MAA MD-DC-VA Section
Program Abstracts
Spring 2004 Meeting, April 23 and 24
Salisbury University, Maryland

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Cardinality of GL(n, Z_m) and Several of its Subgroups.

The general linear group GL(n, Z_m) is the group of invertible n x n matrices over the ring Z_m of integers modulo m. In this talk I will count the matrices in GL(n, Z_m), as well as those in the special linear group SL(n, Z_m) of determinant 1 matrices in GL(n, Z_m). PGL(n, Z_m) and PSL(n, Z_m) will also be counted. This entire counting project could be assigned to students in an abstract algebra class.

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Proofs of Various Forms of the Recursion Theorem

In this paper I will investigate the proofs of three different forms of the recursion theorem. I will also briefly show that the recursion theorem can be used to define functions.

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Analysis of Modified Picard Algorithms

Picard Method is analyzed to show its faults and then elimenimated using a polynomial projection. After the polynomial projection is complete I analyze the difference between the Taylor solution that the projection generates, the Pade rational function approximation, an exponential function approximation, and a near minimax approximation.

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The Impact of Participation in an Ancillary Science and Mathematics Program (SEMAA) on Engagement Rates of Middle School Students in Regular Mathematics Classrooms

The purpose of this study was to investigate the impact of participation in a short-term, co-curricular, mathematics and science program (Science Engineering Mathematics Aerospace Academy, SEMAA) on the engagement rates of sixth and seventh grade students in public school mathematics classes. The engagement was measured with the Student Record of Behavior at three time intervals. A 22.3 mixed ANOVA design was utilized to investigate three main effects (participation, level of access to technology, and time) and their primary and secondary interactions. Results reflected no discernable impact of the SEMAA program on student engagement rates. Discussion suggests that ancillary programs designed to compensate for deficiencies in primary programs may represent vastly different opportunities for engagement than those found in primary programs and may not impact engagement in regular classrooms, and subsequently improve achievement outcomes, when implemented in high-stakes accountability settings and low-performing schools. Broadened samples, settings, and variables in further study are recommended.

*Ilhan M. Izmirli
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A Precalculus Approach to Elliptic Integrals

In this talk, I will use the arithmetic-geometric mean of Gauss along with the Landen transform to obtain approximations to elliptic integrals using nothing more than basic algebra and trigonometry.

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Shapley/Owen Analysis of the Electoral College

My project updates a past paper on power in the Electoral College. Using new data from the past 20 years, I calculate the power of individual states in the Electoral College and discuss how the power structure has changed over the years.

Philip E. Luft
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Mystery of the Missing Gasoline

An accountant newly employed by a Salisbury company was unable to find 722 gallons of gasoline that should have been in the storage tank used to fuel the firm's vehicles. The boss wanted a mathematical explanation for the company myth that the underground tank was tilted. I was hired as a consultant to answer the question, and had to choose an appropriate method.

*William W. Reith III
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Creating Knots with Arcs

A great deal of research has focused on the least number of line segments required to create knots, called the stick number. My research extends this notion to finding the the fewest number of hyperbolas and ellipses required to create knots, called the arc number. My research describes a method of creating arc diagrams from stick diagrams and places an upper bound on the number of arcs needed to create a knot, given its stick number. An upper bound for the arc number of the connect sum of two knots is given, as well as a proof that the arc number of a knot equals three if and only if the knot is the trefoil.

*Nikeda Hamilton
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Fourier Analysis and convergence of the Fourier Series.

In the talk I will look at some results in Fourier analysis which include some properties of Fourier coefficients,I will also look at the concepts of approximate identity and convolution. Finally I will look briefly at the series in an inner product space and discuss some aspects of the convergence of the Fourier series.

*Gwyneth Whieldon
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Recursion Formulas on (q+1)-Regular Trees

This talk provides an algorithm for computing the number of integer solutions to specific quadratic forms N(x) in four variables N(x0,x1,x2,x3)=p^k for arbitrary k. The quadratic forms N(x) are derived from the maximal orders of quaternion algebras over the p-adics, and the recursion formulas used to derive the solutions are drawn from observations of recursion on paths on (q+1) regular trees. Further research to explore integer solutions to the norms drawn from non-maximal orders will be discussed.

