First Coast Meeting of the Florida Section of The Mathematical Association of America

University of North Florida
January 30, 2009
3:00-9:00 P.M.

Abstracts

Registration Desk: 2:00-6:00 Building 51 Social Sciences First Floor
Contributed Talks: 3:00-5:50 Building 51 Rooms 1103, 1104, 1205
Plenary Lecture: 6:00-6:45 Building 51 Room 1205
Dinner Banquet: 7:00-9:00 Building 14 Rooms 1601-1603

Session I 3:00-3:50

3:00-3:50 **What is elliptic curve cryptography?**
1205
Daniel Dreibelbis
University of North Florida
Abstract: This talk will cover the basics of elliptic curves and their application to cryptography.

3:00-3:50 **Mathematical Methods for Modeling of Lightning and Thunderstorm Electrification**
1103
Beyza Aslan
University of North Florida
Abstract: The change in the electric potential due to lightning is evaluated. The potential along the lightning channel is a constant which is the projection of the pre-flash potential along a piecewise harmonic eigenfunction which is constant along the lightning channel. The change in the potential outside the lightning channel is a harmonic function whose boundary conditions are expressed in terms of the pre-flash potential and the post-flash potential along the lightning channel. The expression for the lightning induced electric potential change is derived both for the continuous equations, and for a spatially discretized formulation of the continuous equations. The forcing term in the equation which is associated with the movement of charged particles by the wind can be estimated using the balloon-borne electric field sensors.

3:00-3:25 **Chemicals that Calculate and Origins of Life**
1104
Robert Vergenz
University of North Florida, Department of Chemistry and Physics
Abstract: Nobel laureate in physics Manfred Eigen in 2005 said that the important thing about life is that chemicals can read and write. Indeed, the most difficult step in theories of origins of life by molecular evolution is the complex chemistry necessary for the origin of self-replicating ribozymes. We

present a model chemical mechanism which has the essential abilities of a Turing machine: to store information in the form of temporal pulses of chemical composition, to scroll through it in two different ways, and to read and write under the direction of a chemical data pointer. With modifications to provide a second pointer for program control, it is a fully functional chemical computer, albeit, rather inefficient. When the products confer a survival benefit to the system, the mechanism constitutes a system capable of true neo-Darwinian evolution, that is, a living system under the NATO Roadmap definition of life. Results from emulating a primitive digital operating system, with four commands and two modes of operation defined by the chemistry, demonstrate that 57% of 50,000 trials produced stable...

3:25-3:40 **Closure Properties of Involution Codes**
1104 *Alex Kane*
University of North Florida, Student Presenter
Abstract: Involution codes were inspired by difficulties with DNA strand design associated with undesirable hybridization. This talk presents examples of morphic and antimorphic involutions and discusses coding properties of languages that are preserved under certain language operations such as union and concatenation.

3:40-3:50 **Characterizing Planar Graphs by Partially Ordered Sets**
1104 *Danielle Glaze*
University of North Florida, Student Presenter
Abstract: Partial orderings can be applied to very diverse sets of objects and can provide important information. The ability to order, sort, and rank elements of sets permits more in-depth comparisons and analyses. Many relationships have been established between graphs and posets. In particular, Schnyder's theorem characterizing planar graphs in terms of poset dimension will be discussed.

Session II 4:00-4:50

4:00-4:25 **Defending a Graph with Mobile Guards**
1205 *Chip Klostermeyer*
University of North Florida, School of Computing
Abstract: We discuss the number of guards needed to defend a graph against an infinite sequence of attacks. Tight bounds are proved in the case when only one guard can move at a time and a variety of other results are discussed for different models.

4:00-4:25 **Students' placement in the lower level mathematics & statistics courses at UNF**
1103 *Faiz Al-Rubaee*

University of North Florida
Abstract: This presentation will address the tools and mechanisms that the University of North Florida has been using to place students in lower level mathematics and statistics courses. We will convey the changes we have adopted to create new mechanisms for assessment and placement. We will additionally discuss some of the outcomes of the placements exams which led to new course development. The weaknesses and benefits of these placement exams will also be addressed.

4:00-4:25 **Using wavelet based multiresolutional analysis**
1104 *Sean Rampacek*
University of North Florida, Student Presenter
Abstract: This talk will investigate the concept of data compression. We will discuss the concept of analyzing a signal using multiresolutional analysis (MRA), specifically, the wavelet based MRA. We will explore a few examples of wavelet based MRA's that range from the most basic Haar wavelet to the Daubechies 4-tap wavelet and then the Cohen-Daubechies-Feauveau (9,7) wavelet, each with its own specific purpose. The goal of this talk is to investigate how the wavelet based MRA uses algorithms for data compression and how JPEG 2000 incorporates the C-D-F (9,7) wavelet for image compression

4:25-4:50 **An Almost Periodic Function of Several Variables with no Local**
1205 **Minimum**
Greg Spradlin
Embry-Riddle Aeronautical University
Abstract: An almost periodic function is a generalization of the idea of a periodic function. Most of the literature on almost periodic functions is for functions of one variable, but almost periodic functions may be defined for more general topological groups. I will present a surprising counterexample showing that, unlike in one variable, an almost periodic function of two variables need not have a local minimum.

