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http://sections.maa.org/southeastern/maase/conference2014/

Abstracts for all Talks

BF1.1	*The Nine Card Problem: The Mystery Revealed*	
Breeeanne Baker	The Citadel	
The "Nine Card Problem" is a card trick credited to magician Jim Steinmeyer. In this card trick, the third card in a stack of nine is noted. Then three stages of shuffling occur based on the face value of the card, ie Ace of Spades. Afterward these shuffles, the card which was third originally is now fifth. In this talk, the Nine Card Problem will be demonstrated and then permutations will be used to explain why the trick always works. Modifications of this trick will also be considered.		

BF1.2	*Stability and Pattern Formation in a Generalized Keller-Segel Model*	
Erica Zuhr	High Point University	Patrick De Leenheer, Oregon State University; Jay Gopalakrishnan, Portland State University
In this talk I will discuss mathematical modeling of the biological phenomenon chemotaxis. The Keller-Segel model is a system of two nonlinear partial differential equations which is commonly used to model chemotaxis. I will present a generalization of the Keller-Segel model for chemotaxis to an n-equation system, as well as results on stationary solutions of the generalized model and their stability. Potential biological applications of the generalized model will also be discussed.		

BF1.3	*The classification of compact simply connected biquotients of dimension of dimension at most 7*	
Jason DeVito	University of Tennessee at Martin	
A biquotient is the quotient of Riemannian homogeneous space by free isometric action. Equivalently, given a compact Lie group G and a subgroup H of G x G, H naturally acts on G and when the action is effectively free, the quotient G//H is called a biquotient. We present the classification of compact simply connected biquotients of dimension at most 7. In dimension at most 6, we are able to determine all pairs (G,H) and embeddings H into G x G giving rise to a particular biquotient.		

BF1.4	*Syndactyl LCMs: What Are They?*	
Benjamin Wescoatt	Valdosta State University	
Number theory is a topic usually included in mathematics content courses for pre-service teachers. The literature abounds with creative ways to explore topics such as greatest common factor and least common multiple (LCM). For example, note that 42 and 20 share a common digit, 2. "Fusing" these numerals along the common digit forms the numeral 420. However, the LCM of 42 and 20 also happens to be 420; this LCM is dubbed a Syndactyl LCM. This talk explores and expands on the notion of a syndactyl LCM, discussing ideas such as a general condition for when syndactyl LCMs exist, syndactyl LCMs represented in bases other than ten, and the underlying number and numeral concepts pre-service teachers have the opportunity to explore while investigating syndactyl LCMs.		

BF1.5	*Artin's Conjecture in Multiquadratic Fields*	
Maria Stadnik	Birmingham-Southern College	
This talk will study when the unit group of certain rings has minimal index in the unit group of the mod p quotient ring. By letting p vary, we will see how this question is related to Artin's conjecture for primitive roots and the Riemann hypothesis.		

BF1.6	*Radio Labeling of Graphs*	
Amanda Niedzialomski	University of Tennessee at Martin	
In graph theory, the problem of assigning values to the vertices and/or edges of a graph in such a way that some given conditions are met is called graph labeling. Since its (surprisingly recent) introduction to the literature in the 1960's, this notion has inspired many different types of graph labelings -- each originally rooted in the idea that the existence of a certain optimal labeling for a given graph has applications to other problems. We will be talking about radio labeling, which has historical roots and applications to the assignment of radio frequencies to transmitters. From this motivation, the goal is now to classify all graphs with respect to this labeling. We will discuss some of the difficulties in accomplishing such a goal, and examine examples of particular interest.		

BF1.7	*Positive definite functions. The extension problem.*	
Robert Niedzialomski	The University of Tennessee at Martin	
We will talk about the extension problem for continuous positive definite functions defined on a connected and open subset of the Euclidean space. We will survey recent development in this topic and list some open problems.		

CT1.1	*Algebra from geometry in the card game SET*	
Timothy Goldberg	Lenoir-Rhyne University	
The card game SET has often been studied as a rich source of combinatorial and probabilistic questions, and also as a beautiful and hands-on example of a finite geometry. In fact, SET also possesses an interesting algebraic structure: there is a natural binary operation on the cards in SET, which is commutative but possesses no identity and is not even associative. In this talk, the speaker will describe this algebraic structure and its properties, and show that it is an involutory quandle. The proof of this fact follows largely from an understanding of the geometric structure of SET. This talk should be accessible to an undergraduate audience.		

CT1.2	*Magic Matrices and the Chamber of Four*	
William Griffiths	Southern Polytechnic State University	
Let $H_n(r)$ be the number of $n \times n$ matrices with non-negative integer entries such that the sum along each row and column is r. We present a general method for enumerating these objects for any fixed line sum, including a previously unknown formula for $r = 4$. The P-recursivity (polynomial recurrence relation) of these objects has been famously conjectured by Stanley, and we present proof of the property for $r = 2,3$, and give a progress report on the question for $r = 4$.		

CT1.3	*A Strategic Attack on a Secret Sharing Scheme*	
Michael Freeze	UNC Wilmington	
A secret sharing scheme is a method of producing message fragments so that a secret message can be recovered when sufficiently many message fragments are properly combined. Secret sharing schemes have been quite useful in many cryptographic applications from protection of cryptographic keys to electronic voting. Consider a threshhold secret sharing scheme where several secrets A, B, C, ... have been sliced into a, b, c, ... parts respectively so that any k, l, m, ... slices can be combined to recover secrets A, B, C, ... respectively. We investigate the smallest number of slices that (regardless of the distribution of these slices from secrets) guarantees an adversary can recover all of the secrets. This number certainly exists since the adversary can recover all the secrets by capturing all a+b+c+ ... of the slices. But usually the adversary needs to capture only a smaller number of the slices.		

CT1.4	*Magic Polygrams*	
Karen Yokley	Elon University	
Magic polygrams, which are extensions of magic squares, can be found with computer programs through exhaustive searches. However, many number arrangements contain so many elements that computational searches are unproductive. Thus, these possibilities must be limited algorithmically. The current project investigates both a large traditional hexagram and a traditional octagram. Systematic approaches based on the arrangement of even and odd numbers are used to identify solutions.		

CT1.5	*Casus Irreducibilis over Finite Fields*	
Matt Lunsford	Union University	

For centuries, mathematicians were puzzled by the fact that Cardano's formula requires an excursion into the complex numbers to express in radicals the roots of an irreducible cubic polynomial with rational coefficients having only real roots. In this talk, we consider an analogous case for irreducible cubics over finite fields. In this simpler setting, we explore whether or not the roots of an irreducible cubic polynomial are expressible in terms of irreducible radicals present in its splitting field. The key theorem gives a simple divisibility condition that answers this question completely. Thus there is a situation that mirrors the historic "casus irreducibilis" in that both cases require the presence of elements not in the splitting field in order to express the roots of an irreducible cubic in terms of irreducible radicals.

CT1.6	*The Dynamic Quote-and-Prove Rules: A Swift, Comprehensive, and Inerrant Method for Structuring Informal Proof*	
Damon Scott	Francis Marion University	

The Dynamic Quote-and-Prove Rules form a set of "how-to-prove-it" rules that are coherent, ramifiable, and dynamic. They are applied to both the assumptions (data) and conclusions to be reached (quaesita) in real time so as to produce a structure for proving the conclusions from the assumptions. They are also applied, in real time, to the variables quantified anywhere inside the proposition being proved. By means of this process, the structure of the straightforward proof of a proposition can be determined swiftly, algorithmically, and inerrantly, and the result is a proof structure that is not only impeccably correct, but also easy to write and to read.

CT2.2	*Area based fan beam projection model for computed tomography*	
Phillip Stevens	Georgia Southern University	

Computed tomography (CT) refers to image reconstruction of objects using computer processed transmission or reflection data from x-rays, which is usually referred to as projection data. This projection data is often modeled using line integrals, but x-rays are of finite width in reality so the accuracy of reconstruction can be improved if an area based approach is used instead. In addition emitter beam shapes affect the reconstruction effectiveness and data collection efficiency, with the two main types of beam choice for 2-D scanning being fan-beam and parallel-beam. Fan-beam offers some advantages over parallel beam, such as a faster data collection, but is computationally more arduous. I will present an area based fan beam projection model for CT and discuss its effectiveness based on the numerical experiments of reconstruction from the proposed model.

<table>
<tr><td>CT2.3</td><td colspan="2">Simulating the Allee effect in Urocyon littoralis populations with an agent-based model</td></tr>
<tr><td>Anne Yust</td><td>Birmingham-Southern College</td><td>Erin Bodine (Rhodes College), Jim Crowder (Birmingham-Southern College), Huda Qureshi (Birmingham-Southern College), Allison Russell (Birmingham-Southern College), Shelby Scott (Rhodes College)</td></tr>
<tr><td colspan="3">The Allee effect is a biological phenomenon where the fitness of an individual or population is dependent on the density of the population. Data suggests that an Allee effect is present in island fox (Urocyon littoralis) populations located on the Channel Islands off the coast of California. Our faculty/student research group used agent-based models (ABMs) to simulate the effects of environmental factors on the foxes in order to witness an Allee effect. I will present the emergent behavior realized in the simulation.</td></tr>
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<tr><td>CT2.4</td><td colspan="2">Distances in Tree-like Polyphenyl Systems</td></tr>
<tr><td>Tabitha Williford</td><td>Georgia Southern University</td><td>Hua Wang, Georgia Southern University; Alex Collins, Georgia Southern University; Shainaz Landge, Georgia Southern University</td></tr>
<tr><td colspan="3">Tree-like polyphenyl systems form an important family of compound structures in Chemistry. These non-polar molecules have multiple industrial applications, such as lighting. In recent years, many extremal results regarding such structures under specific constraints have been provided, among which various sub-categories of such systems with the extremal Wiener index. We provide a labeling of the vertices on each hexagon, which facilitates the illustration of a tree-like polyphenyl system with its corresponding tree structure. This approach helps characterizing the extremal tree-like polyphenyl systems with respect to the Wiener index.</td></tr>
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<tr><td>CT2.5</td><td colspan="2">Autonomous View from Nonautonmous Data</td></tr>
<tr><td>Amal Moghraby</td><td>North Carolina A&T State University</td><td></td></tr>
<tr><td colspan="3">Lagrangian Coherent Structures (LCS) play a key role in understanding the underlying dynamics of a velocity field in the form $x = f(x,t)$. LCS in a certain field act as organizers of transport and are obtained by following the Lagrangian trajectories $x(t)$, the solution to the above differential equation. In this study we use a Lagrangian diagnostic to compute LCS for a Rossby Wave. We show that by using an appropriate advection termination time, one can retrieve a time-independent instance of the LCS from a time-dependent velocity field.</td></tr>
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CT4.1	*Ideas for Ending a Course Effectively*	
Mike Pinter	Belmont University	
As college teachers, we typically pay a great deal of attention to course design and the course syllabus, including goals for the course and desired learning outcomes. Starting with the very first class meeting, we spend significant time trying to set the right tone and get the class off to a really good start (McKeachie, 2002). In contrast to all of this advance preparation, we may spend relatively little time preparing for the ending of a course, especially since faculty and students are often in a frenzy as we near the conclusion of a course and all may be feeling a sense of "let's just get this over with and move on" (Duffy & Jones, 1995). Thus, despite our best intentions, we may find it particularly challenging to give even minimal attention to developing strategies and activities that will enhance student learning outcomes as they complete our course. Paying careful attention to how we end a course is very important for a variety of reasons, both emotional and cognitive. Lowman (1995) observed that, as with ending any shared experience, the conclusion of a college class is typically an emotion-filled time. Cognitively, the conclusion of a course can be an important time for reflection and intellectual growth (Lutsky, 2010). Ending with only a final exam or paper may not be the best way to wrap up a course and may miss important emotional and cognitive opportunities. We will discuss some ideas for constructive and effective activities at the conclusion of a semester, including approaches I have used in my (primarily general education) mathematics courses. I believe activities of this sort have helped my students to achieve better learning outcomes as they complete a course. I will incorporate assessment of the effectiveness of activities and assignments that I have used, including some samples of student work. One of my goals for the session is that instructors will be able to implement ideas in their current courses as they near the end of the semester (instead of having to settle for setting ideas aside until preparing for a later semester).		

