MD-DC-VA Section MAA Fall 2000 Meeting

Contributed Paper Abstracts

(Alphabetical order by last name of first author)

James V. Blowers, US Army Combined Arms Support Command

Weaving Paper Polyhedra

The art of weaving paper polyhedra has been around since 1873, when Gorham constructed models of naturally occurring crystals, and 1959 with R. Pageter's talk to the MAA and article in the American Mathematical Monthly. Since 1997 I have been giving a workshop each year in western Virginia on making the models. I will show some of the models that can be made, a brief description of how to make them, and some of the mathematical theory behind the design of the models.

T. Hoy Booker, American University

Proofs and Their Theorems

This talk is centered on the concept of a one-semester course that introduces proof-writing techniques. Material is organized in terms of the type of proof necessary with some hand-waving discrete leaps of faith through the undergraduate mathematics curriculum.

Stephen Casey, American University

Sampling Theory and the Residue Calculus: What did Cauchy Really Know?

Starting with the Cauchy Integral Formula, we derive the Whittaker-Kotelnikov-Shannon (WKS) Sampling Formula. Moreover, we can show equivalence in restricted cases. We then go on to use this machinery to derive generalizations, including sampling data involving derivatives, and sampling on unions of sampling grids. We close by asking just how close Cauchy was to deriving the sampling formula. Should it now be called CWKS sampling?

Larry Crone, American University

Color graphs of complex functions: mathematics, art, both, or neither

I will demonstrate a technique for graphing functions of a complex variable with color. Applications range from locating zeros to drawing cartoons. I will also show graphs of some very complex complex functions.

George DeRise, Thomas Nelson Community College

A Mathematics Professor Attends a Physics Conference

In January I attended a conference "String Theory for the Millenia" at Cal Tech. Many of the big names of current day physics were there, including Stephen Hawking, Ed Witten etc. This would be an informal talk about current ideas in physics, the mathematics that the physicist uses and some personal observations.

Deborah Lynn Gochenaur, Messiah College

Summer Math Camp Growing Pains

The Boyer Academy at Messiah College seeks to provide summer learning experiences for students in the community, including those from populations that are under represented in careers in mathematical sciences. By sharing what has been experienced in the birth of this program, others may be encouraged to consider similar programs at their own institutions.

Brian Guarraci and Michael Bardzell, Salisbury State University

Hit Counting Algorithms for 2-D Cellular Automata

We will consider 2-D cellular automata generated by group multiplication from a finite group G. By counting the number of times a given cell is "hit" by either a given group element or element from a fixed subgroup of G, one can assign a hit probability to each cell after a given number of iterations. Coloring the grid according to these probabilities produces patterns reminiscent of an outward growing fractal. We will

discuss these coloring algorithms and some properties of the structures being created by them.

Ilhan, M, Izmirli, Strayer University

Fractals and Music

In this talk I will analyze some of the mathematical connections between fractals and musical composition styles of the twentieth century. The talk assumes nothing more than an elementary knowledge of fractals.

Dan Kalman, American University

Marden's theorem on the roots of a complex cubic

If a, b, and c are noncolinear complex numbers, then they define both a triangle in the complex plane, as well as a cubic polynomial p(z) = (z-a)(z-b)(z-c). Marden's theorem says that the roots of p'(z) are the foci of an ellipse inscribed in the triangle and tangent to the sides at the midpoints. This presentation will discuss the algebra and geometry involved in Marden's theorem and demonstrate an interactive computer exploration of the theorem. The computer activity is a Mathwright document.

Gary D. Knott, Civilized Software, Inc.

Orienting a Scribble

A closed-curve in the plane, such as a "scribble" drawn with abandon as one does in coaxing the ink in a ballpoint pen to flow, which intersects itself (a finite number of times) and/or overlaps segments of itself (a finite number of times) can be traversed without crossing itself. This is a special kind of Eulerian circuit. A constructive proof is provided.

Fat Lam, Gallaudet University

Why The 9-Point Circle Should Be Called The 12-Point Circle

The 9-point circle is a beauty geometric construct but is rarely covered in high school or post-secondary institutions. This talk aims to restore proper familiarity of the circle and why it should be called the 12-point circle.

Tzong-Yow Lee, Maryland, College Park

Shapes That Do Well in The Covering Problem

The simple inequality $2(a_1^2 + a_2^2) \geq (a_1 + a_2)^2 > 0$

can be visualized easily: a square of side ($a_1 + a_2$) can be covered by two squares of side a_1 and two squares of side a_2. Can we play such a geometric game in general? For example, the inequality above extends easily to

$k^{n-1}(a_1^n + a_2^n + \cdots + a_k^n) \geq (a_1 + a_2 + \cdots + a_k)^n > 0$, where all a are positive,

and positive integers, k and n. Can the "shape corresponding to" the left-hand side cover the shape corresponding to the right-hand side? Sometimes they can, and sometimes NOT (even when square shape is used)! We'll discuss "invariants" to explain the NOT cases, and show some interesting patterns that emerge from the "can" cases. What if we use triangles, or other shapes, instead of squares?

Conrad Lotze, American University

Online Mathematics Tutoring

The progress of an ongoing dissertation study investigating online mathematics tutoring (OT) will be discussed. The OT environment in the study uses an Internet-based whiteboard application along with digital notepads, webcams, and microphones. The software and hardware used will be demonstrated, and preliminary results will be discussed.

