MAA SOUTHEASTERN SECTION

MATHEMATICAL ASSOCIATION OF AMERICA

Ninety-Sixth Annual Meeting

Mercer University

Macon, Georgia

Thursday—Saturday, March 9-11, 2017

http://sections.maa.org/southeastern/?2017_Conference

Abstracts for all Talks

SS2.4	**Friday 2:40:00 PM**	*My PIC Math Experience: Finding Problems, Course Design, and Lessons Learned*
Zach Abernathy		Winthrop University
The main goal of this talk will be to share my experiences teaching a research-focused industrial mathematics course as part of the NSF-funded Preparing Industrial Careers in the Mathematical Sciences (PIC Math) program sponsored by the MAA and SIAM. I will focus on the process of establishing contact with local industries, offer suggestions for course design to keep students engaged and manage team dynamics, and share several other tips such as how to acquire data mining software. I will also discuss various outcomes (for both myself and my students) that emerged from the course as well as lessons learned for improving the course in its next iteration.		

SS1.4	**Friday 3:00:00 PM**	*Using Embroidery to Explore Mapping the Sphere to the Plane*
Shemsi Alhaddad		University of South Carolina at Lancaster
I use hand-embroidered balls (temari) and hand-embroidered fat quarters to illustrate properties of stereographic and cylindrical projections of the sphere to the plane. In this talk I will start with a brief introduction to temari. Then I will explain the mathematics used in projecting the spherical temari designs to the fat quarters that represent the plane. I will describe mathematical properties of the designs that are preserved and ones that are lost under the projection. I will also present teaching ideas and adaptations that will allow these concepts to be introduced to students of different levels.		

UT9.5	**Saturday** **11:20:00 AM**	*Ensuring Fairly Timed Network Communication*
James Andrus		The Citadel
Given the rise in network based collaboration, online stock trading, and competitive online gaming, it has become increasingly important that all parties involved receive information at the same time. We propose an algorithm to fix the issue of unfair delays between different parties participating in a collaborative application. The algorithm proposed applies to networks with a single source and with multiple destinations. It starts with a modified form of Dijkstra's algorithm that ensures that all destinations are leaf vertices. For any destinations that are outside a given delay bound, the algorithm finds a new path from the source vertex to the specific destination vertex within the delay bound if such a path exists. The algorithm works by concatenating simple paths, meaning that no vertex will be used more than twice if cycles arise, ensuring that bandwidth does not become an issue. The process used by this algorithm is similar to a depth first search, recursively exhausting adjacent vertices that meet certain criteria until a suitable path is found or terminating if no such path exists. This algorithm has a variety of direct applications where fair and timely communication is essential, including sending updates to distributed financial databases, maintaining quality of service in video conferencing, or ensuring fairness in online gaming. In our research, we propose this algorithm for fairly timed network communication, provide proof of correctness for the proposed algorithm, and perform simulation experiments to analyze its efficiency.		

SS3.4	**Friday** **3:00:00 PM**	*Bounding the k-Domination Number*
John Asplund		Dalton State College
When faced with a parameter that is computationally infeasible to calculate, finding a computationally efficient bound on the parameter can be a helpful starting point. Caro and Pepper introduced in 2014 the degree sequence index strategy (DSI-strategy) which provides a unified framework for using the degree sequence of a graph to bound NP-hard invariants. This talk will describe a new domination invariant based on this DSI-strategy that bounds the *k*-domination number. The *k*-domination number is the minimum cardinality of a set of vertices S such that each vertex not in S is adjacent to at least k vertices in S. In addition, we will describe properties that are inherent in this new domination number.		

SS1.6	**Friday 3:40:00 PM**	*Teaching Algorithms using the Josephus Problem and Music*
Shaun Ault		Valdosta State University
The Josephus Problem is a famous counting problem in which elements of a circular array are chosen in turn according to a simple rule: skip a fixed number of elements before choosing the next element. In fact this problem leads to an algorithm that produces a permutation of the original sequence of elements. In this preliminary report we discuss the use of the Josephus Problem in teaching primary school students about combinatorics and algorithms. To make the lessons fun and memorable, we relate the permutation to a sequence of notes of the diatonic or chromatic scales, varying the number of initial notes as well as the number of skipped notes. This can be done in a hands-on way using an instrument with movable notes such as a xylophone, which we intend to demonstrate during the presentation. This study can bridge the gap between mathematics and art, as students can use the Josephus Problem to compose new music "algorithmically."		

