Mathfest 2000
Los Angeles, CA

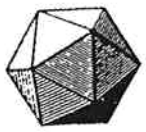
MAA and Pi Mu Epsilon
Student Paper Sessions
August 3 – 4, 2000

PI MU EPSILON

Pi Mu Epsilon is a national mathematics honor society with over 275 chapters throughout the nation. Established in 1914, Pi Mu Epsilon is a non-secret organization whose purpose is the promotion of scholarly activity in mathematics among students in academic institutions and among staffs of qualified non-academic institutions. It seeks to do this by electing members on an honorary basis according to their proficiency in mathematics and by engaging in activities designed to provide for the mathematical and scholarly development of its members.

Pi Mu Epsilon regularly engages students in scholarly activity through its *Journal* which has published student and faculty articles since 1949. In addition, the society awards monetary prizes for mathematics contests and awards established by chapters.

Since 1952, Pi Mu Epsilon has been holding its annual National Meeting in conjunction with the summer meetings of the Mathematical Association of America (MAA).



MAA Student Chapters

The MAA Student Chapters program was launched in January 1989 to encourage students to continue study in the mathematical sciences, provide opportunities to meet with other students interested in mathematics at national meetings, and provide career information in the mathematical sciences. The primary criterion for membership in an MAA Student Chapter is "interest in the mathematical sciences." Thus, the Student Chapter program supplements, but does not compete with, the chapters of Pi Mu Epsilon. Currently there are approximately 200 active Student Chapters on college and university campuses nationwide. Students are also members of the MAA Sections in their geographic region. Many of the MAA Sections provide special activities for students at their regularly scheduled meetings.

J. Sutherland Frame Lecture

Friday, August 4, 2000
8:00 - 9:00 pm
Grand Horizon Ballroom, Covel Commons

THE MATHEMATICS OF COMPUTERS

John H. Ewing
American Mathematical Society

Everyone knows that computers have influenced the way we do mathematics, but many people are unaware that mathematics profoundly affects what goes on inside your computer. Mathematics – serious mathematics – underlies much of what happens everyday on your computer. This talk presents a few key examples of mathematics that are crucial to computers, explaining the way computers talk, listen, and see . . . all of which would be impossible without some sophisticated mathematics working behind the scene

The J. Sutherland Frame Lecture is named in honor of the ninth President of Pi Mu Epsilon, who served from 1957 to 1966 and passed away on February 27, 1997. In 1952, Sud Frame initiated the student paper sessions at the annual Pi Mu Epsilon meeting, which is held at the Summer Mathfests. He continually offered insight and inspiration to student mathematicians at these summer meetings.

Student Activities
Schedule of Events

Wednesday, August 2

5:30 pm - 6:30 pm	MAA/PME Student Reception	Delta Terrace, Covel

Thursday, August 3

9:00 am - 5:00 pm	Student Hospitality Center	212 Bradley
1:00 pm - 2:35 pm	MAA Session #1	213 Bradley
1:00 pm - 2:35 pm	PME Session #1	216 Bradley
1:00 pm - 2:35 pm	MAA Session #2	215 Bradley
1:00 pm - 2:35 pm	PME Session #2	217 Bradley
3:00 pm - 4:55 pm	MAA Session #3	213 Bradley
3:00 pm - 4:35 pm	PME Session #3	216 Bradley
3:00 pm - 4:35 pm	MAA Session #4	215 Bradley
3:00 pm - 4:35 pm	PME Session #4	217 Bradley

Friday, August 4

9:00 am - 5:00 pm	Student Hospitality Center	212 Bradley
1:00 pm - 2:55 pm	MAA Session #5	213 Bradley
1:00 pm - 2:35 pm	PME Session #5	216 Bradley
1:00 pm - 2:35 pm	MAA Session #6	215 Bradley
1:00 pm - 2:35 pm	PME Session #6	217 Bradley
3:00 pm - 4:35 pm	PME Session #7	216 Bradley
3:00 pm - 4:15 pm	PME Session #8	217 Bradley
6:00 pm - 7:45 pm	PME Banquet	Study Lounge, Covel
8:00 pm - 9:00 pm	J. Suthlerland Frame Lecture **John H. Ewing**, AMS *The Mathematics of Computers*	Grand Horizon, Covel

Saturday, August 5

9:00 am - 3:00 pm	Student Hospitality Center	212 Bradley
1:00 pm - 2:50 pm	MAA Student Workshop **V. Frederick Rickey**, USMA *Fun, Interesting, and Historical Examples of Infinite Series and Improper Integrals*	Salon A, Covel
3:00 pm - 3:50 pm	MAA Student Lecture **Michael O'Fallon**, Mayo Clinic and ASA *Attributable Risk Estimation: A Tale of Mathematical/Statistical Modelling*	Salon A, Covel
4:00 pm - 4:50 pm	Student Problem Solving Competition	Salon A, Covel
5:00 pm - 5:50 pm	MAA Modeling Contest Winners	Salon A, Covel

MAA Session #1

213 - Bradley International Center 1:00 P.M. - 2:35 P.M.

