MD-DC-VA Section MAA Fall 2005 Meeting, Montgomery College, Germantown, MD:
Contributed Paper Abstracts (this includes all abstracts received as of October 19, 2005):
(**) recommended for all students
(##) recommended for graduate and advanced undergraduate students

Karen S. Adams, Morgan State University
(**) Reproving Minkowski's Inequality as a Tool for Student Research

This paper further develops Suzuki's idea (Focus, 2004) of using reproof as a method of independent research. This talk will reprove Minkowski's inequality (discrete case p = 2) using Mathematical Induction.

Chiru Bhattacharya, Randolph-Macon College
How 'non-abelian' are free groups?

The lower central series of a group is a tool group theorists use to analyse how abelian or non-abelian a group is. In this talk I will look at the lower central series of a free group and analyse the size of the factor groups

Ralph H. Buchholz, DSTO, Fort Meade, MD 20755
(**) A non-scatological exposition of cyclic rational area polygons

This talk will cover both historical work and recent work which is related to the characterization of cyclic polygons with rational sides and rational area. The dramatis personae include Archimedes, Hero, Brahmagupta, Paramesvara, Euler, and Robbins to name a few.

Paul Chi, Bowie State University, Bowie MD
(**) Toward a general framework for induction and recursion

Induction and well-ordering principle are viewed as one thing in classic number theory. The author will present a view based on recursively-defined structures. Applications will be presented too.

Donald Joseph Gray Chiarella, Maryland Department of Transportation / State Highway Administration
(**) Maryland 2004 Traffic Safety Facts

This is a description of the methodology and problems involved in producing government statistical abstracts and evolving them into better products under continuous improvement methodologies. How to assure the right level of readability in government statistics compared to advanced theorectical graduate research projects and papers.

J. Coughlin, Towson University
(**) Pricing of Options

This talk deals with an example of the pricing of options in the financial markets and follows the Black-Scholes approach.

Jerome Dancis, University of Maryland
(**) Guided Discovery Learning for the Product to Powers Maxim

Starting with the product rule for derivatives, we demonstrate how to guide students to both discover and derive the rules for derivatives of rational powers of functions. This Product to Powers Maxim is missing from the undergraduate math curriculum.

Archie W. Earl, Sr., Norfolk State University
(**) A High-Tech In-Service Graduate Math Course

Some of the technologies used in a new graduate level mathematics course for in-service middle school teachers is presented. The course is offered by the Mathematics Department of Norfolk State University, in Norfolk, Virginia, USA. Technologies discussed include the internet, the graphing calculator, instructional CD and VHS videos, and Microsoft Excel.

Cathy Furlong, Fairfax County Public Schools/ American University
(**) What Factors Predict the Amount of Overlap of Collectors of Herbaria?

My talk is a summary of the analysis I completed for my summer internship at the National Herbarium, Smithsonian, National Natural History Museum, Department of Botany. Some of the worldwide herbaria have begun the time-consuming and expensive process of digitizing their collection. If it can be shown that a significant level of overlap in collectors exists between herbaria, other institutions could be encouraged to participate in developing on-line data sets.

Arthur D. Grainger, Morgan State University
(##) Ideals of Ultrafilters on the Collection of finite subsets of an infinite set

Let J be an infinite set and let I be the collection of all non empty finite subsets of J. Let BI denote the collection of all ultrafilters on the set I. This talk examines the ideals of BI when BI is equipped with the right topological semigroup structure that is the Stone-Cech Compactification of the right topological semigroup on I generated by the binary operation of the union of two (finite) sets and the discrete topology. In particular, the smallest ideals of a class of subsemigroups of BI are characterized.

Denny Gulick, University of Maryland
(##) Remediation for Calculus Students

Because of the declining algebra and trigonometric skills of students entering the physical science - engineering - mathematics variety of calculus, at the University of Maryland instituted a 3-week intensive remediation of algebra and trigonometry at the outset of the calculus I course. We will discuss the process, and preliminary results.

Bob Hanson, James Madison University
(**) An space-filling irregular truncated octahedron

This talk will show how to select centroids of sub-tetrahedra of any tetrahedron to form an irregular space-filling truncated octahedron that tiles space and has several pretty geometric properties.

Ilhan M. Izmirli, **American University**
(**) An elementary proof of the singularity of generalized Lucas matrices.

