2007 Conference Schedule

9:00-10:00: Registration-Atrium

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

	Room 1062	**Room 1111**	**Room 1120**	**Room 2057: COMAP**
10:30-10:45	Jeff Burdette	Andrew Miskimen	Carrie Davis	ICM - C, YSU
10:50-11:05	Scott Hunter	Kerry McIver	Michael Henninger	ICM - C, YSU
11:10-11:25	Joseph Marusa	Matthew Ward	Leanna Cluff	MCM - A, YSU
11:30-11:45	Jeff Cornfield	Anne Rollick	Tara Cruickshank	MCM - A, SRU
11:50-12:05	Rodica Nan	Kevin Kreighbaum	Michelle Cordier	MCM - A, YSU

12:05-1:00: Lunch-Atrium

	Room 1062	**Room 1111**	**Room 1120**	**Room 2057**
1:00-1:15	Nick Gemuenden	Courtney Gilmore	Liz Smietana	MCM - B, SRU
1:20-1:35	Tim Smith	John Hoffman	David Ledbetter	MCM - B, WC
1:40-1:55	Tyler Drombosky	Scott Zimmerman	Anthony Lehew	MCM - B, YSU
2:00-2:15	Kris Reash	Allen A Cox	Emily Elder	Rory Tiedemann
2:20-2:35	Andrew Periello & Bryan Bischof	David Martin	Michele Huston & Shannon Winkler	

2:40: Closing Remarks-Atrium

10:30-10:45 **Room 1062**

Jeff Burdette
What is the sum of every third number in the nth row of Pascal's Triangle?
Kent State University
Advised by: Dr. Morley Davidson

The corresponding question for the series for e^xwill be our warm-up; we will show how the complex third roots of unity solve such questions in a surprisingly slick way. As a byproduct we instantly get a cool partial fraction decomposition for $\frac{1}{1-x^3}$ which we guarantee you didn't see in Calc 2!

10:30-10:45 **Room 1111**

Andrew Miskimen
A Proof of the Law of Quadratic Reciprocity
Baldwin-Wallace College
Advised by: Dr. Chungsim Han

The Law of Quadratic Reciprocity is a very important result that is used to evaluate Legendre symbols. During this brief presentation, a proof of the Law of Quadratic Reciprocity will be the focus. In addition, various examples that demonstrate the application of the Law of Quadratic Reciprocity will be discussed.

10:30-10:45 **Room 1120**

Carrie Davis
The Mathematics of Shooting Free Throws
Youngstown State University
Advised by: Dr. Angela Spalsbury

We will create a mathematical model for shooting a free throw. Then, by using calculus and methods of optimization, we will determine the ideal angle that must be used to guarantee a "nothing but net" shot.

10:50-11:05 **Room 1062**

Scott Hunter
Fractions: A Continuing Story
Youngstown State University
Advised by: Dr. Angela Spalsbury

Continued fractions are an interesting branch of mathematics that looks at expressing real numbers in a finite or infinite fractional expansion. This representation has many applications including solving linear indeterminate equations (Diophantine equations). In this talk, some of the basic ideas, theorems, and applications about continued fractions will be presented.

10:50-11:05 **Room 1111**

Kerry McIver
Analyzation of the Perfect Shuffle
John Carroll University
Advised by: Dr. Leo Schneider

I will compare the number of riffles needed to obtain a perfect shuffle in a poker versus a pinochle deck. Also, I will compare two different methods of shuffling to see if the number of riffles changes.

10:50-11:05 **Room 1120**

Michael Henninger
There's Still Time to Change the Road You're On
Westminster College
Advised by: Dr. Carolyn Cuff

This is a statistical study of students changing their majors at Westminster College. Similar studies at other universities search for a relationship between major changing and the duration of the students' time as an undergraduate student. This investigation looks to determining if a student has a certain level of likelihood to finish in a given major based on the major with which he or she began his or her college career.

11:10-11:25 **Room 1062**

Joseph Marusa
The Chinese Remainder Theorem and its Application to Secret Sharing
Cleveland State University
Advised by: Dr. Sailai S. Shao

The Chinese Remainder Theorem was known to Chinese mathematicians in ancient times, and it is still in wide use in applications today. Secret Sharing is a natural application of the Chinese Remainder Theorem because the Chinese Remainder Theorem itself is a secret sharing scheme. This talk will focus on the Chinese Remainder Theorem and its application in Secret Sharing schemes.