1:00 - 1:15

PREDICTABILITY OF LOUISIANA AND SOUTH CAROLINA WATERLOGGED FORESTS

Jeffrey L. Wolfe
Coastal Carolina University

Given tree diameter measurements from several dry, intermediately flooded, and completely flooded plots in Louisiana and South Carolina, the growth and mortality of such trees is determined. Forecasting the survival status of the trees within these plots is attempted using mathematical modeling.

1:20 - 1:35

TRAJECTORY ESTIMATION OF A 2.75-INCH HYDRA-70 ROCKET

H. Alex Ortiz
SUNY College at Fredonia

We will present an algorithm for computing the trajectory of a 2.75-inch rocket using onboard angular rate sensors and accelerometers. These rockets are typically launched from helicopter platforms and exhibit maximum spin rates of 35 Hz, which complicates the nonlinear system of differential equations required to model their flight.

1:40 - 1:55

ANALYZING THE FACTORIZATION OF A FOUR-TERM MULTIWAVELET TRANSFORMATION

Alison Leuthard* and Meghan O'Brien
University of St. Thomas

Image data are often integer-valued. It is desirable that any transform used to process the image maps integers to integers. In this talk, we describe a two step algorithm for scaling multiwavelet transforms so that they map integers to integers and derive the first step of the algorithm.

2:00 - 2:15

SCALING MULTIWAVELETS TO MAP INTEGERS TO INTEGERS

Alison Leuthard and Meghan O'Brien*
University of St. Thomas

In this talk, we derive the second step in a two step algorithm that describes how to scale multiwavelet transforms so that they map integers to integers. We conclude the talk with some examples of how the algorithm works and how multiwavelet integer transforms compare to other transforms in data compression.

2:20 - 2:35

SYMMETRIES OF GRAVITATIONAL FIELDS

Jamie B. Jorgensen
Utah State University

Symmetry arguments play a central role in general relativity. This talk describes a research project whose goal is to classify and characterize all possible symmetries of 4-dimensional spacetimes. The project utilizes Maple software to compute invariant tensor fields, connections, reduced Einstein equations, residual symmetries, etc., corresponding to each symmetry group.

PME Session #1

216 - Bradley International Center **1:00 P.M. - 2:35 P.M.**

1:00 - 1:15

WHAT DOES A 40% CHANCE OF RAIN REALLY MEAN?

Katie Fleming
Youngstown State University - Ohio Xi

Weather is around us everyday. Rain, in particular, affects many aspects of our lives. In this talk I look at the different aspects of weather and translate the percentage chance of rain into what it really means to find out if the weathermen and -women are 100% right.

1:20 - 1:35

STATISTICAL ANALYSIS OF MASTERY LEARNING

Jodie Matulja
Youngstown State University - Ohio Xi

Mastery Learning is a teaching technique that promotes student learning by letting each student rework tests to reclaim missed points. There is a considerable amount of extra grading involved for teachers who implement Mastery Learning. This project will compare information from two linear algebra classes that were taught using Mastery Learning to ascertain if it is a worthwhile classroom technique.

1:40 - 1:55

MARK MCGWIRE MEETS MATHEMATICIANS

David Gerberry
Youngstown State University – Ohio Xi

In recent seasons of major league baseball, the outburst of offense has definitely added excitement to the national pastime. However many "old school" fans have been left to wonder what happened to the days of the pitchers duel. Using statistical methods to examine the offensive trend, we can hope to shed some light on this phenomenon and its possible causes.

2:00 - 2:15

A RISKY ALGORITHM: THE RELATIVE RISK VS THE ODDS RATIO

John Slanina
Youngstown State University - Ohio Xi

In medical statistical analysis, the odds ratio is most often used to predict the risk for health outcomes given exposure to a disease. Because the odds ratio and its respective confidence intervals are easy to compute, statistical software packages such as SPSS and SAS use this indicator as their method to compute risk. In some health studies however, the incidence of disease is high and the odds ratio's estimate of risk is erroneous, sometimes by several magnitudes. This presentation will focus on creating an algorithm to calculate the correct relative risk values and its computationally challenging confidence intervals from the given statistical data.

2:20 - 2:35

VIRTUAL VISUALIZATIONS

Robert Shuttleworth
Youngstown State University - Ohio Xi

The spread of smog and other airborne contaminants is a growing problem in the world. To effectively analyze these problems, scientists create visualizations as an easy means to three-dimensionally organize and view the data in question. This presentation will showcase the mathematics behind creating these visualizations as well as how these visualizations are used in the work of both Oak Ridge National Labs (ORNL) and the Defense Intelligence Agency (DIA).

MAA Session #2

215 - Bradley International Center **1:00 P.M. - 2:35 P.M.**

The presentations in this session involve students of Professor Anant Godbole in the REU Program at East Tennessee State University.