Let x_1 and x_2 be arbitrary numbers, not both zero, and for $n = 1,2,\ldots,$ set $x_{n+2} = x_{n+1} + x_n$. Define the k by k matrix $A = [a_{i,j}]$ by $a_{i,j} = x_{k(i-1)+j}$. In this talk I will give an elementary proof that for any $k \geq 3$, the matrix A is singular.

Robert W. Jernigan, American University
(**) Statistics Before Your Eyes: Photographs of Statistical Concepts

Observing patterns of use in everyday life allows for the illustration of many statistical concepts. I will present several photographs with analysis demonstrating the statistical concepts of discrete probability distributions, normal distributions, skewed distributions, bivariate distributions, and linear regression.

Dan Kalman, American University
(**) Envelopes, Ladders, and Couches: an old topic gives a new look to an old problem

The ladder problem is to find the longest segment that can fit around a corner in a corridor. The couch problem is similar, but you have to move a rectangle instead of a segment. The first is a standard max/min problem in calculus books, and the traditional solution begins with a reversal: instead of looking for the longest segment that WILL go around the corner, we seek the shortest segment that WON'T. But there is a direct approach that is both much simpler and gives much better understanding. This direct approach uses envelopes of families of curves, a topic that was once a standard part of the undergraduate math curriculum, but which (sadly) seems to have disappeared.

Bill Mitchell, Retired Scientists, Engineers & Technicians , Springfield VA
(##) Retired Scientists, Engineers & Technicians (ReSET)

I will provide a brief introductory description of ReSET, show an 8.5 minute DVD describing our program, and then answer questions.

Irina Popovici, US Naval Academy
(**) On the stability of orbits in a two-dimensional model of the cardiac cell

We study a model of the human heart cells as a family of dynamical systems parametrized by the concentrations of potassium and magnesium. The principal results give the existence and stability properties of orbits analogous to the so called escalator orbits of the one-dimensional family, the co-existence of stable orbits for fixed values of the period parameter, existence of bunny-ears orbits. We consider the latter results our most important, due to conjectures that such period parameter values could produce arrhythmic behavior in a potentially spatially disorganized fashion.

George Rublein, College of William and Mary
(**) Chemistry Applications in Beginning Calculus

Students taking physical chemistry, and even general chemistry, are treated to heavy doses of mathematics with little in the way of previous exposure in a standard calculus class. The author

is preparing certain chemistry problems to appear as applications in beginning calculus. Some of these problems will be discussed in this presentation.

Ken W. Smith, Central Michigan University/University of Richmond
(**) Groups, rings and group rings -- Tools for combinatorial structures

Finite groups form a fundamental topic in modern algebra; they are used to construct a variety of discrete structures including error-correcting codes, regular graphs and combinatorial designs. In this talk, we introduce finite groups and their group rings and show how these tools can be used to construct combinatorial designs. Prerequisites for this talk are a first course in linear algebra. Helpful (but not necessary) would be a basic introduction to modular arithmetic and cyclic groups.

Laura Taalman, James Madison University
(**) Sudoku Variations

In the game of Sudoku, one must fill a 9x9 grid with the integers 1,2,...,9 in such a way that every row, every column, and certain 3x3 subgrids are populated with distinct integers. The recent popularity of Sudoku indicates that even the math-phobic can appreciate logic puzzles, and may give math educators a new way to expose students to logical reasoning. In this talk we will examine many different types of Sudoku variations; sample games will be provided!

Amit Trehan, Montgomery College, Takoma Park Campus
(**) Representations of p-adic groups.

We will start by talking about p-adic numbers and groups and their representations. Then we talk about Langlands' Conjectures and the relation of representation theory with number theory.

Marina Vulis, Queensborough Community College
(**) The Game of Sudoku

The Game of Sudoku: its history, applications in cryptography, a tool for teaching.

A. P. Warth, University of Maryland, College Park
(**) The Infinitely Small: Introduction to Infinitesimals.

The notion of infinitely small numbers has appeared throughout the history of continuous mathematics---from the philosophy of Plato, through development of the calculus, to modern work in hyperreal analysis. This expository talk communicates the history of infinitesimals while reviewing their elementary properties and their usefulness in several fields.

Susan Schwartz Wildstrom, Walt Whitman High School
(**) Mathematical Induction--Even a Child Can Do It!

It is not unusual for students on their first exposure to proofs by mathematical induction to doubt whether anything at all is "being proven" but to "humor the teacher" by parroting the steps that are taught. Remarks about how this teacher has been a bit more successful in convincing high school students of the validity of the process and a five-step approach to the construction of proofs by mathematical induction will be shared.