CT4.2	*Herding Cats - Using an Attendance App to Learn Names and Keep Up with Your Students*	
Robin Lovgren	Belmont University	
With the growing size of classes, learning students' names and keeping up with their attendance and homework can be daunting. Instructors who learn their students' names seem more approachable and caring. This intentional action can foster a better learning environment and help build stronger relationships in the classroom. This presentation examines the use of the Attendance2 app in learning students' names as well as keeping track of attendance and completion of homework assignments.		

CT4.3	*What Colleges expect and What They Actually See*	
Josie Ryan	Lander University	
A look at four year institutions with which the author is familiar and current incoming freshmen. An attempt to gather information from colleagues from other universities and colleges on their institutional response and a look at the author's own experience. Is there really a changing trend in student preparation? Are students actually less responsible? Are they less able to deal with problems? What effect is the cultural shift toward increasing on-line/electronic immersion having? How do we address either a perceived or actual calculator dependence? This is NOT a scientific study, but an attempt to gather information to help high school/middle school students and their parents prepare for college. However, it includes information gathered from wellness and admissions professionals and professors in cross-disciplinary areas. A session outlining the progress the author has made in creating a publication; with a look toward input from others on what needs to be included.		

CT4.4	*x Marks the Spot: Student Conceptions of Variable*	
Benjamin Wescoatt	Valdosta State University	
Students' struggles with understanding the concept of variable have been documented. While notions of variable become more sophisticated with experience, even college students appear to have weak conceptions, inhibiting problem-solving efforts. This current study explores college students' understanding of variable as manifested while verifying trigonometric identities. While students generally viewed a variable in the function argument as a general number, many students did so at the sake of either mentally replacing or overwriting the argument with a preferred letter, usually x. While doing so facilitated these student in verification, the dependence on the letter x as a somewhat default variable inhibited some students from recognizing identities. The talk will include implications for a possible hierarchy in the development of variable and the function argument as related to trigonometric identities.		

CT4.5	*Write Your Own Math Textbook*	
Paul Baker	Catawba College	
Are you unhappy with the textbook options for one of your courses? Are you concerned with the prices your students pay? Consider writing your own text for use in your own courses. This session will examine a number of details and lessons learned by the speaker while authoring three different math books used at Catawba College. The overall conclusion is that writing a textbook isn't all that time-consuming or onerous.		

CT4.6	*Empowering Students through Mathematica*	
Laura Lynch	College of Coastal Georgia	
This session will illustrate a myriad of ways in which faculty can incorporate the technologies of Mathematica and Wolfram Alpha into their classrooms. Mathematica, a software program developed by Wolfram Research, allows faculty to create substantially interactive lectures and presentations using on-the-fly calculations and visualizations through examples that are relevant to the students. Learn how Mathematica can be used to help your students in mathematics courses ranging from College Algebra and Quantitative Literacy to the Calculus Sequence and more!		

CT5.1	*Some Convolution Identities Involving Fibonacci and Tribonacci Numbers*	
Curtis Herink	Mercer University	
In _Proofs That Really Count_, Benjamin and Quinn show how Fibonacci identities may be given combinatorial proofs by considering the n-th Fibonacci number to be the number of tilings of an n-board by squares and dominoes. In like fashion, the Tribonacci numbers may be thought of as the number of tilings of an n-board by squares, dominoes, and 3-tiles. We use this representation to give a combinatorial proof that the excess of Tribonacci numbers over Fibonacci, T_n - F_n, equals a convolution of the Fibonacci sequence with the Tribonacci sequence. As time allows, we will present other identities that can be proven using similar identities.		

CT5.2	*A new twist on the Ping-Pong lemma…and why we care.*	
Josh Hiller	Western Carolina University	
Felix Klein's 1872 address to the faculty of the University of Erlangen was one of the pivotal moments in the history of group theory. Not only did he define and classify the projective groups, the hyperbolic groups, and the elliptical groups but he also put forth one of the most powerful and insightful tools in all of group theory: the Ping-Pong Lemma (or Klein Criterion). Even today, 142 years later, we still use his discovery to find free groups hiding within other naturally occurring infinite groups. In this talk, we will discuss the most recent incarnation of Klein's beautiful lemma and also why we care about free groups in the first place.		

CT5.3	*3-terms recurrence coefficients of a special orthogonal family*	
Anh Tran	Georgia Southern University	Shuai Yuan, Georgia Southern University; Sze-Man Ngai, Georgia Southern University
Given the moments computed based on the measures, one can start applying Gram-Schmidt process to derive the orthonormal family of polynomials, and also its 3-term recurrence coefficients. However, the process becomes more computationally expensive and ill-conditioned as the moments get smaller. In 1990s, G. Mantica developed an efficient technique to compute the Jacobi matrices associated with singular measures. Followed his technique, we present the numerical results of these coefficients and its polynomials.		

CT5.4	*Analogues of the Prime Number Theorem in Certain Rings of Integers*	
Eric Morgan	Tennessee Tech University	
This talk is based on ongoing work for a Master's thesis at Tennessee Tech University. The speaker will present a brief history of the prime number theorem and certain previously established analogues. Results characterizing the prime elements in the rings of integers corresponding to certain quadratic algebraic number fields will be discussed. Based upon these results, the speaker will unveil analogues of the prime number theorem in these rings of integers.		

CT5.5	*Anti-Waring Numbers*	
Chris Fuller	Cumberland University	
For given positive integers k and r, the Anti-Waring number $N(k,r)$ is defined to be the first integer such that it and every subsequent integer can be written as the sum of the k-th powers of r or more distinct positive integers. A theorem will be presented that allows a number to be computationally verified as $N(k,r)$ when certain conditions are met. Also, new Anti-Waring number results and a generalization will be discussed.		

CT5.6	*Convolution and GCD Properties in Hosoya's Triangle.*	
Antara Mukherjee	The Citadel	Dr. Rigoberto Florez, The Citadel, Charleston SC; Mr. Robinson A. Higuita, Universidad de Antioquia, Medelln, Colombia; Dr. Leandro Junes, California University of Pennsylvania, California, PA
The Hosoya triangle is a triangular arrangement of numbers similar to Pascal's triangle where the entries are product of Fibonacci numbers. In this research we discuss the generalized Fibonacci polynomials, these polynomials have Fibonacci numbers as coefficients. Next we construct the Hosoya's polynomial triangle which is a generalization of the Hosoya triangle where each entry is a product of two generalized Fibonacci polynomials. We show that some algebraic and geometrical properties that occurs in the Pascal triangle also holds in the new triangle. For instance, we show that the GCD property for the Star of David holds in our triangle. We define a convolution with the entries of the Hosoya polynomial and we show that this convolution is another generalized Fibonacci polynomial. We also discuss other polynomial triangles similar to Hosoya's polynomial triangle and their properties. In particular we use Chebyshev polynomials and Morgan-Voyce polynomials to construct these polynomial triangles.		

CT6.1	*Chebyshev's Sum Inequality on Positive Tensor Products*	
Wei-Kai Lai	University of South Carolina Salkehatchie	

Chebyshev's sum inequality states: for any real number sequences $\{a_i\}_i^n$ and $\{b_i\}_i^n$ both in increasing (or decreasing) order, we have

$$\frac{1}{n}\sum_{i=1}^{n} a_i b_i \geq \left(\frac{1}{n}\sum_{i=1}^{n} a_i\right)\left(\frac{1}{n}\sum_{i=1}^{n} b_i\right).$$

We now consider the Wittstock injective tensor product $\ell_p \tilde{\otimes}_i X$, and the Fremlin projective tensor product $\ell_p \hat{\otimes}_F X$, in which X is a Banach lattice. Using a technique introduced by Bu and Buskes at 2006, we can show that the Chebyshev's sum inequality still exists in these two positive tensor products if $\{a_i\}_i^n$ is in ℓ_p and $\{b_i\}_i^n$ is in X.

CT6.2	*Diffusive logistic equation with constant yield harvesting and negative density dependent emigration on the boundary*	
Jerome Goddard	Auburn University Montgomery	R. Shivaji (University of North Carolina Greensboro)

The structure of positive steady state solutions of a diffusive logistic population model with constant yield harvesting and negative density dependent emigration on the boundary is examined. In particular, a class of nonlinear boundary conditions that depends both on the population density and the diffusion coefficient is used to model the effects of negative density dependent emigration on the boundary. In this presentation, we discuss existence results established via the well-known sub-super solution method.

CT6.3	*Fredholm Integral Equations of the Second Kind: A Solved Example and an Unsolved Example*	
Iason Rusodimos	Georgia Perimeter College	Barrett Walls (Georgia Perimeter College)

Fredholm Integral Equations of the Second Kind appear in several boundary value problems. Depending on the parameters and functions involved finding closed form solutions can be notoriously difficult. Our talk examines a method for solving these in certain cases, both by hand and with computers. We also discuss the difficulties in solving these types of equations by examining a particular problem that arose in our research.

CT6.4	*Some Results on Periodicities for Min-Max Recursive Sequences*	
Heather Gaddy	Wake Forest University	Dr. Kenneth Berenhaut, Wake Forest University
In this talk, we consider a conjecture regarding convergence of solutions to min-max recursive sequences. Some partial results related to the greatest common divisors of elements in underlying sets are proven. We also discuss some related generalizations and open questions.		

CT6.5	*A new twist on one of the oldest calculus problems*	
Jeffrey Norden	Tennessee Tech Univ	
A ball is launched into the air from ground level and subject only to the constant force of gravity. It follows a simple parabolic curve. Instead of finding the maximum height or the range of the ball, we consider the point at which the straight-line distance from the launch point to the ball is maximum. If the object is launched at a steep angle, this occurs near (but not at) the top of the trajectory. If it is launched at a shallow angle, the maximum distance occurs when it lands back on the ground. We show that this maximum distance will occur in the air iff the initial slope with which the ball is launched is greater than than $\frac{1}{2}\sqrt{22+10\sqrt{5}}$.		