11:10-11:25 **Room 1111**

Matthew Ward
The Philosophy of Mathematics
Youngstown State University
Advised by: Dr. Brendan Minogue

A basic look at the four main schools of thought in the philosophy of mathematics and some modern alternatives to these traditional views.

11:10-11:25 **Room 1120**

Leanna Cluff
Probability on Death Row
Youngstown State University
Advised by: Dr. G. Jay Kerns

There are three prisoners on death row. The prisoners are told only that one of them will be pardoned. Since the first prisoner can not find out if he is pardoned, he asks which of the other two will die. Will the answer he receives give him any more information? Do the odds that he will be pardoned change? These questions and others will be investigated.

11:30-11:45 **Room 1062**

Jeff Cornfield
Napoleon Triangles: A Brief Presentation
Youngstown State University
Advised by: Dr. Thomas Smotzer

Napoleon Triangles state that given equilateral triangles erected outwardly on the sides of triangle ABC and containing centers X, Y, and Z; the triangle formed from the vertices X,Y, and Z is also an equilateral triangle. I will demonstrate a proof of the Napoleon Triangles, discuss a brief history of the Napoleon Triangles, and discuss further research and applications of the Napoleon Triangles, especially Fermat Points.

11:30-11:45 **Room 1111**

Anne Rollick
Spheres on a Cayley Graph
John Carroll University
Advised by: Dr. Leo Schneider

We will define free groups, Cayley graphs of free groups, and distance functions on those graphs. We will show results on the numbers of points on spheres under various representations. This work was done at an REU at Indiana University during Summer, 2006.

11:30-11:45 **Room 1120**

Tara Cruickshank
Statistical Analysis of the Percentage Body Fat in Men
Youngstown State University
Advised by: Dr. G. Jay Kerns

Body fat is a key factor in assessing the health of an individual; a cost effective and accurate method for determining percentage body fat is in demand. In this talk, we will investigate the relationship between percentage body fat and various physical characteristics using multiple linear regression methods and resampling techniques to determine which factors accurately predict percentage body fat.

11:50-12:05 **Room 1062**

Rodica Nan
Conics
Cleveland State University
Advised by: Dr. Keith Kendig

My presentation is based on an independent study on Conics. The main problem concerns ellipses in general and more specifically what happens with a burst of photons that moves within an ellipse. The idea is to look at what happens with these photons, first in the real plane and then in the imaginary space. The Minkowski's plane will come into play after I show that in the real plane the photons slowly converge towards the major semi-axis and become a single photon. By analyzing closely this simple result, I will try to make an extension to the fascinating 3D slices of Four Space.

11:50-12:05 **Room 1111**

Kevin Kreighbaum
Hidden Group Structure
Mount Union College
Advised by: Dr. Sherri Brugh

One of the most basic groups in abstract algebra is $U(n) = \{k|0 < k < n \text{ and } gcd\,(k, n) = 1\}$. This is a group under multiplication modulo n. For any k in $U(n)$, we will look at the set $S = \{kg|g \text{ is in } U(n)\}$and prove that it is a group under multiplication modulo kn . This group's "hidden" structure will be explored.

11:50-12:05 **Room 1120**

Michelle Cordier
The Josephus Problem
Kent State University
Advised by: Stephen M. Gagola Jr.

I will explore the origins of the Josephus Problem, and present the case when every other person is chosen.

1:00-1:15 **Room 1062**

Nick Gemuenden
Simulation of a Generic Kerosene Can Combustor
Youngstown State University
Advised by: Dr. George Yates

I will present a simulation of a generic kerosene can combustor, which represents a combustor chamber on a jet engine. This work was done at an REU at the Wright-Patterson Air Force Base in Summer 2006.

1:00-1:15 **Room 1111**

Courtney Gilmore
Moving Out: Modeling Population Migration Using Linear Algebra
Westminster College
Advised by: Dr. Carolyn Cuff

A population migration model using linear algebra and Markov chains was examined. The model assumes that the total population of the system remains fixed, the migration rate for any two states is constant, and the eigenvectors of the population matrices are linearly independent. Changes were made to the model to incorporate relaxed assumptions. Limitations of the models were determined using proofs and an analysis of United States-Mexico population migration data.

