and defined so that the ranking vector is an eigenvector of the matrix. The inverse Power Method is then used to determine the eigenvector which gives the desired ranking. Using different strategies for determining the probabilities needed, rankings are computed for the 2002 college football season and are compared with the final rankings of that year.

Sarah Yurco
Black-Scholes Equation
Youngstown State University
Advised by: Dr. J. Douglas Faires

I plan to briefly discuss the definition and function of an option. Then I will explain the assumptions needed for the Black-Scholes Equation. Finally, I will go through the derivation of the model which includes partial derivatives.

Janine Zambo
Witches, Lights, Soap Bubbles, and Fights: A History of Mathematical Curves
Kent State University, Tuscarawas Campus
Advised by: Jeff Osikiewicz and Beth Osikiewicz

In this talk, we will present the history behind four famous mathematical curves and the mathematicians who developed them. In particular, we will examine the Witch of Agnesi, Lissajous Curves, Plateau Curves, and the Cycloid.

YSU Pi Mu Epsilon Officers

President: Maria Salcedo

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Secretary: Darcy Davis

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We gratefully acknowledge funding from the National Science Foundation Regional Mathematics Conferences (NSF-RUMC) Grant Committee for their support of our conference this year (NSF Grant DMS-0241090).

Special thanks also to the Department of Mathematics and Statistics at Youngstown State University.