CT7.1	*On the Inverse New Modified Weibull Distribution*	
Valeriia Sherina	Georgia Southern University	Broderick Oluyede, Georgia Southern University
A new class of distributions called the Inverse New Modified Weibull (INMW) distribution is developed. The family or class of distributions includes several sub models such as Inverse Exponential, Inverse Weibull, Inverse Rayleigh, Frechet, Additive Inverse Weibull and Modified Inverse Weibull. Statistical properties including hazard and reverse hazard functions, moments and entropy measures, order statistics are derived and studied. The method of maximum likelihood is used to estimate the parameters of this new class of distributions. Finally, real data examples are discussed to illustrate the applicability of this new class of distributions.		

CT7.2	*Gamma Exponentiated New Modified Weibull Distribution*	
Shusen Pu	AMS	
The Weibull distribution is one of the most important distributions in reliability. For the first time, we introduce the Gamma Exponentiated New Modified Weibull distribution which extends recent models in Weibull family. The new distribution is an important competitive model to the Weibull, exponentiated exponential, exponentiated Weibull, gamma exponential and gamma Weibull distributions since it contains all these models as special cases. We demonstrate that the density of the new distribution can be expressed as a linear combination of Weibull densities. We provide the moments and two closed-form expressions for the moment-generating function. Explicit expressions are derived for the mean deviations, Bonferroni and Lorenz curves, reliability and entropies. The density of the order statistics can also be expressed as a linear combination of Weibull densities. We obtain the moments of the order statistics. The expected information matrix is derived.We define a log-beta exponentiatedWeibull regression model to analyse censored data. The estimation of the parameters is approached by the method of maximum likelihood. The usefulness of the new distribution to analyse positive data is illustrated in two real data sets.		

CT7.3	*The Kumaraswamy Generalized Lindley Distribution with Applications to Lifetime Data*	
Tiantian Yang	Georgia Southern University	Broderick O. Oluyede (Georgia Southern University)
In this presentation, a new class of generalized distribution called the Kumaraswamy generalized Lindley (KGL) distribution as well as related sub-distributions are proposed. This class of distributions contains the Kumaraswamy Lindley (KL), generalized Lindley (GL), Lindley (L) distributions as special cases. Series expansion of the density is obtained. Statistical properties of this class of distributions, including hazard function, reverse hazard function, monotonicity property, shapes, moments, reliability, quantile function, mean deviations, Bonferroni and Lorenz curves, entropy and Fisher information are derived. Method of maximum likelihood is used to estimate the parameters of this new class of distributions. Finally, real data examples are discussed to illustrate the applicability of this class of distributions.		

CT7.4	*Rethinking MLB Batting Average*	
Darin Mohr	Georgia College	
Classic statistics in Major League Baseball such as batting average for batters and earned run average for pitchers do not incorporate the skill of the opposing players. In this talk, we present new metrics for batter and pitcher performance that incorporates the relative skill of the opponents.		

CT7.5	*Optimal metric distance on registered curves with application*

	to a Fourier transform-infrared spectroscopy analysis of maize	
Yishi Wang	UNC wilmington	
Registered curves containing a variety of information are becoming more and more frequent in natural sciences research. To date, most statistical analysis of such curves involves using only a portion of the information contained within these curves. In order to utilize information across the entire spectrum of the curve, we propose to consider shape and/or magnitude distance that measures the similarity of these non-smooth functional curves, and an object function to compare the effectiveness of different distances measures. Once a similarity/dissimilarity matrix is obtained, various statistical properties can be ascertained about the relationship between two or more curves. Herein, we develop an approach that can identify the most effective distance measure and apply it to an analysis of maize seed Fourier transform-infrared spectroscopy (FT-IR) spectral data. Dimension reduction techniques, such as multidimensional scaling (MDS), is then applied to represent the original curves in a lower dimensional space.		

CT7.6	*The Number of Zeros of Linear Recurring Sequences over Finite Fields*	
Yasanthi Kottegoda	Southern Illinois University Carbondale	
I discuss the possible number of zeros of a homogeneous linear recurring sequence over a finite field $\mathbb{F}_q$, based on an irreducible polynomial of degree d and order m as the characteristic polynomial. I give upper and lower bounds on the cardinality of the set of number of zeros. The set is determined when $t = (q^d - 1)/m$ has the form $q^a + 1$ or $q^{2a} - q^a + 1$ where $a \in$ □ . The connection with coding theory is a key ingredient.		

CT8.1	*IBL in ODE*	
Curtis Kunkel	University of Tennessee Martin	
Discussion of a recent attempt at an Inquiry Based Learning approach (quazi-Moore Method) in an introductory Ordinary Differential Equations class (prerequisite of Calculus 2). A comparison between topics covered and speed/depth of coverage will be considered as part of the analysis, as well as some student feedback/advice that was received. (note: Nagle, Saff, and Snider's Fundamentals of Differential Equations was used as the text in the course)		

CT8.2	*My experience of teaching linear algebra*	
Tin-Yau Tam	Auburn University	
In this talk experience of teaching linear algebra is shared, especially to help students to deal with abstract concepts.		

CT8.3	*Pre-service Teachers and Numerical Reasoning*	
Bernadette Mullins	Birmingham-Southern College	Maria Stadnik (Birmingham-Southern College), Anne Yust (Birmingham-Southern College)
We are investigating the extent to which inquiry-based mathematics courses impact content knowledge and attitudes toward teaching mathematics. We distributed pre- and post-tests that assess numerical reasoning ability to pre-service teachers enrolled in a course geared toward numerical reasoning and to students that were not enrolled in this course. We will present preliminary results of our investigation into the improvement in understanding of pre-service teachers.		

CT8.4	*Honest Multivariable Calculus*	
Jeffrey Clark	Elon University	
When I learned Multivariable Calculus in the previous millennium, all examples were rigged to permit successful work by hand without numerical approximation. Many textbooks still restrict their exercises similarly. With student access to Computer Algebra Systems such as Mathematica, we should encourage students to work with a wider range of problem domains.		

CT8.5	*College Geometry Instruction Assisted by Geometer's Sketchpad*	
Paul Baker	Catawba College	
This semester is the first semester for integrating the use of Geometer's Sketchpad into the instruction for the College Geometry course at Catawba. Although it is still early in the semester, several encouraging student and instructor observations about the effectiveness of the dynamic geometry software will be shared in this session.		

CT8.6	*Random Fun With a Calculator*	
David Vogel	Middle Georgia State College	
This presentation will demonstrate how the TI-84 (or TI-83) calculator can be used to simulate multiple rolls of two dice. The simulation can be accomplished as a classroom activity in about 30 minutes and vividly illustrates how the Law of Large Numbers applies to a discrete probability distribution. It also teaches students less-familiar features of the calculator, such as list manipulation, command editing, and graphing parameters. Bring your calculator!		

CT9.1	*Symmetries in Taxicab Geometry*	
Kasey Jones	Western Carolina University	
The objective of the talk will be to explore Taxicab geometry and how it relates to the Euclidean metric. We will focus on symmetries in Taxicab, both two and three-dimensional. The difference in metrics produces interesting results and nice comparisons; these will be analyzed through this talk.		

CT9.2	*Are the Knot Crossings really there?*	
Ramanjit Sahi	Austin Peay State University	
Knots have been of interest to mankind since the dawn of human history. They have appeared in woodcuts, manuscripts, stamp seals paintings and other forms all over the world. It was a little over century ago that scientists like Gauss, Lord Kelvin, Tait that gave a stimulus to classical knot theory. By defining a new sort of crossing called the virtual crossing, Kauffman introduced the concept of virtual knots in 1996. Virtual knot theory is a generalization of the classical knot theory and has been established on combinatorial basis. In this presentation, we will look at basic definition, some fundamental properties and in particular how to describe these knots using Gauss diagrams.		

CT9.3	*Sweeping Polygons with Line Segments*	
Tzvetalin Vassilev	Nipissing University	Borislav I. Karaivanov, Columbia, SC Minko M. Markov, Sofia University, Sofia, Bulgaria
We consider the problem of decontaminating the interior of a simple polygon in the plane using line segments. This problem has natural connections to the many variants of the Art Gallery Theorem and visibility/illumination problems in computational geometry. It also represents natural generalization of various discrete search problems on graphs. We consider the problem of optimizing the total length of the segment(s) necessary and sufficient to decontaminate a simple polygon in the plain. We present bounds, exact solutions for restricted classes of polygons and discussion on the general complexity of the problem.		

CT9.4	*Max Dehn's Early Work in Topology*	
David Peifer	UNC Asheville	
The talk will begin with a brief history of Max Dehn. In particular, Dehn's papers from 1910-1914 will be discussed. Results and techniques from these papers are still important today. A few of Dehn's early results in topology will be examined.		

CT9.5	*Math History by a Thread*	
Leigh Atkinson	UNC Asheville	
To teach math history from, say, Thales to Hilbert, in one semester is impossible. Nonetheless my department purports to offer such a course. One way to attempt to square this circle is to contract the horizons a bit and follow a particular thread through history, giving curious students the means to strike off to one or another side. This talk will describe a plan for one such course with the question ``What is a number?'' as the thread; audience participation will be invited.		

CT9.6	*Product of sum of squares and sum of reciprocal squares of*

	consecutive Fibonacci numbers	
Tieling Chen	University of South Carolina Aiken	Shan Cong School of Mathematics and Computer Science, Wuhan Textile University, China
The paper studies the limiting value of the product of the sum of squares and the sum of reciprocal squares of consecutive Fibonacci numbers. Take the any consecutive numbers starting from the nth number of the Fibonacci sequence and make the product of the sum of their squares and the sum of their reciprocal squares. The limiting value of the product as n approaches infinity is determined by a Lucas number. The closed formula of the limiting value of the product is also obtained. The discovery reveals a new relation between Fibonacci numbers and Lucas numbers.		

CT10.1	*Edge-balanced index sets of complete bipartite graphs*	
Christopher Raridan	Clayton State University	Hung Hua, Elliot Krop, Pritul Patel, Clayton State University
In 2009, Kong, Wang, and Lee began work on the problem of finding the edge-balanced index sets of complete bipartite graphs $K_{m,n}$ by solving the cases where $n=1$, 2, 3, 4, 5, and also the case where $m=n$. In 2013, Krop, Minion, Patel, and Raridan found a general solution to the edge-balanced index set problem for all complete odd bipartite graphs, thereby concluding the problem for that case. In this presentation, we examine the edge-balanced index set of $K_{m,n}$ for m or n even.		

CT10.2	*Monochromatic Sinks in 3-Switched Tournaments Without Rainbow Triangles*	
Adam Bland	Middle Georgia State College	Jeremy Aikin, Middle Georgia State College
Let T be a tournament whose arcs are colored using at most three colors. A cycle C in T is called k-switched if there are at most k vertices in C whose incident arcs in C are two distinct colors. We prove that if every cycle in T of length at least four is 3-switched and every cycle of length three is 2-switched, then T contains a monochromatic sink.		

CT10.3	*Graphs and Matrices: Finding Your Way From A To B*	
Anthony Coggins	Georgia Southern University	Jimmy Dillies
A common problem in graph theory is counting paths between two nodes. For small graphs, this can easily be done by hand. This talk will focus on counting paths from one node to another on planar graphs with more than 5 nodes. I will introduce the adjacency matrix, and use this notion to derive a formula for counting paths.		