4:25-4:40 **The Problem with Definitions**
1103 *Marilyn Repsher*
Jacksonville University
Abstract: Undergraduate mathematics majors often fail to appreciate the role of a definition in writing proofs. This paper will describe an experimental course in introductory abstract algebra in which students wrote...

4:25-4:40 **Summer Institute in BioStatistics**
1104 *Richard Barfield*
University of North Florida, Student Presenter
Abstract: I will describe my experience at the SIBS program at Boston University. My time at SIBS dealt with biostats, epidemiology, clinical trials, and statistical genetics.

4:40-4:50 **Mathematical Methods for Detecting Evidence of Weak Interactions in**
1104 **Amyloid-I^2(1-42) Fibrils**

Jeremy Nix
University of North Florida, Student Presenter

Abstract: The formation of neuritic plaques by the aggregation of soluble amyloid-beta (AÎ²) peptides into insoluble fibrils is strongly implicated in Alzheimer's disease pathology. The key suspect is a 42-mer, AÎ²(1-42), which aggregates more aggressively and with higher neurotoxicity than other AÎ² n-mers. Our goal is to computationally analyze recent solid-state nuclear magnetic resonance (NMR) three-dimensional structures for evidence of weak methyl CH/Ï€ and CH--O interactions that affect the structure of the protein. Starting from a system of labeled Cartesian coordinates which represent our system, we create unique identifiers for each possible interacting atom. We then use vector geometry to calculate two of the defining properties of hydrogen bonding, distance and valence angle, and each possible interaction is ranked based on these two variables. We perform frequency analysis on these possible interactions across 10 experimentally-determined conformer models to determine which regions of the protein are the best candidates for further computational research. We also carry out statistical analysis on the variation in position of the atoms across the 10 conformers.

Session III 5:00-5:50

5:00-5:50 **Poisson's Remarkable Calculation a Method or a Trick?**
1205

Denis Bell
University of North Florida

Abstract: Many practitioners and students of mathematics are familiar with the remarkable method of Poisson for evaluating the Gaussian integral

$I=\int_0^\infty e^{-x^2}\,dx$. One writes the square of I as a double integral in the plane,

transforms to polar coordinates, and the answer magically pops out. In this talk we shall investigate the extent to which Poisson's method can be pushed to integrate other functions. The answer is rather surprising...

5:00-5:50 **Mathematical Amusements**
1104

Scott Hochwald
University of North Florida

Abstract: I will present mathematics that has a twist. Here's an example: A fair coin is tossed until two heads in a row are observed. What is the probability that this experiment ends on the 12th toss? The answer involves the Fibonacci sequence.

5:00-5:25 **Interesting Applets for Calculus**
1103 *Michael Gagliardo*
Jacksonville University
Abstract: I will be demonstrating various applets that I use for calculus, vector calculus and pre-calculus. We have all heard that we should use technology in the classroom, but sometimes it is hard to implement it in a constructive way.

5:25-5:50 **Journaling in Real Analysis (It's not what you are thinking)**
1103 Paul Crittenden, Amy Kelly
Jacksonville University
Abstract: In the summer of 2008 we taught an experimental course in Real Analysis that was centered on a journal article rather than using a text. The course was taught as part of the Intensive Mathematics a Mentoring, Education and Research Summer Experience (IMMERSE) program at the University of Nebraska-Lincoln. The program included mentoring at a variety of levels and was primarily designed to give a group of pre-grads a head start on graduate school as well as provide a research experience for the instructors. In this talk an overview of the IMMERSE program is given as well as a description of the process for creating the course and its eventual design. The student audience was a group of 16 students that graduated from smaller schools with fewer opportunities than a major research university who had been accepted into graduate mathematics program for the Fall. The course was taught in a very interactive manner which included lecture, student problem working sessions and student presentations.

Plenary Session

6:00-6:45 **The Pythagoreans: The Cult That Gave Us Mathematics**
1205 *Fredric Zerla, Professor Emeritus*
University of South Florida
Abstract: The use of number to explain and organize our environment began with the earliest human cultures. Puzzle-problems extend this from necessity to the edge of reality in a playful fashion. But the study of number for its own sake, with no immediate practical application, began with the Pythagorean cult. They called this study, "Mathematics", and their ideas remain with us today.