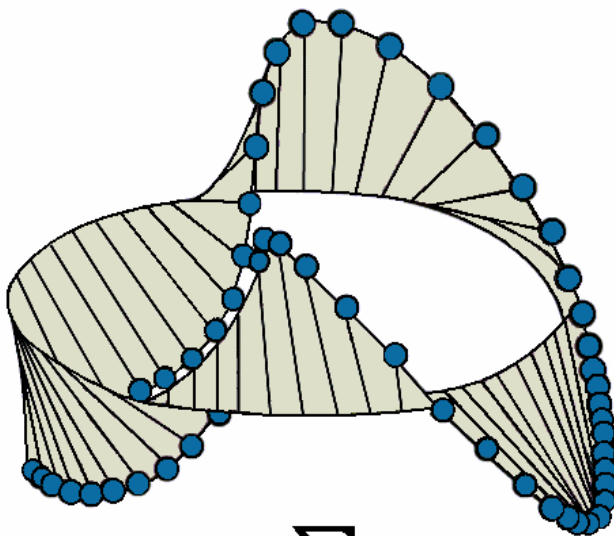


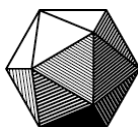
**Garden State Undergraduate Math Conference
2006**



$G\Sigma C$

**Georgian Court University
Lakewood, NJ**

Saturday, April 8, 2006



MAA-NJ

Greetings!

Welcome to the third Garden State Undergraduate Mathematics Conference (GSUMC) hosted by the New Jersey section of the Mathematical Association of America (MAA-NJ). GSUMC promotes opportunities for undergraduate students to present their mathematical work, participate in a mathematical problem-solving contest, attend career workshops and foster interactions with fellow students. GSUMC attendees are welcome to attend any events of the MAA-NJ section meeting.

If you have any questions or problems, don't hesitate to ask any members of the GSUMC staff for assistance.

Lawrence D'Antonio
GSUMC Director

New Jersey Undergraduate Mathematics Competition (NJUMC)

NJUMC is a problem-solving contest in which teams of up to three students participate over a three-hour period in two events: a team competition and an individual session. Contest questions are modeled on the Indiana Friendly Math Competition and are more accessible than the Putnam Exam problems. Questions are drawn from high school mathematics, calculus, linear algebra, differential equations, and other introductory courses that a mathematics major would take. The emphasis of the competition will be on having fun trying to solve interesting problems.

The competition results will be announced at the end of the conference and awards will be presented to the winning teams from four-year and two-year colleges. The organizers wish to thank Thomson Publishing for sponsoring the team prizes for the New Jersey Undergraduate Mathematics Competition.

Here are some sample questions:

1. What is the probability that a dart, hitting a square board at random, lands nearer the center than the edge?
2. Call a number N fortunate if it can be written with four equal digits in some integral base $b > 1$.
 - a) Clearly 2222 is fortunate; why is 2000 fortunate?
 - b) Find the greatest fortunate number less than 2000.
3. Determine whether $\sqrt{1 + \sqrt{2 + \sqrt{3 + \sqrt{4 + \dots}}}}$ converges or diverges.

Keynote Speaker

Chaos Games and Fractal Images *Robert L. Devaney, Boston University*

In this lecture we will describe some of the beautiful images that arise from the “Chaos Game.” We will show how the simple steps of this game produce, when iterated millions of times, the intricate images known as fractals. We will describe some of the applications of this technique used in data compression as well as in Hollywood. We will also challenge students present to “Beat the Professor” at the chaos game and maybe win his computer.

A native of Methuen, Massachusetts, **Robert L. Devaney** is currently Professor of Mathematics at Boston University. He received his Bachelors degree from Holy Cross in 1969 and his PhD from the University of California at Berkeley in 1973 under the direction of Stephen Smale. He taught at Northwestern University and Tufts University before coming to Boston University in 1980.

His main area of research is dynamical systems, primarily complex analytic dynamics, but also including more general ideas about chaotic dynamical systems. Lately, he has become intrigued with the incredibly rich topological aspects of dynamics, including such things as indecomposable continua, Sierpinski curves, and Cantor bouquets.

He is the author of over ninety research papers in these fields. He is also the (co)-author or editor of a dozen books on various aspects of dynamical systems theory. Professor Devaney has delivered over 1,300 invited lectures on dynamical systems and related topics in all 50 states in the US and in over 30 countries on six continents worldwide. (He only needs Antarctica to complete his goal of speaking on all continents ---so if you teach at South Pole State and run some kind of seminar, give him a call!)

In 1994 he received the Award for Distinguished University Teaching from the Northeastern section of the Mathematical Association of America. In 1995 he was the recipient of the Deborah and Franklin Tepper Haimo Award for Distinguished University Teaching at the annual meeting of the Mathematical Association of America. In 1996, he was awarded the Boston University Scholar/Teacher of the Year Award. In 2002 he received the National Science Foundation Director’s Award for Distinguished Teaching Scholars. In 2002, he also received the ICTCM Award for Excellence and Innovation with the Use of Technology in Collegiate Mathematics. In 2003, he was the recipient of Boston University’s Metcalf Award for Teaching Excellence. In 2004 he was named the Carnegie/CASE Massachusetts

Professor of the Year. In 2005 he received the Trevor Evans Award from the Mathematical Association of America for an article entitled Chaos Rules published in Math Horizons.