CT10.4	*Graphs with Cut Vertices and Zagreb Indices*

James Adam Schrum	Western Carolina University	Dr. Risto Atanasov
The first and the second Zagreb Indices are a pair of topological invariants commonly used to quantify the connectedness of a graph. We will consider graphs with cut vertices and discuss how the number of cut vertices affects the Zagreb indices.		

CT10.5	*Classifying Coloring Graphs*	
Kara Shavo	Presbyterian College	Ruth Haas, Smith College; Julie Beier, Earlham College; Heather Russell, Washington College; Carl Lienert, Fort Lewis College; Janet Fierson, La Salle University
Let G be a simple graph and k be a postive integer. Then the k-coloring graph of G, denoted $\mathcal{C}_k(G)$, is the graph whose vertex set is the set of all proper k-colorings of G, with two k-colorings adjacent if they differ in color on exactly one vertex of G. In this talk we will attempt to answer the question: what graphs can be coloring graphs? We will establish several useful lemmas that will enable us to classify all coloring graphs of certain orders, including all those of order less than 20, all those of prime order, and all those with $k = 2$. We will establish that the cycle C_5 cannot be an induced subgraph of any coloring graph, but that all other cycles can be. We will also show that trees cannot be coloring graphs and that, with a few exceptions, neither can cycles. A few more potentially useful lemmas will be presented, along with some open questions.		

Ct10.6	*Distance subtrees and middle parts of trees*	
Shuai Yuan	Georgia Southern University	
Different middle parts such as center, centroid, subtree core have been defined and studied. We want to provide some general insights on the difference between them and consider how far apart (with given order of the tree) two different `middle point' can be and when such maximum distances are achieved. This study, after conducted on general trees, is naturally extended to trees with restricted degrees or diameter due to the evident correlation between these restrictions and the maximum distance between middle parts. Some related interesting questions arise that may be of interest independently.		

CT11.1	*Epistasis in Predator-Prey Model*	
Iuliia Inozemtseva	Georgia Southern University	James Braselton, Georgia Southern University
Epistasis is the interaction between two or more genes to control a single phenotype. We model epistasis of the prey in a two-locus two-allele problem in a basic predator-prey relationship, using famous Lotka-Volterra predator-pray equations and with Hardy-Weinberg proportions for the alleles. The resulting model allows us to examine both population sizes as well as genotypic and phenotypic frequencies. In the context of several numerical examples, I show how epistasis results in an undesirable or desirable phenotype in the prey, by making the particular genotype more or less susceptible to the predator or dangerous (lethal or poisonous) to the predator. As a result, elimination of undesirable phenotypes and then genotypes occurs.		

CT11.2	*Modeling Soybean Yield Using Climate Data*

Jamie Rowell	Western Carolina University	
Understanding the potential effects that climate change has on crop yield is a vital planning tool for the future. Using climatic data collected over a period of six years across the state of Georgia in the top ten soybean producing counties, we attempt to predict potential soybean yield through the use of statistical modeling. We compare two main types of statistical approaches to crop modeling; multiple regression analysis and a time series model, and identify their strengths and limitations in reference to predicting crop yield.		

CT11.3	*The Leontief Input-Output Production Model And Its Application To Inventory Control*	
Aniekan Ebiefung	Uinversity of Tennessee	Clare Obikwere, University of Calabar, Nigeria
The standard input-output production model is relaxed in order to handle more problem instances. The relaxed model is solved as a minimization linear programming problem. It is shown that the minimization linear programming problem is equivalent to an important mathematical problem, the linear complementarity problem. Using the complementary conditions of the linear complementarity problem, it is shown that a solution to the relaxed input-output problem is the required solution that will satisfy both internal and external demands for the goods and services of the sectors with minimum inventory level. A numerical example of a six-sector economy is used to illustrate the utility of the proposed model.		

CT11.3	*Analysis of Catalyst Kinetics*	
Phillip Hall	Austin Peay State University	Ramanjit Sahi, Austin Peay State University, and Elisha Hall, Austin Peay State University
In recent years, a lot of attention is being spent on finding renewable sources for fossil fuels such as coal, diesel, gasoline etc. Biodiesel is a current renewable alternative to petroleum based diesel. Our idea is to make biodiesel from waste vegetable oil using a solid catalyst to convert the free fatty acids in the waste vegetable oil. We do this by injecting methanol and waste vegetable oil over the catalyst in a packed bed reactor to convert the free fatty acids to biodiesel. In this project we will apply statistical techniques to analyze the collected data. The results will help us determine the retention time and temperature delay in the reactor startup.		

CT11.4	*A block hybrid method for the direct solution of second order initial value problems*

Fidele Ngwane	USC Salkehatchie	Samuel N. Jator Department of Mathematics and Statistics, Austin Peay State University Clarksville, TN 37044 Jators@apsu.edu
In this paper, we derive a block hybrid trigonometric fitted continuous method for directly solving second order initial value problems.This numerical method is implemented in block form.We discuss the stability properties and present some numerical examples to demonstrate the accuracy of the method.		
CT11.5	*Magical Matrices which Decompose Polygons Stellarly*	
Doug Burkholder	Lenoir-Rhyne University	
We demonstrate a simple and elegant way to construct three 7×7 matrices which decompose any 7-gon in $\mathbb{R}^3$ (not necessarily planar!) into three polygons which flattens and stellarizes the 7-gon while preserving area and distance. To be precise, we construct 7×7 matrices M_1, M_2, M_3 so that for any P in $(\mathbb{R}^3)^7$ the three polygons $A_i = M_i P$ have the following four properties: the A_i are each planar polygons; the polygon A_1 is the affine image of a regular 7-gon and the polygons A_2 and A_3 are the affine images of regular $\{7/2\}$ and the $\{7/3\}$ star polygons, respectively; for every projection onto any plane, we have $\text{Area}(P) = \text{Area}(A_1) + \text{Area}(A_2) + \text{Area}(A_3)$; furthermore, this decomposition is reversible, $A_1 + A_2 + A_3 = P$. The author will also discuss the general case for any n-gon.		

CT2.1	*Application of flow network in reversing the mutation of cancer cells*	
Yiran Zhang	Georgia Southern University	
In this talk we explore the application of flow network in identifying the key genes in a defected cancer cell. In such cells, a set of genes has a change of expression that causes the change of the network (formed by significant genes) function. Through appropriate set up of the network structure and flow capacities, we mimic the function of a gene network and provide theoretical prediction of the genes whose enhancement or inhibition may reverse the mutation of a cancer cell.		

DS.1	*Fighting infections with mathematics*	
Judy Day	University of Tennessee	

Chances are you have gotten sick from some kind of infection before, but have thankfully recovered enough to read this abstract! In some cases, unfortunately, infections can be fatal – a reality that clinicians working in intensive care units face every day. Although bacteria, viruses, and other pathogens might be responsible for initiating an illness, the body's response to the infection can be the real culprit in some cases. How is it that our body's immune response is necessary but also potentially lethal? What is going on inside when we are sick? In more serious infections, why might recovery not be a possibility? How can we understand this process better so we can properly intervene? The answers to these questions (and how we answer them) may surprise you. We will see how combining mathematics with biology can provide a deeper understanding of the dynamics of an infection and reveal possible strategies for successfully controlling the response.

DS.2	*Some classical minimization problems*	
Ted Shifrin	University of Georgia	
I will discuss (in collaborative fashion) some classical minimization problems and various approaches to their solution (calculus, different geometric approaches). One interesting result which comes up is Ptolemy's Theorem, which is a close relative of the triangle inequality.		

FT1.1	*Inverted classrooms for lower-level math courses—A flipping challenge?*	
Adam Graham-Squire	High Point University	Karen O'Hara, High Point University
A flipped classroom is one in which the material usually done during class (lecture) is moved to the time outside of class through reading exercises or screencasts. Time in class is then freed up to work problems that would normally be done as homework. To study the effects of a flipped classroom on lower-level mathematics courses, we flipped sections of Finite Math, Business Calculus, Precalculus, and Calculus during the fall semester of 2013. Each professor taught two sections, one with a standard lecture approach and the other with a flipped approach. Although other research has demonstrated benefits with using the flipped classroom, our preliminary data does not support such a conclusion for the courses that we taught. We will discuss the techniques we used, benefits and drawbacks of the flipped approach, and preliminary results of our study.		

FT1.2	*A Personalized Solution for Increasing Student Success*	
Marcela Chiorescu	Georgia College	Rodica Cazacu, Georgia College
To help students enhance their basic mathematical knowledge necessary for their academic success, Georgia College has begun offering a redesigned College Algebra using the latest instructional technology and a learner-centered pedagogy. This presentation will cover how the course was implemented, what changes we have made since implementation and the results we have so far.		

FT1.3	*Engaging Students in the College Algebra Classroom*	
Kathy Cousins-Cooper	North Carolina A&T State	Katrina Staley, Ph.D.,

	University	knstaley@ncat.edu, North Carolina A&T State University
This presentation will focus on strategies used to engage students in the active learning of college algebra and trigonometry. The presenters will describe their experiences in using the math emporium model of instructional delivery, which includes methods to encourage and require students' participation in the classroom such as self-paced instruction, peer tutoring, immediate feedback. This method also allows instructors proactive interactions with students to assure student learning before formal assessment has taken place.		

FT1.4	*Cultivating Skills for the Real World*	
Cindy Box	Georgia Perimeter College	
Skills such as reading, interpreting, analyzing, and articulating are important for student success when using math in real world problems. I will show example problems that I use in class to encourage discussion and practice precision with writing answers. The classes that I will pull examples from are Quantitative Skills & Reasoning and Statistics.		

FT1.5	*Interactive Instruction in College Algebra*	
Viveka Borum	Spelman College	
This session will discuss ways of instruction for a College Algebra course involving an adaption of Cornell notes and applications using the iPad. Discussion on ways of engagement, participation, and a clearer understanding of the concepts will also be examined.		

FT1.6	*College Algebra Course Redesign*	
Kay Geving	Belmont University	
College Algebra skills are necessary for many courses. Providing a quality College Algebra experience for each individual creates quite a challenge for University instructors. I piloted a "Hybrid" College Algebra section in Spring 2013, and am now teaching my fourth and fifth sections of this redesigned course. I combine "regular" mini-lectures with the use of computer-assisted instruction using the Hawkes Learning System Software. In this session, I plan to present Belmont University's course redesign of College Algebra, as well as reactions and results of this redesign.		

FT2.1	*A Discrete Math Modeling Course with an Emphasis on Biological Applications and No Calculus PreReq*

Erin Bodine	Rhodes College	
Discrete Mathematical Modeling with Biological Applications is a course that was offered for the first time in Fall 2013. It is a cornerstone course for the new Biomathematics major at Rhodes College. In the course, students investigate how a variety of discrete mathematical models (discrete difference equation models, matrix models, and individual or agent-based models) are applied to answer questions which naturally arise from the study of biological systems. Some of the biological applications explored include modeling population sizes over time, simulating the concentration of a drug in the body over time, modeling the process of ecological succession, and modeling the genetic structure of a population over time. This presentation will go over the structure of the course, and discuss the choice and pitfalls of creating an undergraduate math modeling course with no calculus prerequisite. An assessment of the first iteration of the course and how the course will be improved for future iterations will be given.		