1:00 - 1:15

CORDIAL LABELINGS OF RANDOM GRAPHS

Carl Miller* and Dan Ramras
Duke University and Cornell University

A graph labeling is **cordial** if it satisfies a certain parity constraint. The existence of a cordial labeling is necessary for a well-known condition for graphs called gracefulness. We consider cordiality in the case of the random graphs $G(n,p)$ and $G(n,k)$.

1:20 - 1:35

PEBBLING

Dorea Claassen, Julia Salzman*, and Adam Wierman
University of Nebraska - Lincoln, Princeton University, and Carnegie Mellon University

We consider a distribution of t pebbles on n vertices with a pebbling step consisting of removing two pebbles from one vertex and placing one pebble on a neighboring vertex. A graph is **pebblable** if each vertex can be reached in a sequence of pebbling steps. We investigate the pebbling threshold function for random graphs $G(n,p)$.

1:40 - 1:55

KAPREKAR'S CONSTANT

Sam Greenberg
Oberlin College

Consider any four-digit number. Re-order the digits in decreasing order, creating the largest value with those digits. Reverse that for the smallest value. Subtract those two arrangements and repeat the process. Eventually, one reaches the fixed point 6174. We will discuss the above phenomenon and generalizations with n digits in base b.

2:00 - 2:15

COIN FLIPPING

Julia Eaton
University of Rochester

The objective of our two player p-coin flipping game, where $P(\text{heads}) = p$, is to obtain the highest number of flips before flipping heads. A tie requires additional rounds until a winner emerges. We calculate the expected number of flips and rounds for this game and then investigate a game of n players.

2:20 - 2:35

RANDOM PERFECT MATCHINGS

Deborah E. Sinclair
University of Redlands

We consider two perfect matchings chosen at random and examine the distribution of the number of edges in the overlap. We study graphs including cycles, bipartite graphs, wheels, and the Peterson graph. We also investigate the expected number of overlaps for an n-cube and a random graph.

PME Session #2

217 - Bradley International Center **1:00 P.M. - 2:35 P.M.**

1:00 - 1:15

PROPERTIES OF POSITIVE SEMI-DEFINITE OPERATORS

Anthony D. VanHoy
East Carolina University - North Carolina Delta

What is a "positive matrix?" Early in elementary education, students learn a basic definition of positive numbers. Soon after, students learn of arrays of numbers called matrices. Here I wish to combine these two concepts in an attempt to provide a comprehensive definition and some important properties of "positive matrices."

1:20 - 1:35

FRACTAL TILINGS WITH RADIAL SYMMETRY

Adam Roberts
The University of Akron - Ohio Nu

Let $m > 1$ be an integer and let $\{v_j\}_{j=1}^{m}$ denote the collection of two-dimensional vectors composed of the $m-1$ roots of unity and the zero vector. Attractor sets will be generated using an iterated function system of the form

$$f_j(z) = v_j + \begin{bmatrix} \alpha & -\beta \\ \beta & \alpha \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}, \quad j = 1, 2, \ldots, m$$

where $\alpha^2 + \beta^2 = 1/m$, $\alpha, \beta \in \mathbb{R}$. This talk will address the problem of determining conditions on α, β and m so that these attractors are self similar tilings possessing radial symmetry.

This work is part of a summer research program for undergraduates at the University of Akron.

1:40 - 1:55

IRREGULAR SIERPINSKI TRIANGLES

Matthew Palmer
The University of Akron - Ohio Nu

The Sierpinski triangle is a classic example of a fractal curve generated by a system of functions. First, I will show how to randomize the Sierpinski triangle with linear transformations of the form

$$f_i(\vec{x}) = M\vec{x} + \vec{\mu_i},$$

where M is a 2×2 matrix and $i = 1, 2, 3$. This construction allows for subtriangles that are not congruent. Second, I will address conditions under which a change of basis matrix B can be found so that

$$h = BMB^{-1} = \begin{bmatrix} \alpha & -\beta \\ \beta & \alpha \end{bmatrix}.$$

This transformation h gives us the fractal dimension of the random triangle.

This work is part of a summer research program for undergraduates at the University of Akron.

2:00 - 2:15

MANIFOLDS: THEY'RE NOT JUST FOR CARS

Duane K. Farnsworth
Mount Union College - Ohio Omicron

Real manifolds form an important class of mathematical objects. Using specific examples, we will explore some basic properties of manifolds. We will also examine the boundary and the interior of a manifold. Finally we will briefly investigate differentiable real manifolds.

2:20 - 2:35

FUNDAMENTAL GROUPS AND THE MANIFOLDS IN YOUR CEREAL BOWL

Judy Maendel
Mount Union College - Ohio Omicron

What is the difference between a cocoa-puff and a fruit loop? If you answered, "One has a hole and the other does not," you are correct; however, since you are most likely a math major, you will need to have a more rigorous explanation. Find out how Fundamental Groups can help!