MD-DC-VA Section MAA Fall 2004 Meeting, Morgan State University: Contributed Paper Abstracts

(**) recommended for all students
(##) recommended for graduate students

Marshall M. Cohen, Morgan State University and Cornell University
(**) On the classification of wallpaper groups

It is a classical fact that there are 17 wallpaper groups, up to isomorphism. The speaker will explain his view that the teaching of this classification can be organized around the concepts of normal form and conjugacy in the isometry group of the plane.

Jerome Dancis, University of Maryland
(**) Mathematically Correct and Mathematically Incorrect Pattern Recognition

The talk will discuss pattern recognition, which is Mathematically useful and correct, and pattern recognition, which is Mathematically incorrect. Some examples will be taken from the NCTM 2000 standards and from MD's pretend Algebra exam.

Divya E. Devadoss, Salisbury University
(**) Mathematical Modeling of Frontal Polymerization

Frontal polymerization is a method of converting monomer into polymer by means of a self-propagating reaction wave. There are two modes of frontal polymerization, isothermal and exothermal, each, for example, giving a different front velocity. By correctly modeling such modes into mathematical equations, we can control the parameters as needed to dictate the velocity.

Elizabeth Goode, Towson University
(**) The Limit Languages of DNA Splicing Systems

The study of DNA splicing systems and splicing languages has been extended to include the notion of limit languages. Limit languages constitute the set of molecules that actually remain in the test tube after splicing enzymes and ligase cut and past double stranded DNA iteratively to equilibrium. Our unexpected main result is that the set of Limit Languages is precisely the set of Regular Languages in the Chomsky hierarchy of formal languages.

Arthur D. Grainger, Morgan State University
(##) Ultrafilters on the Collection of Finite Subsets of an Infinite Set

Let J be an infinite set and let X be the set of all non empty finite subsets of J. Let B be the collection of all ultrafilters on the set X. We consider the structure of B (as a compact, Hausdorff right topological semigroup). In particular, we give a characterization of the smallest ideal on B.

Denny Gulick, University of Maryland, College Park
(**) Many Faces of Chaos

What does it mean for a function or a system (such as the weather or a double pendulum) to be chaotic? Since there are many diverse definitions of (mathematical) chaos, the answer may not be so clear. We will explore relationships between several current definitions, and see which may be most applicable to the weather and to a double pendulum.

Candice JeanLouis, Student, Morgan State University
(**) Chaos, RNA Chains and Selected Topics From Enumerative Combinatorics

We will survey various combinatorial techniques that are used to study RNA chains (sequences or patterns). Some of the techniques explored are combinations, permutations, the Johnson Trotter algorithm, the binomial theorem, generating functions, and recurrence relations. The goal of this paper is to identify biologically significant patterns in natural occurring RNA chains.

Dan Kalman, American University
(**) Two Ellipse Questions

This talk discusses two problems about ellipses:
1. What is the maximum angle that can be observed between a normal vector on an ellipse and the vector from the center of the ellipse, and where does it occur?
2. If an ellipsoid is projected orthogonally onto a plane, what is the area of the resulting ellipse?

Robert Lewand, Goucher College
(**) Hill's Polygraphic Cryptological System

In 1931 Lester Hill devised a polygraphic cryptological system that is actually more general than the system usually associated with his name. In this paper I introduce necessary background material, describe this generalized version of his system, and then reveal an aesthetically pleasant surprise.

Roland Minton, Roanoke College
(**) Two Optical Illusions

The calculus of two optical illusions is discussed. In one, a spinning cube appears to have a curved edge, which vector projections show is a hyperbola. In the other, the apparent speed of an astronomical object can exceed the speed of light and in the limit appears to move infinitely fast when it is not moving at all.

Bhamini M. P. Nayar, Morgan State University
(**) A Characterization of Paracompactness in terms of Filterbases

There exist characterizations for compact spaces, Lindelof spaces, countably compact spaces, etc. in terms of filterbases. Such characterizations for paracompactness are not available in elementary courses in general topology. This talk provides such a characterization.