FT2.2	*Infusing Precalculus with the Life Sciences*	
Zahava Wilstein	Berry College	
Animal Science and Biology are two of the largest majors at Berry College, a small undergraduate, liberal arts institution. These majors require Calculus or Precalculus, but students are often not ready for Calculus. As a result, we have tailored a Precalculus course to this group of students. In this talk we'll discuss a number of short activities and examples that motivate precalculus topics through the life sciences. Many of these examples incorporate real data and are conducive to inquiry-based activities.		

FT2.3	*Bridging the Prerequisite Knowledge Gaps for Calculus Students*	
Joanna Wilson	Georgia Perimeter College	
Often the biggest difficulty for calculus students is not the calculus but the algebra and trigonometry. I will share some strategies that I have employed and discuss the results.		

FT2.4	*Desigining Calculus I Applets: A Course Project*	
Vicky Klima	Appalachian State University	
The speaker will present a project that was born out of her need to assess the effectiveness of using GeoGebra applets in teaching Calculus I. Working in small groups, the students began the project by writing formal critiques of the applets that had been used in class. Next, the groups used what they learned from the critiques to design improved applets of their own. Finally, each group gave an advertisement pitch for their applet design to the class. After a class vote, we created a production copy of the best applet. This talk focuses on the logistics of the project, what was successful about the project, and what the speaker sees as potential improvements.		

FT2.5	*A Modified Moore Method in PreCalculus*	
Thomas Cooper	University of North Georgia	Karen Briggs, University of North

		Georgia
In this session, we will discuss results from the first year of a two-year quasi-experimental study to compare the effects of using a Modified Moore Method (a student-centered approach with very little direct instruction) to a traditional lecture approach in Precalculus. A Likert-type survey was used to assess the students' preferences for teaching style, and open-ended surveys and interviews were used to gather more detailed information on the students' perceptions and attitudes. In addition, a pre-test and common final exam was used to compare achievement. We will describe the teaching approach and provide an overview of both the quantitative and qualitative results.		

FT2.6	*Watch that Rounding!*	
J D Fortin	Johnson & Wales University	
Rounding and small changes to coefficients can lead to large error in computed solutions. Examples will be presented from curve fitting and systems of equations (two and three unknowns) that illustrate how small changes can significantly alter solutions. These examples have been employed in first year math courses to emphasize the need for careful computation and checking solutions. The need for alternative rounding rules will also be discussed.		

GR1.1	*On the Stability of Solutions of a Phase Transition Model*	
Heather Hardeman	Wake Forest University	Dr. Stephen Robinson - Wake Forest University
We will discuss the stability of certain solutions of a phase transition model. This model is typically expressed as a partial differential equation: $u_t = -\varepsilon^2 u_{xx} + F'(u) = 0, u_x(0) = u_x(1) = 0$, where $F(u)$ is a so-called "double-well" potential. We consider both classical and nonclassical examples for F. Furthermore, the main method we use in this discussion of stability is that of upper and lower solutions.		

GR1.2	*Crystal Basis Theory*	
Ethan Smith	Appalachian State Universtiy	Vicky Klima
The focus of this talk will be on the theory related to sl(2,C), the Lie algebra consisting of two by two complex matrices of trace zero. The quantum group for sl(2,C) is a deformation of its universal enveloping algebra, created by incorporating a quantum parameter q. Taking the limit as q approaches one for a representation of the quantum group, gives the corresponding representation for the universal enveloping algebra, which in turn corresponds to a representation of sl(2,C). Crystal bases for representations of the quantum group can be thought of as bases for these representations when q = 0. They parameterize representations for any q. While they may seem complicated at first, crystal bases exhibit numerous combinatorial patters. As an example of this, the Tensor Product Rule will be briefly described along with preliminary, expository result from the affiance version of sl(n,C).		

GR1.3	*On Complex Newton's Method*

Thomas Cook	Appalachian State University	
In first semester Calculus class, one of the first applications of the derivative is Newton's Method for finding root of certain real-valued functions. However, upon further inspection, one can find instances where Newton's Method does not "find" the root. I will demonstrate that if one takes a function from the reals to the complex, then Newton's Method uncovers more dynamics that cannot be seen in the real case. For instance, with the cubic function f(z)=z^3-1, the boundaries of the attraction basis of any root are not smooth boundaries, as one might expect. I will discuss the types of dynamics that arise when looking at Newton's Method, specifically, applied to f(z)=cos(z).		

GS.1	*Fifty Years of Chaos: From Strange Attractors to Complex Systems to Big Data*	
Jeff Knisley	East Tennessee State University	
In 1961, MIT meteorologist Edward Lorenz discovered that determinism need not be predictable, thus initiating the study of chaos and fractals. Almost immediately, many seemingly isolated mathematical and scientific phenomena from the past were shown to be a part of this new field, and as a result, the study of chaotic dynamics developed rapidly and spread throughout the sciences, quickly becoming central in nearly every area it impacted. Although there is some history, the focus of the talk is on what fifty years of chaos has led to today. In particular, the focus is on complex systems, which are systems that feature nonlinear interactions of chaotic and non-chaotic variables. "Big Data" is often thought of as data produced by a complex system, and correspondingly, the "Big Data" phenomenon includes everything from twitter data to social networks to biological systems and beyond. Not surprisingly, the emerging techniques for dealing with "Big Data" are highly mathematical -- indeed, in many ways themselves a product of fifty years of chaos.		

GS.2		
Ron Taylor	Berry College	

GS.3	*The Fractal Geometry of the Mandelbrot Set*	
Bob Devaney	Boston University	
In this lecture we describe several folk theorems concerning the Mandelbrot set. While this set is extremely complicated from a geometric point of view, we will show that, as long as you know how to add and how to count, you can understand this geometry completely. We will encounter many famous mathematical objects in the Mandelbrot set, like the Farey tree and the Fibonacci sequence. And we will find many soon-to-be-famous objects as well, like the "Devaney" sequence. There might even be a joke or two in the talk. This talk only supposes a knowledge of complex numbers and is accessible to undergraduates.		

PS1.1	*Developing Consistency in The Terminology and Display of Bar Graphs and Histograms*

Pat Humphrey	Georgia Southern University	Sharon Taylor, Georgia Southern University; Kathleen Cage Mittag, University of Texas at San Antonio
Students often are confused about the differences between bar graphs and histograms. The authors discuss some reasons behind this confusion (both due to textbooks and classroom teaching) and offer suggestions that help clarify thinking.		

PS1.2	*Statistics and Service Learning in the Campus Garden*	
John Wagaman	Western Carolina University	
We have several courses at our university which serve as introductory courses in statistics for many students; among these are a service course in applied statistics and a graduate course in experimental design. In Fall 2012, we started our involvement with the Campus Kitchen Garden, a student-run facility and organization under the Center for Service Learning at WCU. In this talk, we will describe our past work with this organization, and current and future directions including the use of wood in hugelkultur beds.		

PS1.3	*Using Technology to Motivate an Understanding of Sampling Distributions*	
David Steele	UNC-Asheville	
The idea that the sample mean and the sample proportion are random variables with their own probability distributions is a challenging concept for many students. Simulations carried out in software such as Minitab can be useful in demonstrating the means and variances of these sampling distributions as well as their tendency toward normality.		

PS1.4	*Teaching Probability and Statistics with a Historical Perspective*	
Jose Almer Sanqui	Appalachian State University	
The premise of this talk is that almost all topics in probability and statistics can be made more interesting by introducing them with a historical perspective. In this talk, we will discuss some examples of how I introduce various topics by discussing the personalities and the historical events that led to the development of the topic. For each of the examples, we will also discuss current specialized areas of probability and statistics whose origin can be traced back to these personalities and historical events.		

PS1.5	*Regressions and Refutations: On the Logic of Model Discovery*	
Philip Larson	Greenville Technical College	

With apologies to Imre Lakatos, several noteworthy data sets will be considered for how they can support a student's understanding of model building (conjectures). As time permits, attention will be given to these data sets, and perhaps others: Edwin Hubble's data on galaxy velocity and distance, Robert Boyle's data on the pressure and volume of an ideal gas, Galileo Galilei's data on free fall, Pavel Yakovlev's and Walter Guessford's data connecting politics and alcohol consumption

PUB.1	*The Next Big Thing: Tablet Compatible Mathematics Courseware*	
Emily Jones	Hawkes Learning Systems	
Courseware Development Engineers at Hawkes Learning have designed an innovative, browser-based platform built specifically with the tablet in mind. Our Expert System offers a distinctive approach to mastery-based learning with instant and specific feedback when students make a mistake, thus improving learning outcomes and reducing anxiety. Plugins or installations are no longer required, allowing students to quickly jump into the material. Come and learn about Hawkes' big launch and be entered to win an Amazon gift card!		

PUB.2	*Engaging the Instant Feedback Generation*	
Malissa Peery	Cengage Learning and University of Tennessee	
Today's students do not have to stand in line to register for classes or go to the campus bookstore to buy their textbooks. They don't even have to wait until scheduled office hours to ask a question of their instructor. Everything they need is available at the click of a button. They expect instant feedback. Engaging today's students can be a challenge, but the use of online homework and clickers gives students the instant feedback they crave. At the same time, these engaging technologies help instructors encourage effective use of the textbook and require students to be responsible for learning.		

UG1.1	*Searching For Optimal Solutions Using Ant Algorithms*	
Rahul Issac	Furman University	
We apply Ant Colony Optimization Algorithms, a Swarm Intelligence technique, to find good solutions to a variety of problems in graph theory. The technique uses a "pheromone trail" that is laid down on previously found solutions and evaporates over time. In particular, we use the technique in the Minimum Dominating Set and Maximal Independent Set problems.		

UG1.2	*Machine Learning for Phylogenetic Invariants*	
Hannah Swan	Winthrop University	Dr. Joseph Rusinko - Winthrop University; Brian Hipp - Winthrop University; Emili Price - Winthrop University

We build on Eriksson and Yao’s work, which uses machine learning to optimize the power of phylogenetic invariants to reconstruct evolutionary trees. To do this, we solve a semidefinite programming problem, using GNU Octave and CSDP, a solver for semidefinite programming problems. Our method includes inequalities arising from the study of the real points on the phylogenetic variety into the metric learning algorithm. Previous work focused on selecting a good set of invariants for the construction of quartet trees, we extend this work to more taxa by testing the accuracy on twelve taxa trees.

UG1.3	*A mathematical model of linear cancer networks with radiation therapy*	
Olivia Manley	Winthrop University	
Rather than the traditional explanation of cancer as the result of mutated genes that cause uncontrolled cell growth, a theory of mutated developmental control networks has been developed by Oxford scientist Eric Werner. This research examines one such developmental control network, a linear cancer network. A linear cancer network describes a system where cancerous growth is driven by cancer stem cells, which produce more cancer stem cells and other nondividing tumor cells. A mathematical model that depicts the behavior described by this new paradigm of cancer growth is proposed. Then, treatment in the form of radiation therapy is introduced, and the resulting effects on each cell population are explored. This research aids in the understanding of cancer, its growth, and how treatment may interact with it. The proposed mathematical model uses a nonlinear system of three ordinary differential equations that describe the growth of cancer stem cells, tumor cells, and healthy cells. Equilibrium points are analyzed and interpreted to uncover the long-term behavior of the model. Numerical simulations of the system confirm the stability analysis and reveal behavior such as failed treatment, cure states, and tumor recurrence for varying levels of radiation effectiveness.		