1:00-1:15 **Room 1120**

Liz Smietana
Fly Space and Beyond
John Carroll University
Advised by: Dr. Leo Schneider

The Anoto Fly pen is a miniature computer which makes use of a position coding pattern in Fly Space. To understand what a position coding pattern is and how it works, we will explore Fly Space along with an original position coding pattern.

1:20-1:35 **Room 1062**

Tim Smith
Wilson's Theorem: from Prime to Composite
Cleveland State University
Advised by: Dr. Leah Gold

Wilson's Theorem states that, for a prime number P,

$$(P-1)! = -1 \, (mod \, P)$$

That is, if we multiply together every positive integer less than P and add 1, the result is divisible by P. But what if P is a composite number? Using elementary concepts of number theory and some help from Euclid, Euler, Gauss, Fermat and the 3rd-century CE Chinese, we will journey with Wilson's Theorem into the land of composite numbers.

1:20-1:35 **Room 1111**

John Hoffman
Dawn of the Logistic Function
Youngstown State University
Advised by: Dr. Angela Spalsbury

I use a population model to predict the spread of zombies across the United States. Ultimately, I show how much time is available to escape the infection.

1:20-1:35 **Room 1120**

David Ledbetter
On the Number of Primes less than x
Mount Union College
Advised by: Dr. Sherri Brugh

Over two millennia ago Euclid gave a ground breaking proof that the number of primes is infinite. In that time dozens, if not hundreds, of other proofs have been found to show that the prime number set is infinite. The question that has remained unanswered in all of that time is the question I will focus on in this presentation: how many primes are there less than the number x?

1:40-1:55 **Room 1062**

Tyler Drombosky
Statistical Comparison of Discrete Mathematics
Youngstown State University
Advised by: Dr. G. Jay Kerns

It's easy for a person to tell if two samples of audio are similar or not, but how hard would it be to do this mathematically? We take a look at comparing two real songs on a computer in a journey to find their similarity. Computer science, statistical programs, and moment sequences all play a critical role in finding the answer.

1:40-11:55 **Room 1111**

Scott Zimmerman
The Decimal Expansion of 1/2007
John Carroll University
Advised by: Dr. Leo Schneider

An examination of the decimal expansion of various fractions, beginning with 1/2007. Examination of the data revealed interesting yet familiar results in the area of Number Theory.

1:40-1:55 **Room 1120**

Anthony LeHew
Sufficient Statistics and Exponential Families
Youngstown State University
Advised by: Dr. G. Jay Kerns

Data reduction in statistics becomes vital when a sample size starts to reach a large population. The data can be reduced as long as vital information about the population isn't lost. This is accomplished by using sufficient statistics. We will take a look at how sufficient statistics work, what is necessary for it to work, and the Exponential Family and how it applies to sufficiency.

2:00-2:15 **Room 1062**

Kris Reash
Keeping the Balance
Youngstown State University
Advised by: Dr. G. Jay Kerns

This research is based on one full regular season with the Columbiana High School Varsity Football Team. There are four major areas that Columbiana's offense uses in its offensive scheme. This research will take the four major groups of Columbiana offense (closed, unbalanced, normal, and spread), and decide whether this football team is balanced in their offensive attack. The methodology identifies and describes the four groups of offense, then compares each of the groups and how many times they were run throughout the ten game regular season. A chi-squared goodness of fit test was used to check for imbalance. The group is that most successful by the yards gained from every play was identified. This leads the research to find the most successful plays throughout the whole offense, so that they can be run in the post season.

2:00-2:15 **Room 1111**

Allen A. Cox
Solving a Multivariable Inequality by Using Derivatives or Jensen's Theorem
Kent State University
Advised by: Dr. Stephen Gagola

In this talk, I will work through the proof of a multivariable inequality published in a recent issue of the College Mathematics Journal. The first part of the talk will focus on the lengthy but ultimately accessible way to use derivatives to arrive at a solution, and the second part will detail how to solve the inequality very shortly and elegantly using Jensen's Theorem.