Howard L. Penn, United States Naval Academy
(**) Making faces and other parametric equation art

This talk will summarize the results of an assignment to my class to use parametric equations to draw a face. The assignment may be given to any class that uses a graphing calculator of graphical software.

Samir Safi, James Madison University
(**) The Efficiency of OLS in the Precedence of Auto-Correlated Disturbances in the Regression Models

It is well known that the ordinary least squares (OLS) estimates in the regression model are efficient when the disturbances have mean zero, constant variance and are uncorrelated. In problems concerning time series, it is often the case that the disturbances are, in fact, correlated. It is known that OLS may not be optimal in this context. Using computer simulations, we consider the robustness of various estimators, including estimated generalized least squares (GLS).
We found that if the disturbance structure is autoregressive and the dependent variable is nonstochastic and linear or quadratic, the OLS performs nearly as well as its competitors. For other forms of the dependent variable, we have developed rules of thumb to guide practitioners in their choice of estimators.

Bonita V. Saunders, National Institute of Standards and Technology
(**) Using Adaptive Mesh Generation to Capture Key Features of 3D Function Surfaces

This talk will describe the latest version of grid generation techniques being used to facilitate the plotting of complex mathematical functions for the NIST Digital Library of Mathematical Functions Project. The use of tensor product splines and optimization techniques will be discussed. Some of the latest 3D function visualizations will be shown.

Vojislav Stojkovic and Grace Steele, Computer Science, Morgan State University (**) Perl and Math

The presentation demonstrates how Perl could be very useful for mathematicians and non-mathematicians (scientists, educators, engineers, businessman, and etc.) in developing solutions to diverse problems. The presentation provides references, comparisons, and illustrations on several math modules, including: Inline::C, Math::cephes, Math::RealMatrix, PDL, Octave, and R.

Jenny Stovall, Student, University of Mary Washington
(**) On Codes Generated by Quadratic Surfaces of PG(3,q)

We examine two classes of binary linear error-corrected codes that can be generated from the two classical quadratic surfaces of finite projective 3-space. Properties of the codes are discussed as well as simulation results used to show how the codes might work in a real world setting. The talk is designed for a general audience.

Jamal Theodore and Tari Appah, Students, Morgan State University (**)
Analyzing Biological Sequences using Dynamic Programming

This paper will discuss techniques for using dynamic programming to analyze biological sequences of either DNA or protein. This includes finding the edit distance between two sequences, their alignment and complexity, and objective score. This discussion will also cover the alignment algorithms CLUSTALW and MUSCLE.

Bruce Torrence, Randolph-Macon College
(**) Keeping Dry - The Mathematics of Running in the Rain

I will attempt to answer the age-old question: when caught in the rain without an umbrella, what is the optimal speed of travel (the speed that will keep you driest)? Attention will be focused on the most mathematically interesting case, the case when there is a tail-wind. Different models will yield subtly different answers. This won't be a dry presentation!

Kimber Tysdal, Hood College(**) There's more than one way to skin a cat, or, having students present what they don't already know

In this talk I will describe an activity I used last spring in my abstract algebra class. This activity involved on-the-spot presentations by students of various proofs that the converse of Lagrange's Theorem is false. The trick is that the students did not see the proofs before hand. How did it work? Come find out!

Maryam Vulis, Queensborough Community College (**)
Mathematics on the Chessboard

This talk is about using the chessboard to illustrate certain mathematical formulas.

Susan Schwartz Wildstrom, Walt Whitman High School
(**) Discovering derivative rules in calculus using experimentation and technology

Exploration activities using technology in calculus will be demonstrated and their usefulness discussed with participants. Handouts of lessons will be provided. (In particular there are four presentations any one of which or any combination of which can be presented, but each pretty much wants 15 minutes: 1) product and quotient rule--no technology involved; 2) trig function derivatives--sine and cosine--student drawn estimation on graph followed by technology generated graphs of derivatives using midpoint difference quotient formulas; 3) exponential and logarithmic function derivatives based on technology generated graphs and tables and conjectures based on what is seen; and 4) the chain rule--conjectures formed based on graphs of derivatives.