UG1.4	*Modeling Interactions among Migrating Species*	
Anne Talkington	Duke University	
Migrating species are affected by their interactions with one another, the biotic environment, and the abiotic environment. The ability to understand and predict their patterns of movement is of particular interest for purposes of conservation, development planning, and resource management. Attempts have been made to model the direction in which they move, and the extent of their movement. However, current models focus on a specific element of the ecosystem. The complexity of the organism’s interactions and instinctual drive is often simplified. I am suggesting a matrix-based model that expands on previous models and allows the researcher to describe the ways in which an organism interacts with its biotic and abiotic environment, in as much detail as the research demands. This model can describe the strength of an organism’s attraction to a particular place, or the relative speed at which it will migrate there. The matrix model is generalized, so it is applicable to any species; yet, it can be fit to specific organisms. The ability to determine a migration pattern is a significant step in making an educated decision regarding human intervention in a natural migration pattern.		

UG1.5	*How to Violate the Second Law of Thermodynamics While Shooting Pool*	
Aaron Smith	Coastal Carolina University	David Duncan, PhD, Coastal Carolina University

The Poincaré recurrence theorem is one of the first and most fundamental theorems of ergodic theory. When applied to a dynamical system satisfying the theorem's hypothesis, it roughly states that the system will, within a finite amount of time, return to a state arbitrarily close to its initial state. This result is intriguing and controversial, providing a contradiction with the Second Law of Thermodynamics known as the recurrence paradox. Here, we treat a set of pool balls on a billiards table as a dynamical system that satisfies the hypotheses of the Poincaré recurrence theorem. We prove that time is a volume-preserving transformation from the state space onto itself. After showing that the hypotheses for the recurrence theorem are met, we discuss the implications of the theorem's result for our system, including possible resolutions of the paradox that arises.

UG1.6	*An Agent-based Model for a Caribbean Coral Reef*	
Chelsey Beese	Coastal Carolina University	Aaron Smith, Coastal Carolina University; Tessa Weinstein, Coastal Carolina University

In the past three decades, severe environmental disturbances caused previously stable reefs, such as the fore reef in Discovery Bay, Jamaica, to destabilize due to mass mortality of algal grazers. This rapid deterioration of the herbivorous community caused an ecosystem phase shift from coral to macroalgal dominance, threatening the existence of the reef. To inform management strategies for jeopardized reefs, biologists are turning to mathematical models. Here, we present an agent-based spatial simulation model designed in MATLAB™ to forecast the future of Discovery Bay based on its unique characteristics. Unlike previous works, the model uses a cell area of $1\ \text{cm}^2$, the approximate size of a coral polyp. Additionally, it employs a hexagonal grid rather than a traditional square grid. Compared to previous models, the small cell size coupled with the hexagonal grid more accurately reflects natural coral geometry and inherent scale. Specific input parameters for representative species are garnered from empirical data. We apply the model to a number of initial conditions to determine threshold values of grazing and disturbance that promote significant reef recovery. These threshold values can then be used as goals for ecosystem management.

UG2.1	*On the Edge-Balanced Index Set of* $K_{7,6}$	
Hung Hua	Clayton State University	Elliot Krop, Pritul Patel, Christopher Raridan, Clayton State University

In this presentation, we provide an introduction to the idea of the edge-balanced index set (EBI) of a graph and some historical perspective on the problem of finding the EBI for certain graphs. We will also examine the EBI of the complete bipartite graph $K_{7,6}$ and discuss some of the difficulties in determining the EBI of $K_{m,n}$ where m is odd, n is even, and $m > n \geq 6$.

UG2.2	*Fighting Fires with Fighters*	
Stella Watson	Furman University	

This talk examines a version of the graph theoretic firefighter problem in which the firefighter

attempts to contain a fire spreading along the nodes of a square graph by protecting nodes in a connected path around the fire.

UG2.3	*Odd-Domination on the Torus: a Solitaire Puzzle*	
William Lewis	Furman University	
We make use of a simple solitaire puzzle in order to investigate odd-domination in lattice graphs embedded in tori. Several interesting properties abound.		

UG2.4	*Polynomials and The Construction of N-to-1 Graphs*	
Michelle Randolph	UNC Asheville	Halley McCormick, Whitman College
The forward problem for electrical networks is to find the response matrix of a graph of resistors given the conductivities on each edge. In this talk we address the inverse problem in which, given a response matrix, we examine the recoverability of the graph, in particular, using Legendre and Bernstein polynomials, we show that we can construct a graph such that the response matrix could have come from N distinct sets of conductivities.		

UG2.5	*Tree Decomposition of Cayley Digraphs*	
Evan Moore	Kennesaw State University	Dr. Erik Westlund, Kennesaw State University; Dr. Mari Castle, Kennesaw State University
A tree T decomposes a graph G if there exists a partition of the edge set of G into isomorphic copies of T. In 1963, Ringel conjectured that any complete graph on 2k+1 vertices can be decomposed by any tree with k edges. In 1989, Häggkvist conjectured more generally that every 2k-regular graph can be decomposed by any tree with k edges. This conjecture remains unresolved in general, despite generating considerable interest and a significant literature. Expanding upon the work of Fink (1994), we present further results on Häggkvist's conjecture by establishing a new family of Cayley digraphs that are decomposable by any tree satisfying the divisibility conditions. Some open problems and future directions will also be discussed.		

UG2.6	*Pebbling Graphs of Diameter Two on Surfaces*	
Matt Mohorn	Davidson College	Carl Yerger, Davidson College
In this talk we will briefly introduce the field of graph pebbling and describe results relating to the diameter of a graph. The *diameter* of a graph G is the maximum length of a shortest path between two arbitrary vertices of G. We will then describe recent work relating to a topological result that is part of the speaker's honors thesis.		

UG3.1	*Solving elliptic PDE using polynomial basis functions via perturbed collocation.*	
Dodji Kuwonu	APSU	Dr. Samuel Jator
In this presentation, we propose a method for solving elliptic Partial Differential Equations		

(PDEs) using polynomial basis functions via perturbed collocation. The method is implemented without requiring starting values or predictors. Numerical examples such as Poisson Equation, Laplace Equation are solved to show the accuracy of the method.

UG3.2	*A Numerical Method with Non-Polynomial Basis for Solving Singular Initial Value Problems*	
Michael McAllister	Austin Peay State University	Dr. Samuel Jator
A numerical method with non-polynomial basis for solving singular initial value problems (IVPs) is proposed. The motivation governing the development of the new method is inherent in the fact that the non-polynomial basis is that the method has the advantage of controlling the position and nature of the singularity present in the IVP. The accuracy of the method is demonstrated numerically.		

UG3.3	*Solving the Telegraph Equation by a hybrid Nystrom Method*	
Bruce Cain	Austin Peay	Dr Samuel Jator
The Telegraph Equation is solved using a hybrid Nystrom Method. The method is self-starting and implemented in the predictor and corrector mode. A numerical example is included to show the accuracy of the method.		

UG3.4	*Mathematics Behind Lighting and Shading Techniques within 3-D Computer Graphics*	
Samantha Scoggins	Methodist University	
The purpose of this project is to research and understand through existing knowledge the processes and their mathematical backgrounds that help to implement effective and realistic lighting and shadowing in 3-D computer graphics. This project should address certain areas such as the movement of light, the representation of light in computer graphics, and the techniques that are used to implement shading in computer graphics. Some mathematics that is implemented to help represent light in computer graphics is vectors, trigonometry, geometry, and certain aspects of linear algebra.		

UG3.5	*Ecological systems with aggregation, grazing, and Sigma-shaped bifurcation curves*	
Lyndee Bobo	Auburn University Montgomery	Zach Burnett (Auburn University Montgomery) Heather Pierce (Auburn University

		Montgomery) * All three students will take turns presenting this talk.

Population models built upon the reaction diffusion framework have provided important biological insight into the patch-level consequences of various assumptions made on individual behavior in ecological systems. Such models have seen enormous success both in their empirical validation with actual spatio-temporal distribution data and their ability to yield general conclusions about an eco-system based on the analytical results of theoretical models. Even with these great successes, the varied dynamics of theoretical reaction diffusion models are still not fully understood. In this talk, we will explore the dynamics of a logistic population model on a one-dimensional domain with hostile boundary, aggregation modeled by modifying the diffusion term, and grazing, i.e. a form of natural predation, via study of the model's positive steady state solutions. We obtain results through use of the quadrature method and Mathematica computations. Specifically, we computationally ascertain the existence of Σ-shaped bifurcation curves and will briefly explore their biological implications.

UG3.6	*Iteration of the Takagi Function*	
Meg Fields	UNC Asheville	Mark McClure, UNC Asheville

The dynamics of continuous, differentiable functions have been extensively studied and characterized. The dynamics of specific nowhere differentiable functions, however, remain largely unexamined. In this presentation, we look at the iterative dynamics of the Takagi function, τ, a continuous but nowhere-differentiable function. In particular, we show there are countably many fixed points which form a sequence converging to the fixed point $2/3$. We also show that the orbits of most points in *[0,1]* converge to $2/3$.

UG4.1	*The Classification of Biquotients of the Form Sp(3)//Sp(1)^2*	
Robert DeYeso	University of Tennessee at Martin	Dr. Jason DeVito, University of Tennessee at Martin; Michael Ruddy, University of Tennessee at Martin; Philip Wesner, University of Tennessee at Martin

Central to the task of finding quasipositive curvature on all inhomogeneous biquotients of the form Sp(3)//Sp(1)^2 is classifying all inhomogeneous, effectively free biquotient actions of Sp(1)^2 on Sp(3). We give a brief overview of biquotients and then prove that there are precisely 12 such inhomogeneous biquotients.

UG4.2	*Introduction to Percolation Theory and Cluster Size Analysis*	
Michael Ackerman	Georgia Southern University	

Percolation theory was officially introduced in 1957 to model the flow of fluids through porous material. This topic has then been extensively studied and generalized to many

applications in industry, physics and related areas. In this presentation I will use simple games and models to demonstrate the types of questions that are typically asked in percolation theory while discussing elements of graph theory and probability. I will also propose questions about higher dimensions. In two dimensional space, I will discuss a game involving a police force and a fleeing thief. I will propose questions involving the thief's chances of escape and the optimal retention strategy for the police department. These questions will be answered through graphical modeling and established theorems in percolation theory.

UG4.3	*Brownian Motion and Probability Simulations*	
Annie Brunelle	Belmont University	
I investigated classical Brownian motion looking specifically at predicting future patterns. Through the use of Monte Carlo simulations I generated Brownian motion sample paths and took a deeper look into conditional properties given past behavior. Through pattern detection I was able to develop a conjecture for the question: What is the probability that Brownian motion will stay below zero for all discretized points t=1,2,3,...,n?		