Garden State Undergraduate Math Conference Spring 2006 Program

8:30 – 10:00	Registration and Breakfast, the Casino
8:30 – 9:00	Check-in for NJ Undergraduate Math Competition, the Casino
9:00 – 12:00 (9:00 – 10:00) (10:00 – 12:00)	NJ Undergraduate Math Competition Individual Session Team Session Headquarters: Arts and Sciences Building Little Theater
12:00 – 1:00	Lunch , the Casino
1:00 – 1:45	Career Workshops (concurrent): <i>All workshops are in the Arts and Sciences Building</i> <i>Topics and presenters will be announced in a separate flier in your folder</i> <i>Workshop 1: A&S 207</i> <i>Workshop 2: A&S 220</i> <i>Workshop 3: A&S 165</i>
1:50 – 3:05	Presentations by Students: Talks and Poster Session <i>Arts and Sciences Building</i> Student Session 1: A&S 207 Student Session 2: A&S 220 (note: this session starts at 2:10) Student Poster Session: Front entrance
3:05 – 3:25	Refreshments, the Casino
3:25 – 4:20	<i>Chaos Games and Fractal Images, Robert L. Devaney,</i> Boston University, <i>in the Casino</i> Presider: Mark Korlie, Montclair State University
4:20 – 4:30	Contest Results, Awards, and Prizes, the Casino
4:30	End of Conference

**Mathematical Association of America
New Jersey Section
50th Anniversary (Spring 2006) Meeting Program**
*All sessions except the concurrent sessions at 1:30 p.m. will
take place in the Casino*

8:30 – 9:15	Registration and Coffee, the Casino
8:30 – 1:30	Book Exhibits, the Casino
9:15 – 9:30	Welcome by Dr. Joseph Gower, Provost , Georgian Court University
9:30 – 10:25	<i>Eulerian Numbers and Worpitsky's Identity</i> , Roger Pinkham , Stevens Institute of Technology Presider: Eileen Poiani, St. Peter's College, section governor 1976-79
10:25 – 10:35	Presentation of Distinguished Service Award and Distinguished Teaching Award
10:35 – 10:45	Chair's and Governor's Reports, and recognition of 25- and 50-year members
10:45 – 11:05	Intermission, the Casino
11:05 – 12:00	<i>Why Historical Truth Matters to Mathematicians: Dispelling Myths while Promoting Maths</i> Judith Grabiner , Pitzer College Presider: Amy Cohen, Rutgers University, section governor 2000-2003
12:00 – 1:30	Lunch , Raymond Hall, North Dining Room (Book exhibits end at 1:30.)
1:30 – 3:05	MAA-NJ Contributed paper sessions (concurrent): <i>All sessions are in the Arts and Sciences Building</i> History of Mathematics: A&S Little Theater General Contributed Paper Session I: A&S 103 General Contributed Paper Session II: A&S 104
3:05 – 3:25	Intermission and refreshments, the Casino (Silent Auction bidding ends at 3:25)
3:25 – 4:20	<i>Chaos Games and Fractal Images</i> , Robert L. Devaney , Boston University Presider: Mark Korlie, Montclair State University, current section chair
4:20 – 4:30	Contest Results, Awards, Drawing of door prizes, Silent Auction Winners announcement (must be present to win)
5:00	Dinner honoring Award Winners, Invited Speakers and Workshop Leaders

Abstracts of student contributed paper sessions

Student contributed papers organized by John T. Saccoman, Seton Hall University

Session 1, Room 207, Arts and Sciences Building
Presider: John T. Saccoman, Seton Hall University

1:50-2:05

Jessica Marini, Montclair State University
Advisor: Baojun Song

A Mathematical Model of Partial Starvation

There are many people in the world today that have anorexia nervosa and/or bulimia. A person who has anorexia or bulimia takes in less food than the body needs. We define this decreased intake as partial starvation. Our mathematical model is based off previous models that describe long-term starvation and normal intake of food. Combining these models we propose a new model for a description of partial starvation. We are interested in the dynamics of the total body mass and of ketone bodies in the human body during this process. Extensive simulations are carried out to find quantitative relations among the body mass, the length of starvation period, and the amount of intake of food.

2:10-2:25

Michelle Kristiansen, Montclair State University
Advisor: Baojun Song

The Dynamics of Alcoholism

Alcoholism and alcohol abuse have become rising problems, particularly among the college population. Often alcohol abuse has been attributed to social pressures, especially in the college environment. In recent years, however, alcoholism has been speculated to be a genetically passed disease. It has been estimated that a person with a family history of alcoholism is 40-60% more likely to develop a problem with alcohol than a person with no family history of alcohol abuse. In this study, we mathematical models to look at the population dynamics of alcoholism as a horizontal, or social, vector and as a vertical, or genetic, vector. The model traces the changes individuals make in their drinking status using factors including social contact, variances in genetic make up, education, and possibility of recovery. To simulate our model, we have constructed a survey to obtain estimates of each parameter.

