**MD-DC-VA Section MAA Spring 2005 Meeting, University of Virginia: Contributed Paper Abstracts**

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

**James V. Blowers, US Army Retired Civilian**
**(**)Some results on the Hat-Guessing Game**

Recently, a hat game in which players wearing red and blue hats guess the color of their hats has been making the rounds. It is known that the optimal strategy sometimes involves use of error-correcting codes. This presentation will explain the game and the error-correcting strategy, including an analogy to aviation maintenance, and will also show the optimal strategy for a few cases.

**Matthew Burke, St Mary's College of Maryland**
**(**)Two-dimensional "Take and Break" Games**

This talk will present a brief background of impartial, combinatorial games including their definition, the major results, and a discussion of some open problems. This introductory material will be focussed on a particular class of impartial games, the so-called "take and break" games. Next I will define variation of these games, which I call "two-dimensional take and break games", and discuss open questions relating to these games.

**Hongwei Chen, Christopher Newport University**
**(**) On some trigonometric powers**

Using the generating function method, the closed forms for various power sums of trigonometric functions are established. Maple is used to carry out the complicated calculations.

**Charlie H. Cooke, Old Dominion University**
**(**) Bounds On Element Order For Integer Rings With Divisors of Zero**

If p is a prime, integer ring $Z_p$ has exactly $\phi(\phi(p))$ generating elements $\omega$, each of which has maximal index $I_p(\omega) = \phi(p) =$ p – 1 . But, if $m = \prod_{J=1}^{R} p_J^{\alpha_J}$ is composite, it is possible that $Z_m$ does not possess a generating element; and the maximal index of an element is not easily discernible. Here, it is determined when, in the absence of a generating element, one can still with confidence place bounds on the maximal index. Such a bound is usually less than $\phi(m)$, and in some cases the bound is shown to be strict. Moreover, general information about existence or non-existence of a generating element often can be predicted from the bound.

**Deborah Denvir, Randolph-Macon Women's College**
**(**) Miquel's Theorem, a lovely but overlooked result in Euclidean Geometry**

A description and proof of Miquel's Theorem will be given. A Geometer's Sketchpad illustration of the Theorem and selected corollaries will also be presented. Miquel's Theorem states that if one chooses a point on each side of a triangle, then the three circles through each vertex and the two chosen points on adjacent sides of the triangle intersect at a common point.

**George DeRise, Thomas Nelson Community College**
**(**) Topology in Physics**

Years ago topology was considered a sanctuary for the pure mathematician. However, many concepts from physics have topological interpretations. A few important examples will be presented in an intuitive manner.

**Greg Dresden, Washington & Lee University**
**(**) Rings of Gaussian Integers**

We all know about the rings Z/3Z (the integers mod 3) or Z/10Z (the integers mod 10). Sometimes these are fields (as in the first case) and sometimes not (as in the second). What if we replace the integers Z with the Gaussian integers Z[i] = {a+bi} (with a,b integers)? What kind of rings (or fields) do we get? (I'll also discuss the history of the Gaussian integers and some current problems in the field, all accessible to undergraduates.)

**Susan Goldstine, St. Mary's College of Maryland**
**(**) Fortunatus's Purse**

`You have heard of Fortunatus's Purse, Miladi? Ah, so! Would you be surprised to hear that, with three of these leetle handkerchiefs, you shall make the Purse of Fortunatus, quite soon, quite easily?' --Lewis Carroll

When its mouth is closed, Fortunatus's Purse is the real projective plane, the lesser-known sibling of the Klein bottle. By almost following the directions from Lewis Carroll's Sylvie and Bruno, we may produce a satisfying model of this charming manifold.

**Richard Hammack, Randolph-Macon College**
**(**) A Visual Proof of the Alternating Series Test**

We describe a short visual proof of the Alternating Series Test and some related estimates.

**Jiashi Hou, Norfolk State University**
**(**) Mathematical Model for Teaching Business Cycles**

Time-delayed differential equations can be used to model business cycles and business stability due to timely implementation of business decisions. Analysis in very simple cases shed lights on the effect of delayed decision on businesses. Available technology makes this a useful tool in teaching business models.

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

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

**Parviz Khalili, Christopher Newport University**
**(**) The study of some second order rational difference equations**

In this talk we analyze the behavior of some second order rational difference equations and show under what conditions the solution is periodic, bounded or asymptotically convergent.