UG4.4	*Impact of Censoring on Estimator of Slope Parameter in a Simple Regression Model*	
Angela Gaetano	Belmont University	Dr. Scott Linder, Ohio Wesleyan University
When a random sample taken from a bivariate normal population is subjected to Type II censoring on one of its variates, the sampling distributions of statistics associated with simple linear regression estimators are typically mathematically intractable because the censoring mechanism induces a complex dependence structure between observations. We examine here the sampling distribution of the least-squares estimator of slope in a simple linear regression model. Using simulation, we measure the variance of this estimator (which has no closed form) under different experimental conditions, and we construct a model useful for estimating this variance from those conditions. Next, we consider the power of the standard t-test for independence in a simple linear regression model. Again, using simulation, we compute power and construct a model for it based on experimental conditions. The model allows prospective researchers to determine various combinations of experimental conditions (original sample size and degree of censoring) that obtain specified power.		

UG4.5	*Exploring Programmed Evolution Using Agent-Based Modeling*	
Micah Brown	Davidson College	
Programmed evolution attempts to reward correctly transformed cells by giving them an		

evolutionary advantage over other cells. In this research, correctly transformed cells will produce theophylline, which will bind to cells and give them an advantage, such as being antibiotic resistant. However, theophylline can diffuse through a cell membrane, which may allow non-productive cells to gain an unfair advantage. This agent-based model simulates a cellular environment in an attempt to show this relationship between the “maker” cells and the “moocher” cells.

UG5.1	*Poset Diagrams of Extended Symmetric Spaces*	
J. Tyrel Winebarger	Student	Vicky Klima Ph.D, Research Director
Representation theory of extended symmetric spaces is an increasingly important field of mathematics that gives useful insight into areas such as physics and analytics. We will focus on the extended symmetric spaces of symmetric groups and dihedral groups with the expectation that our methods will extend to other Weyl groups. Given a Weyl group W and an involution θ of W, we define the extended symmetric space of W by θ as J_θ={w ϵ W | θ(w) = w^(-1)}. In “Algorithms for Twisted Involutions of Weyl Groups,” Helmink and Haas (2012) describe a poset diagram that reveals the structure of J_θ. In hopes of finding a useful pattern, we are studying how the choice of involution and the choice of generators affect the poset diagram and how subgroups generated this way relate to one another.		

UG5.2	*Voting Theory*	
Kent Vashaw	Appalachian State University	Dr. Vicky Klima, Appalachian State University
We worked off of previous research in the field of mathematics applied to voting theory; specifically, the investigation of the ways to "weight" a voting profile, or, in other words, how to score a particular ballot in a vote. This question is important from a practical standpoint in considering the effectiveness or objectivity of voting procedures. We look at this issue from a completely mathematical standpoint, using primarily linear algebra to analyze the way a weighting procedure affects a vote. We will prove an important result using linear algebra, namely that there are mathematically infinite different ways people can vote that, when coupled with a specific weighting system, could lead to a specific numerical result. However, this particular conclusion is not always applicable to practical voting situations, and therefore we will show what these theoretically infinite ways people could vote actually means in a real world scenario. We will also investigate the converse statement: whether, given a specific way that people could vote, are there infinite, or any, weighting vectors that could be chosen in order to acheive a desired result. While this paper will only consider the mathematics behind this voting theory, the results will certainly be of interest to anyone interested in ensuring that voting accurately represents the interests of the parties involved, as these results will emphasize that the selection of a weight system for a vote is often more important than the actual vote itself.		

UG5.3	*Finite Superideal Domains*	
Ashley Lawson	Tennesse Tech University	Andrew J. Hetzel, Tennessee Tech University

A *finite superideal domain* (FSD) is a new type of algebraic structure which was developed during a 2013 summer research project at Tennessee Tech University. We define an FSD to be an integral domain with the property that every nonzero ideal of the domain is contained in only finitely many ideals of the domain. In this talk, we show the relationship between FSD's and other types of domain such as Dedekind domain, FFD (finite factorization domain), and CK-domain (Cohen-Kaplansky domain). We also present several results involving FSD's including the following characterization: Let R be an integral domain. Then R is an FSD if and only if for all nonzero ideals I in R, the factor ring R/I is a finite direct product of SPR's (special primary rings) and finite rings.

UG5.4	*Combinatorics of Quartet Amalgamation*	
Emili Price	Winthrop University	Joseph Rusinko, PhD, Winthrop University

One technique for reconstructing phylogenetic trees is inputting a set of quartet trees (containing four taxonomic units) and amalgamating them into a single supertree. We prove the minimal number, k, such that every compatible quartet system containing at least k quartets defines a unique tree. Moreover, we prove that this bound is optimal because we can construct quartet systems containing k - 1 quartets that do not define a unique tree. We examine quartet subsystems to identify necessary and sufficient conditions required to ensure that the subsystems contain a sparse set of quartets meeting the criteria of Bocker for defining a unique supertree. Moreover, we prove a lower bound for the percent of time a unique tree will be reconstructed for any number of taxa and an arbitrary set of quartets. Our technique can be applied to quartet tree amalgamation algorithms to increase the speed at which they construct supertrees.

UG5.5	*Math behind Dots*	
Amar Idrizovic	Methodist University	

The focus of the presentation will be the Math behind the popular game Dots. I am going to start off with the most common grid, square, and then move on to more advanced grids explaining the game through game theory, graph theory, combinations and probabilities. Number theory topics like how to play the perfect game, or how to increase your chances of winning will be the main idea of the presentation.
Also, I intend to address the various different versions of the Dots game and analyze why and how those variations have been formed.

UG5.6	*Classifying Finite Groups*	
Katelyn Yeomans	Georgia Southern University	

We recall a few results from group theory that are crucial in classifying finite groups. We give a few examples on how to use these results in classifying finite groups of small order.

UG6.1	*The Expected Utility of a Stabilized Middle Class in a Socioeconomic Model*	
Carol Sadek	Wofford College	

According to CollegeBoard, the United States lower class had a 13% decrease in income from 2002 to 2012. Since possible upward social and economic mobility is a desirable characteristic of the United States economy, the government tries to assist the lower class with projects such as welfare and better education. In this project, we look at how government assistance can increase upward socioeconomic mobility. We use a compartmentalized model to analyze the effects of an added socioeconomic class resulting from government assistance. We then analyze the expected utility gains of the added class. We find that, with our parameters, the number of individuals in the lower class decreases and the numbers of individuals in the middle and upper classes increase showing that with the added class, upward social mobility improves. We also find that the expected utility of the added class is directly proportional to the cost of being in the lower class.

UG6.2	*Tracking a Soccer Ball in Soccer Broadcast Videos*	
Christian Weigandt	High Point University	

Automated sports analysis is a large and growing area of study for many researchers. Companies such as NBC and ESPN use complex algorithms to make sense of visual sports data and also to improve the audience's experience. One such area of research is on the sport of soccer and, more specifically, how to detect and track a soccer ball within a broadcast video. Broadcast videos are those shown on television, so they include commercial breaks, logo transitions, and multiple camera shots. Detection of the ball is thus hindered by elements such as occlusion, camera frame rate, and camera angle. The focus of this talk will be on low-level detection of a soccer ball through the use of various computer vision techniques.

UG6.3	*Performance of Newton-Based Iterative Root Finders*	
Kayla Cline	LaGrange College	

There are many iterative methods that can be used to find roots of functions but arguments for the use of the Newton-Raphson method are supported by theory for convergence. When implemented, the speed of convergence to a root of a function is dependent upon the function itself and the accuracy of the initial guess. Straightforward adaptations on the Newton-Raphson method may reduce computational difficulty and therefore runtimes. In this talk, results of different variations of Newton's method are compared and contrasted for several classes of functions.

UG6.4	*The Mathematics in Math Placements*	
Thomas Clevenger	LaGrange College	

At institutes of higher learning, incoming students are regularly placed into mathematics

courses based upon standardized test scores, past academic history, and competency exams. However, the student placement process is often subjective, and hence inconsistent. The research presented from this undergraduate research study focuses on using linear algebra and basic data mining to remove subjectivity from the placement process based on data collected and analyzed from LaGrange College.

UG6.5	*Web-Based Analytical Tools for Golden Gate Assembly*	
Jackson Spell	Davidson College	Micah Brown, Davidson College
Golden Gate Assembly (GGA) is a technique for assembling multi-part DNA sequences. Biologists at Davidson College and Missouri Western State University have developed Junction-GGA, a more modular procedure incorporating user-standardized DNA junctions between sequences to allow repeated interchanging of parts through GGA. The complexity of designing non-interacting primers and junctions, however, renders the initial development of a multi-sequence construct challenging. The Golden Gate Assembly Junction Evaluative Tool (GGAJET) automates the junction-development process, taking in the DNA sequences and returning appropriate junctions and primers. Through strategically implemented Smith-Waterman sequence alignment analysis and secondary structure modeling, GGAJET predicts experimental difficulties and alters the junctions to maximize primer efficiency.		

UG6.6	*Is Democracy a Total Train Wreck? An Exploration of Voting Anomalies in Real-World Data*	
Nick Zayatz	High Point University	David Naylor, High Point University
Voting theory is a branch of mathematics that studies different voting methods. It has been proved mathematically that the Instant Runoff Voting (IRV) method violates certain criteria necessary for a fair vote. One particular anomaly is a violation of the Monotonicity Criterion; a voter choosing to increase their preference for a candidate can cause that candidate to do worse overall. We analyzed real-world IRV election data on large data sets in search of monotonicity anomalies, since no such software is readily available. We created software to mimic the process of running an IRV election, swapped certain voter preferences and re-ran the election to see if it affected the outcome. We also created software to compare and contrast different voting systems such as Plurality, Pairwise Comparison, and various Borda Count methods. By writing code to run each of the mentioned election types with supplied votes, we checked each system for anomalies as well as compared results for each voting method to check for differences (i.e. to find which system runs the “fairest” or “most democratic” elections). Our analysis indicates that monotonicity anomalies are rare, if present at all, in the given data, and the system of voting rarely has an impact on who gets elected.		

UG7.1	*Metacognitive Writing in Introductory Mathematics Courses*	
Carmen Cox	Duke University	Under the direction of Emily Braley

There is a divide between mathematics faculty and first year college students that proves challenging for the both of them. Because of their previous schooling, students usually have a developed attitude on the culture of math and a firm belief in how they will or will not like it. Meanwhile, faculty struggle to reveal some of the rich and complex world of mathematics to their students, while, like all college faculty, encouraging them to embrace learning itself. These clashing viewpoints of can prove challenging in creating a positive classroom experience and exposing students to the many learning opportunities provided in an entry level mathematics course, regardless of whether a student continues to pursue the study of mathematics or not. Encouraging versatility and creativity, faculty can open the door for students to hone their problem solving skills and solve a much wider variety of problems. However, in order to do this, there is a need for students to communicate to their peers, TAs, instructors and themselves how and what they do or do not understand in order for them to tackle problems. Furthermore, being able to communicate and articulate challenging concepts can help students extend their conceptual understanding. By interweaving communication and metacognition through different modes, especially writing, students and faculty alike are given bridges to reach new levels of classroom learning.