2:30-2:45

Samantha Bourque-Trieff, Melissa Dreher, Lauren Kovacs, Lisa Marchalonis (presenter), Catharine Russamano, Monmouth University

Advisor: Betty Liu

Data analysis and mathematical modeling for water quality of three watersheds

Our goal in this project is to aid in improving the water quality of three local watersheds: DealLake, Wreck Pond, and SharkRiver. We will analyze the data from all three using mathematical modeling. First, we will work to map out the locations of the test sites at each watershed. We will look at each individually to observe changes in water conditions from upstream to downstream and also over the changing seasons. Then, we will compare two specific relationships across all three water bodies: depth versus water transparency and temperature versus dissolved oxygen content.

Session 2, Room 220, Arts and Sciences Building

President: Brian Hopkins, St. Peter's College

Note: this session starts at 2:10

2:10-2:25

Maha Elmaamli, Christina Tomeski, St. Peter's College

Advisor: Brian Hopkins

Counting Good Colorings

Given the equation $ax + by = z$ over the positive integers, the Rado number R is the smallest integer such that any 2-colorings of $\{1, \dots, R\}$ must have x, y, z the same color with $ax + by = z$. How many colorings of $\{1, \dots, R - 1\}$ avoid these monochromatic solutions? We have two conjectures about these "good" colorings. Conjecture 1: When $a = 1$ or $b = 1$, there is only one good coloring of $\{1, \dots, R - 1\}$.

Conjecture 2: When $a \neq 1$ and $b \neq 1$, there are at least two good colorings of $\{1, \dots, R - 1\}$.

Computations with small values of a and b show that there are more than two good colorings.

2:30-2:45

Walter Jacob IV, Rowan University

Advisor: Thomas Osler

A Simple Construction to Approximate any Angle

Given any angle, it is impossible to construct a straight line whose length is the radian measure of that angle, using straight edge and compass techniques. We give a simple construction method which gives us approximations to the angle of arbitrary accuracy. This construction is a generalization of a method for constructing $\pi/2$ to arbitrary accuracy which relates to Vieta's product of nested radicals.

If additional student papers are submitted after this program is printed, they will be scheduled in this session in this and later time slots. In that case, a full list of talks for this session will be available as a separate sheet at the registration table for GSUMC.

Abstracts for student poster session

Arts and Sciences Building, Front entrance

Student poster session organized by John T. Saccoman, Seton Hall University

Andrew Poalillo, Ramapo College of New Jersey

Advisor: Katarzyna Potocka

Directed Graphs and Incidence Matrices

In this project we look at connections between some properties of an incidence matrix and the corresponding properties of its directed graph, where linear algebra meets graph theory. We demonstrate how the properties of an incidence matrix A , such as its rank, basis for the nullspace of $\text{Tr}(A)$, or basis for the nullspace of A can be interpreted as parts of the directed graph for A .

Sarah Bleiler, Seton Hall University

Advisor: John T. Saccoman

A correction in the formula for the number of spanning trees in threshold graphs

A graph G is a threshold graph if, for all pairs of nodes u and v in G , $N(u)-v \subseteq N(v)-u$ whenever $\deg(u) \leq \deg(v)$. The 1996 paper by Kelmans and Hammer "Laplacian spectra and spanning trees of threshold graphs" that appeared in *Discrete Applied Mathematics* 65 (pp. 255-273) presents a formula for the number of spanning trees that depends solely on the degree sequence. However, their formula does not work in all cases. We present a correction of this formula, as well as a demonstration of its equivalence to a formula that appeared in the 1985 doctoral thesis of Zbigniew Bogdanowicz.

If additional student poster proposals are submitted after this program is printed, they will be included in this session. In that case, a full list of posters for this session will be available as a separate sheet at the registration table for GSUMC.

Organizing Committee:

John T. Saccoman, Seton Hall University (student talks and poster session)

Karen Clark, The College of New Jersey (advertising and program editor)

Christopher Simons, Rowan University (problem-solving competition)

Theresa Michnowicz, New Jersey City University (speakers)

Lawrence D'Antonio, Ramapo College of New Jersey (conference director)

Advisory Board:

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Cathy Liebars, The College of New Jersey, NJ (Past Chair of MAA-NJ)

Reginald Luke, Middlesex County College, NJ (Governor of MAA-NJ)

Hieu D. Nguyen, Rowan University, NJ (Past Director of GSUMC)

NJUMC Committee:

Christopher Simons, Rowan University, contest director

Su-Chi Wen, Monmouth University

Ben Weng, Ramapo College

Tom Hagedorn, TCNJ

Katarzyna Potocka, Ramapo College

Marcus Wright, Rowan University

Acknowledgements

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- Georgian Court University and its Department of Mathematics for hosting this conference.
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