*Jan Hilmar
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Rational Points on Elliptic Curves: Determining a Lower Bound on the Rank of Elliptic Curves

In elliptic curve theory, the concept of the rank of an elliptic curve plays an important role. While computations involving the rank are mostly beyond the undergraduate level, Ezra Brown developed a method for finding a lower bound on the rank in his 2002 MAA Monthly article "Elliptic Curves from Mordell to Diophantus and Back".
The talk will involve a discussion of the method and how it was applied in my research.

Parviz Khalili
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Improper Integrals Via Laplace Transform

In this presentation we are going to show that in some situatins Laplace Transform may be used effectively to evaluate difficult improper integrals. Examples of such integrals are: Probability and Fresnel integrals. Also we deveolp an algorithm for evaluation of such integrals.

Hongwei Chen
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On a trigonometric inequality

We start out
to sum $\sum_{k=1}^{n -1}

\sin(k\pi/n)$, and then natural to consider a related sum
$\sum_{k=1}^{n -1}\csc(k\pi/n)$. This in turn leads to a number of nice estimates.

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The Impact of Calculus Reform on Student Performance in Subsequent Courses at USNA

The Naval Academy was one of six colleges and universities that took part in an NSF funded study of the long term benefits or detriments of calculus reform. This paper will report some of the results of this study. The study consisted of 3 parts. The first was a study of grades in calculus and courses in math, the sciences and engineering that have calculus a prereq. The second was a attitude survey of Midshipmen who were about to graduate. The third was an interview and test given to engineering majors as they were about to graduate.

Eve Torrence and Adrian Rice
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De-Cyphering Lewis Carroll's Obscure Condensation Method for Computing Determinants

In 1866 Charles Dodgson, aka Lewis Carroll, published a paper in which he presented his condensation method for computing determinants. Despite its computational simplicity, this method has faded into obscurity. We will explain Dodgson's method, take a look at his original paper, and expand on the ``proof'' he gave.

*Ryan Higginbottom
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Dimension theory in group cohomology

The complete splitting of the suspension spectrum of the classifying space of a finite group has been completely calculated, and there are specific ways to label specific summands. We will briefly discuss Nishida's notion of a dominant summand and introduce some dimension theoretic questions that arise in the study of the mod-p cohomology of finite p-groups.

Maryam Vulis
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Geometric Mean and Apportionment

The topics of voting and apportionment are taught extensively in liberal art courses. In particular, the Equal Proportions, or Hill, method uses the notion of the geometric mean. This presentation will discuss the geometric mean and its applications and demonstrate how it is used in the Hill method.

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Comparison of Estimators in Linear Regression Models with Auto-Correlated Disturbances: When is OLS Efficient?

It is well known that the ordinary least squares (OLS) estimates in the regression model are efficient when the errors have mean zero, constant variance and are uncorrelated. In problems concerning time series, it is often the case that the errors are, in fact, correlated. It is known that OLS may not be optimal in this context. We have derived the relative efficiency of the generalized least squares (GLS) estimator to that of OLS estimator for linear and quadratic design vectors. We proved that the relative efficiency of the variance of GLS to that of OLS is invariant to scaling and shifting of the design vectors. Additionally, using computer simulations, we consider the robustness of various estimators, including estimated generalized least squares. We found that if the error 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.

*Kristine Roinestad
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The Connectivity of Julia Sets Of Cubic Polynomials

Over eighty-five years ago, Gaston Maurice Julia published a 199-page paper in which he put forward the iterations of a rational function and gave the first definition of the Julia set. Mandelbrot then studied the set of all points p such that the Julia set of z^2 + p is connected. He called this set the Mandelbrot set. The great importance of the work of Julia and Mandelbrot is substantiated by the fact that mathematicians are still today developing new areas of inquiry into the field of complex dynamics. In this talk I will give an overview of the Julia sets, discuss the properties that can be studied, and prove a theorem which states conditions under which the Julia sets of cubic polynomials are connected.

Jerome Dancis
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College Park, MD

Do the Math: Easy Test for Teachers Will Hurt Students

The Praxis II Middle School Math Content Exam for certifying teachers will be discussed. It appears to have lower standards than that of MD's Pretend Algebra and Pretentious Data Analysis exam, which is aimed at weak Grade 9 students.

* represents student talk