UG7.2	*Concept analysis for incorporating common core into a mathematics classroom*	
Dana Stanfill	University of Tennessee Martin	Sarah Locke (University of Tennessee Martin)
In order to implement common core into the classroom, the teacher must demonstrate the ability to break down the standard into its important concepts. We will be looking at the Concept Analysis method for doing this and using an Algebra II Tennessee State Standard as an example.		

UG7.3	*Quasipositive Curvature on Biquotients of Sp(3)*	
Michael Ruddy	University of Tennessee at Martin	Additional Presenter/Speaker: Philip Wesner, undergraduate at University of Tennessee at Martin
In this presentation we will introduce Riemannian manifolds, biquotients, and techniques of proving positive curvature. We will also present the results of our research, that six biquotients of Sp(3) admit metrics of quasipositive curvature.		

UG7.4	*Finding the sum of an infinite series that contains Fibonacci Numbers*	
John Watson	The Citadel	
In this talk we will explain how we solved a pseudo-alternated series which contains Fibonacci		

numbers. First, by proving that the pseudo-alternated series containing the Fibonacci numbers converges. We will then discuss the possible generalization of this problem. The problem solved is from an issue of the Fibonacci Quarterly.

UG7.5	*Collatz Sequences mod m and Parity Sequences*	
Micah Jackson	Georgia Southern University	
The Collatz Conjecture, named after Lothar Collatz, is an open problem that is stated as follows: Beginning with any positive integer a_0, the sequence of numbers created by iterating the process $a_{n+1} = \frac{1}{2} a_n$ if a_n is even, or $3a_n + 1$, if a_n is odd, will eventually reach the cycle 4, 2, 1. Although the problem, also known as the $3x+1$ Problem, is simple to state and easy to "understand," a proof has eluded mathematicians. In fact, the famous mathematician Paul Erdős commented, ``Mathematics is not yet ready for such problems." We examine Collatz sequences a_n mod m for various values of the modulus m, focusing on $m = 2$, or the parity sequence. For instance, we investigate whether a_n can reach the cycle 4, 2, 1 mod m before the non-reduced sequence reaches 4, 2, 1, and categorize this behavior. We also study the uniqueness of parity sequences and theorems that we can derive from their characteristics..		

UG7.6	*Generating the Fibonacci Numbers, Literally*	
Michael Burnette	The University of Tennessee at Martin	
By using simple algegra and basic knowledge of geometric series, a generating function can be used to derive an expression which gives the nth Fibonacci number. This also shows a connection between the Fibonacci numbers and another interesting topic.		

VC1.1	*Online Learning via the IPython Notebook*	
Jeff Knisley	East Tennessee State University	
Teaching mathematics and statistics in online courses requires the ability both to present and to assess substantive mathematical calculations and data analysis. The IPython notebook allows both in the same context, as we will demonstrate via a number of IPython notebook activities and assessments. Included will be examples from calculus, linear algebra, statistics, the analysis of large data sets, and mathematical computing. Material is from online courses in computation, predictive modeling, and statistical learning applied to "Big Data." Notebooks used in the talk will be available for download, with links provided during the talk itself.		

VC1.2	*Researching through the firewall: Lessons learned participating in an international high school research program*

Carl Yerger	Davidson College	
Recently I was recruited to be an instructor for a virtual research program that connected me with talented high school students from China. I plan to describe my experiences about what I learned from teaching online to students living in a very different country in a very different living and learning situation The focus of my talk will be a discussion of the challenges I have encountered during my first time teaching in this format and the things that I've learned through participating in the program.		

VC1.3	*Employing the Math Emporium Model to Engage Students in Key Freshman-Level Math Courses.*	
Nicholas Luke	North Carolina A&T State University	Kathy Cousins-Cooper, North Carolina A&T State University
This presentation will examine the experiences of the presenter in developing and implementing the Math Emporium model of teaching and learning for a freshman sequence of courses in College Algebra & Trigonometry. The Math Emporium model of instructional delivery includes methods to encourage and require students' participation in the classroom such as self-paced instruction, peer tutoring, and immediate feedback. Effects of the implementation of the Math Emporium in regards to the classroom environment and students' performance in these classes, as well as future plans for expansion of this model will also be presented.		

VC1.4	*My Trek Into the Great Online Unknown*	
Jeffrey Powell	Samford University	
Last May, I was asked by our College of Arts and Sciences to join a small group of faculty to develop and teach some of our first completely online courses. There was one problem--I had no idea how to go about doing it! Fortunately, I got it everything together and the course was taught for the first time during our recent January term. In this talk, I'll describe my journey to design an online course for the first time and give some tips for those who find themselves in a similar situation. I'll also discuss some of the lessons learned from my first time teaching the course.		

VC1.5	*Lessons Learned from a First-Time Online College Algebra Course*	
Jon Ernstberger	LaGrange College	
LaGrange College (a small liberal arts college) piloted an online college algebra course in the Fall 2013 term. The course concluded with a spectrum of lessons to be learned. Causes for successes and failures in the course along with lessons learned and plans for the first revision will be discussed.		

WC1.1	*Using Writing in Undergraduate Mathematics Classes to Dispel "Word Problem" Anxiety and Enhance Mathematical Understanding*	
Tonya Adkins	Johnson & Wales University - Charlotte	
Most students dread "word problems," often because the connection between reading and		

mathematics has never been made for them. Using writing in mathematics can assist in making mathematical connections and reducing the fear and anxiety many students have when having to tackle a math problem that requires reading. In this talk, I will present examples of using various forms of writing in undergraduate math classes (Statistics, Algebra, and Survey) that have been successful in leading students toward success.

WC1.2	*Real World Projects, Real World Writing*	
Andrew Miller	Belmont University	
Over the past several years, I have taught a quantitative-literacy-focused general education class that is built around projects that engage students in realistic quantitative analysis and critical thinking. In this course, students investigate quantitative issues related to consumer credit and personal finance, and each project features a final product addressed to a real-world audience. I will describe several of these projects, including assignments to produce press releases, brochures, personal letters, lesson plans, and policy recommendations.		

WC1.3	*Reflective Writing*	
Emily Braley	Duke University	
Students frequently ask one another "How did you do on that test?" Typical responses to this question give no information about the test, the student's performance, or the student's preparation. Commonly a response includes a score or list of mistakes. We've designed student writing assignments aimed at meaningful reflection on in class exams. These assignments require students to communicate their understanding of the types of questions being asked on assessments (i.e. conceptual questions, skill testing questions) and describe what in their preparation helped them or hindered them in answering questions. The purpose of this study is to identify whether students recognize conceptual questions, and determine whether reflection on exam preparation can influence students' future preparation. Student writing samples and feedback on entry and exit surveys were collected in Fall 2013. In this talk we'll discuss preliminary results.		

WC2.1	*Grading Written College Mathematics -- Methods and Outcomes*	
Rann Bar-On	Duke University	
Traditionally, college mathematics classes do not include a significant writing component. In		

applications of mathematics, however, calculations are rarely presented by themselves. Rather, they are accompanied by text, narrative, and description. In the 1980's, Duke University's calculus program was reformed to include a significant writing component. Since that time, Duke's laboratory-based calculus classes have included a once-a-week extended problem solving session, in which students work in groups to apply the material learned in regular class sessions to data sets and problems from a variety of fields, from chemistry to economics, from environmental science to population dynamics. Upon completion of the lab, students are required to present their results as a lab report--often a significant group paper, with narrative and description. These may take the form of a textbook chapter, a position paper, or other long-form replies. In this paper, I discuss the grading of such reports, and the observed changes in student expectation and writing abilities.

WC2.2	*LaTeXnics: the effect of technical typesetting software on students' writing processes*	
Patrick Bahls	University of North Carolina, Asheville	Amanda Wray, University of North Carolina, Asheville
Mathematics and the mathematical sciences erect barriers to students' self-expression which are not found in many other disciplines. The prevalence of technical terminology, notation, and pagination makes it difficult for students to craft professional-quality writing without the use of typesetting devices (like LaTeX) designed specifically for mathematical communication. Such devices have at least somewhat steep learning curves and gaining facility with these devices may have an impact on students' mathematical cognition as well as on their writing habits. Our study examines students in three sections of two distinct mathematics courses taught at two different universities. In each section surveyed students were required to use LaTeX to craft their solutions to homework and exam problems. Students were surveyed at the beginning and the end of the semester regarding their LaTeX use and their writing habits, and certain students were interviewed in greater depth. In this presentation we present our findings from our study of LaTeX's effects on both the students' writing process and on their acquisition of mathematical knowledge.		

WC2.3	*Teaching students how to write mathematics: addressing writing issues in freshman seminars, bridge classes, and senior capstone courses*	
Julie Barnes	Western Carolina University	
Students often believe that they know how to write mathematics because they have been		

writing since elementary school, but most students have little to no experience writing in mathematics. In this talk, we look at some techniques that can be used to prevent common writing problems in mathematics classes such as a lack of mathematical style and rigor, sloppy work, and plagiarism. In many cases, the underlying problem is that students either try to treat writing math like composing an English essay or they ignore words completely and jump to math equations alone. We will consider examples of some methods for approaching writing problems that can be modified for vastly different kinds of mathematics courses.

WC2.4	*Math in the City: Writing Outside the Classroom*	
Liz Bouzarth	Furman University	
Math in the City is a course at Furman University that gives students an opportunity to use their quantitative and problem solving skills to work on a project of interest to the local community. This course requires students to communicate with a variety of audiences in a variety of media. Students need to convey critical information, articulate questions, and present results and analysis to city officials, academic audiences, and the general public. In addressing these diverse audiences in both oral and written forms, the students develop their ability to shift communication styles for the intended audience of their work. This talk will introduce you to the Downtown Greenville parking optimization project while emphasizing the different written and oral communication expectations the students were under at various points throughout the course.		

WC2.5	*Mat-Rix-Toe: Improving Writing in Linear Algebra*	
Adam Graham-Squire	High Point University	
The Mat-Rix-Toe project utilizes a matrix-based game to deepen students' understanding of linear algebra concepts and strengthen students' ability to express themselves mathematically. The game is similar to Tic-Tac-Toe and is easy to learn, but the strategy necessary to win is far from clear, and not easy to solve with an algorithm. The combination of those factors, plus a thorough editing component, makes the Mat-Rix-Toe project an effective tool in introducing students to mathematical writing. We will discuss how differences in the implementation of the project illustrate the benefits and drawbacks of using the project to incorporate writing and editing in the math classroom.		

WC2.6	*Grading Writing Assignments in First Year Mathematics Classes*	
Jack Bookman	Duke University	
One of the impediments to assigning writing assignments in mathematics classes is the difficulties faced in grading student papers. Furthermore, students often question the purpose		

and value of these assignments. Communicating clear expectations to the students, including the nature of the assignment, guidelines for writing in mathematics and how the papers will be graded, can help address these attitudes. In this presentation, I will discuss some ways to communicate those expectations to first year students. I will compare the advantages and disadvantages of holistic grading vs grading with rubrics and discuss the value of double submission of papers.