**Chris Marron, Department of Defense**
**(**) Title to be announced**

Abstract to be announced.

**Howard Penn, United States Naval Academy**
**(**) Which Major League Ball Parks are Homer-Friendly?**

Baseball can be used to illustrate many concepts in statistics. In this talk we look at which ball parks are easy to hit homeruns in and which are not. We will come up with a statistic which can be used to measure this and then look at the data for all ball parks that were used in the 2004 season.

**Luca Petrelli, Mount St Mary's University**
**(##) Optimal Transport and Wasserstein Metric**

First I will give an overview of the history and main characteristics of the Monge-Kantorovich mass transportation problem and of its dual. I will then show how Partial Differential Equations can be related to mass transportation theory through the gradient flow formalism. I will also discuss recent advances in the field including an application to nonlinear diffusion problems.

**Dave Pruett, James Madison University**
**(**) Motivating Calc III by Celestial Mechanics**

Calculus originated to answer a problem in celestial mechanics: namely, why are the planetary orbits ellipses? However, most often, celestial mechanics is dropped from
Calculus III either for lack of time or presumed inaccessibility for students. The talk will suggest how celestial mechanics can be used both to motivate Calculus III and to provide students with a significant challenge that is nevertheless within reach.

**James Sochacki, James Madison University**
**(**) Polynomial differential equations and periodic solutions**

In this talk I will discuss four historically significant ordinary differential equations that can be put in polynomial form and discuss periodic solutions to them. This will lead to a discussion of Hilbert's $16^{th}$ problem; 'How many limit cycles can a quadratic polynomial differential equation in the plane have?. This talk can be extended to a topics section in an undergraduate ordinary differential equations class.

**Ram Subedi, Montgomery College—Tacoma Park**
***TechnoGenetics*: Cloning Ti-83+/84/86 into Your Computer (OR How to Demonstrate TI Calculator Usage in Classrooms Without Using View Screens!)**

Do you abhor carrying TI View Screens with you (extra luggage!) to classrooms everytime you have to teach or have you ever tripped on the power cord of a slide projector because you were really excited about demonstrating this great feature of your TI calculator and forgot to look on the floor to see the cable? Well, do not despair because we can use the computer in your classroom to store a clone of your favorite TI calculator. Turn on the computer, power the projector, lower the screen, a few mouse clicks on your desktop, and you'll have your TI calculator projected on screen!

**Laura Taalman, James Madison University**
**Problem Zero: A simple way to encourage students to read mathematics**

Students have trouble reading mathematics, and worse, they often refuse to; when working from a textbook, many students attempt the exercises before reading the section, and only refer to the reading to look up examples that mimic the homework problems they are working on. "Problem Zero" is a simple way to encourage students to read the material and organize it into information that makes sense to them. A tiny idea, but one that works, and is easy to grade!

**Leonard Van Wyk, James Madison University**
**(**) *k*-Alternating Knots**

A projection of a knot is k-alternating if its overcrossings and undercrossings alternate in groups of k as one reads around the projection (an obvious generalization of the notion of an alternating projection). We prove that every knot admits a 2-alternating projection, which partitions nontrivial knots into two distinct classes: alternating and 2-alternating.(This is the result of an NSF-REU project.)

**Bill Wardlaw, United States Naval Academy**
**(**) Good and Square Matrices are Invertible**

Let R be a commutative ring with 1. If X is a 1 x n matrix over R, let (X) denote the ideal generated by the entries in X. An n x p matrix A over R is (left) good if (XA) = (X) for every n-tuple X over R. (A good matrix preserves ideals.) It is shown that a matrix A is invertible over R if and only if A is good and square.

**Vonda K. Walsh, Lee S. Dewald , and L. Jane Randall, VMI**
**(**) Peer-Led Team Learning (PLTL) in Finite Mathematics and in Introduction to Probability and Statistics at Virginia Military Institute**

Peer-Led Team Learning (PLTL) is a model that was developed in 1991 by David Gosser, a chemistry professor at the City College of New York, and is now applied in math and science courses at colleges across the country. PLTL employs students who have already completed the course successfully as workshop leaders for groups of 6-8 students. Workshops are designed to focus on problem-solving, case studies, or other learning activities that lend themselves to student interaction and collaboration. The leaders receive training in-group dynamics and learning strategies, meet weekly with the course instructors to discuss workshop materials and session highs/lows, and write journal entries for each session.