Carter Lyons, James Madison University

Lowest Terms Revisited

In the September 1994 issue of Math Horizons the following problem is given in the "Problem Section" (p. 33): "Problem 5: Lowest Terms - What fraction has the smallest denominator in the interval (19/94,17/76)?" The solution given reduced the problem to a small number of cases and exhausted the cases. In this paper we develop a general algorithm which gives a systematic procedure for solving problems of this type.

Paul B. Massell, Statistical Research Division, U.S. Census Bureau

Cell Suppression using Linear Programming: A Disclosure Limitation Technique for Data Tables

Suppose one has a two-dimensional additive data table, i.e., a table in which the sum row and sum column are included. A given cell may represent the total of some quantity for only one company. In order not to disclosure this data value we may choose to not reveal (i.e. to suppress) this value. However, since the table is additive, it is necessary to suppress additional cells so that only an approximation of this value, with a desired amount of uncertainty, can be deduced. We describe one way of doing this using linear programming.

Richard McCoart, Loyola College in Maryland

An Interesting Binary Operation on p Symbols with an Application to Sequences

There is a defined binary operation on p symbols, which is used to define successive terms of a sequence of n-tuples of the symbols. The problem is to determine conditions on n such that the sequences always return to their first term, regardless of what the first term is, and the periods involved for certain n.

Bhamini M. P. Nayar, Morgan State University

Sequentially functionally compact and sequentially C-compact spaces

In this paper we study spaces characterized by the following two properties: (1) Each continuous function from the space maps closed subsets onto sequentially closed subsets. (2)Each function on the space with a strongly-subclosed inverse maps closed subsets onto sequentially closed subsets.

Andrew D. Oh, St. Mary's College of Maryland

Data Transmissions In Wavelength Network

A wavelength network consists of n nodes together with k (1<k<n) wavelength channels and tuning delay where each node is equipped with multiple transmitters and receivers. In this talk, I will present a k-parallel data transmission schedule in wavelength network.

G. Edgar Parker, James Madison University

Using Collaborative Learning to Foster Competition

The presenter had previously used small group dynamics successfully to create a sense of "possession" of material in an interdisciplinary freshman seminar. This paradigm will be presented; how it has been adjusted to foster competition the presenter considers advantageous for teaching calculus is the main focus of the talk.

Howard L. Penn, U.S. Naval Academy

Home run Hitting and Halley

Anyone who saw Mark McGuire's record breaking home run and who knows baseball fields will know that it would not have been a home run in Fenway. This paper will examine what it takes to hit a home run in different ballparks and what this has to do with Sir Edmond Halley.

Steve Penny, James Madison University

A Carothers Projection of the 3-Body Problem

In this presentation I will discuss projectively polynomial functions, as defined in work by Parker and Sochacki. The structural algebraic properties of the projections will be discussed along with examples including a second degree projection of the three body problem and a

second degree reduced projection of an nth degree polynomial. The foundations of this work have already been applied by Rudmin in his work on asteroids using a fourth degree projection of the n body problem and in increasing efficiency of both serial and parallel processing program environments.

Kevin Peterson, Lynchburg College

Creating Interactive Java Applets without Knowing Java

In this talk we will show how to use Geometer's Sketch Pad and Java Sketch Pad to create interactive Java Applets. We will demonstrate how these tools work and present several examples of Applets that have already been created.

Reza Sarhangi, Towson University

Mathematics and New Technology

The advances in instructional technology and new generations of students, have made the classical approaches in teaching and learning mathematics, especially in undergraduate level, less attractive and exciting. The students of today have grown up with equipment, which only could exist in the dreams of their teachers. New technology should be welcomed in today's mathematics classes. However, mathematics as a discipline has its own identity, and in some branches, it is mainly based on the process of thinking and deductive reasoning, than on observation and hands on activities. How, then, can we employ the technology of today in our classes and still provide appropriate mathematics knowledge to our students?

Laura Spielman, Virginia Tech

Computer Laboratory Based Calculus Using Excel and Mathematica

Many freshman and sophomore mathematics courses at Virginia Tech have recently adopted a computer laboratory requirement. I will briefly discuss the new Mathematics Emporium and its widespread use. The main focus will be a presentation of various introductory calculus labs I wrote for use in a multiple section course.

William P. Wardlaw, U. S. Naval Academy

What is the rank of a matrix over a commutative ring?

In an earlier publication, the author defined the spanning rank of a nonzero m x n matrix A over a commutative ring R to be the smallest positive integer r such that there is an m x r matrix C and an r x n matrix D, both over R, such that A = CD. This rank is discussed, and compared with several other definitions of ranks, all of which give the standard value of rank when R is a field, but which can give different values when R is not a field. Some applications of the different rank definitions are mentioned.

Susan Schwartz Wildstrom, Walt Whitman High School, Montgomery County, MD

Encouraging an Enjoyment of Mathematics Through Reading

This presentation deals with an assignment that I use with all of my high school students in which they read a brief mathematical selection of their own choice and write about what they have learned/read. Because students are encouraged to select materials that will interest them, my experience has been that students enjoy the assignment and are more likely to think that it is possible to enjoy reading about and studying mathematics. The presentation includes a full description of the assignment and excerpts from the written submissions that were received from students.

Merle D. Zimmermann, Montgomery College (Rockville)

Singular Points of Polynomial Equations

In this paper we study an important class of polynomial equations known as Schubert Cycles. They are the result of equating to zero the minors of certain matrices. We will provide an algorithm to compute these equations and identify their singular points.