2:00-2:15 **Room 1120**

Emily Elder
Using Divisibility Rules to Solve Problems in Professional Journals
Slippery Rock University
Advised by: Dr. Rich Marchand

We will consider two problems proposed in the Kappa Mu Epsilon Journal that require the application of basic divisibility rules. The only prerequisite background required to consider the problems involves elementary number theory.

2:00-2:15 **Room 2057**

Rory Tiedemann
Win Probabilities of California Football
Mount Union College
Advised by: Dr. Mike Zwilling

This project is to determine the probability of University of California winning a football game based on the situation (time remaining, point differential, field position, and possession). The probabilities were calculated on SPSS using data for all drives, which are defined as a possession in which the offense runs at least one play, under current head coach, Jeff Tedford. An aim of the experiment is to use the final results as a tool to evaluate the offensive, defensive, and special team units' performance.

2:20-2:35 **Room 1062**

Bryan Bischof & Andrew Periello
Infinite Composite Images of Non-Constant Polynomials
Westminster College
Advised by: Dr. Javier Gomez-Calderon

Following the search for a non-constant integer polynomial, producing only primes, an existence proof was discovered that every one of these polynomials has a composite image. Using this proof, we present a solution and then expanding on it, we present a proof of infinite composite images. Additionally, we produce an interesting result involving the order of the prime factorization group.

2:20-2:35 **Room 1111**

David Martin
A Solution to PME Journal Problem 1113, Fall 2005
Youngstown State University
Advised by: Dr. Jacek Fabrykowski

A solution the PME Journal Problem,$\sum_{n=1}^{\infty} \frac{n^p}{k^n}$, where p is a natural number and k is a real number greater than one. First a brute force method will be used and then a more elegant recurrence method will be applied.

2:20-2:35 **Room 1120**

Michele Huston and Shannon Winkler
Evaluating Certain Trigonometric Integrals Using a Hyperbolic Substitution
Kent State Tuscarawas Campus
Advised by: Dr. Jeff Osikiewicz

We first review some of the basic techniques for evaluating certain trigonometric integrals. We then illustrate an alternative method using a hyperbolic substitution.

2007 MCM / ICM - COMAP Modeling Problems

Continuous Modeling (Problem A)

The continuous problem this year dealt with the geographical configuration of the congressional districts for a state. Participants were asked to create the "simplest" shapes for all the districts in a state, and apply their model to the state of New York.

Jared Ruiz, John Hoffman, Krista Foster: Youngstown State University

Tyler Drombosky, Ryan Livingston, Doug Wajda: Youngstown State University

Scott Rager, Duayne Rieger: Slippery Rock University

Discrete Modeling (Problem B)

The discrete problem addressed the problem of minimizing the boarding time of an aircraft. Participants were asked to devise and compare procedures for boarding and deboarding planes with varying numbers of passengers: small (85-210), midsize (210-330), and large (450-800).

Kevin Sobczak, Brad Kirkwood: Slippery Rock University

Bryan Bischof, Jim Bryan: Westminster College

Nick Gemuenden, David Martin, Matt Ward: Youngstown State University

Interdisciplinary Modeling (Problem C)

The interdisciplinary problem required students to build a mathematical model for the US organ transplant network(s). They were asked to explore various medical, political and ethical issues related to the proposed model.

Kevin McGraw, Dave Keffler, Matt Skaggs: Youngstown State University

Tiffiny Rummell, Moriah Wright, Kate Bonn: Youngstown State University

2007 PME National Meeting at MAA MathFest

Please join us at this year's meeting to be held August 3 through August 5, 2007, in San Jose, California. Students are invited to give fifteen minute talks on any mathematical topic or application in areas such as statistics, computing, or operations research. Topics including expository research, interesting applications, problems, etc. are also welcome. Transportation reimbursement is also available to those who qualify. Visit the National Pi Mu Epsilon website at http://www.math-pme.org for more details.

A Warm Welcome to the Participating Schools:

- Baldwin Wallace
- Case Western Reserve University
- Cleveland State University
- Fairmont State University
- John Carroll University
- Kent State University
- Kent State University Tuscarawas Campus
- Mount Union College
- Slippery Rock University
- Walsh University
- Westminster College
- Youngstown State University

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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.