UT9.6	**Saturday 11:40:00 AM**	*Ascending Subgraph Decompositions of the Oriented Multipartite Graphs K(2 : 3n)*
Andrea Austin		University of Tennessee at Martin
In 1987, Alavi, Boals, Chartrand, Erdos, and Oellermann conjectured that all graphs have an ascending subgraph decomposition (ASD). We will show that all oriented complete multipartite graphs with 3*n* partite classes each containing 2 vertices or oriented *K(2:3n)* have an ASD.		

DS.1	**Friday** **9:00:00 AM**	*Undergraduate Research in Galois Theory*
Chad Awtrey		Elon University
The work of 19th century mathematician Evariste Galois shows that roots of polynomials have inherent symmetries. These symmetries are encoded as permutations of the roots, and they reveal many important properties of the polynomial. In this talk, we will discuss some of these properties, the history of Galois' work, and recent results obtained by the speaker's undergraduate researchers in the area of computational Galois theory. General benefits of conducting undergraduate research will be highlighted throughout the talk.		

UP1.1	**Saturday 10:45:00 AM**	*Dominance Domains and the 17-Year Cicada*
Sam Barker		King University
Why the lifespan of the 17-year Cicada is so long has stumped biologists. But what if the answer to this puzzle lies in the sky above? In particular, extrapolating the current recession rate 3.8 cm/yr of the Moon from the Earth, shows that about 250 million years ago, the number of moons per year ω was about 12 + 2/3 rather than what is today, namely, ω ≈ 12.369, a number in the dominance domain of 12+7/19. Thus the life span of the cicada's ancestors may have had a three year life cycle 250 million years ago. As time went on, ω decreased into the dominance domain of 12+3/5 moons/year, whereupon the cicada's lifespan may have leapfrogged into five years, and so on. We apply continued fraction algorithms and dominance domains to model this leapfrogging until ω reached the dominance domain of 12+10/19, an event occurring about 100 million years ago, at which time the cicada may have finalized its life span to what it is today.		

UP1.2	**Saturday 10:45:00 AM**	*Sabermetrics and it's historical impact in sports*
Tyler Barker		Western Carolina University
This poster will present the concept of Sabermetrics in a variety of sports, and its historical context. From early in the popularization of modern sports in America, there has been a competitive desire for tools that allow for an athlete's current impact on the game to be compared to how said athlete projects in the future. Traditionally this was done based off of key raw measurable data and a scout's intuition. A fatal flaw that existed was a tendency towards a exclusionist system, which categorized the have's and the have-not's on a limited basis. Specifically in Baseball, In the 1950's, this system of scouting included an evaluation-based rating, scaling from "poor" to "very good" . Restricting in nature, this scouting had the potential to sabotage an athlete due to Surgery, or an uncharacteristically poor performance. Further development occurred in the late 1970's, based off a more concise "1-7" scale in more measurables which time had shown to be an indicator of future success. Limited by what only the eyes could see, certain statistics could not exist. Bill James, in a series of 40 journals known as The Baseball Analytics (the foundations of the Society of American Baseball Research, or SABR) ushered in a new era looking past blinding biases of the past, Such as age, size, or injuries. By producing these new statistics, known as Sabermetrics, traditional methods of scouting and review in all major sports are being revolutionized.		

SS1.2	**Friday 2:20:00 PM**	*Flowers, Kaleidoscopes, and Coloring Book Images Hiding in Complex Rational Function Projections*
Julie Barnes		Western Carolina University
There is a surprising interplay between the Julia sets of complex rational functions, R(z), and the level curves of the real parts of the iterates of these complex functions. For level curves of height 2 and -2, we can begin to see the actual Julia set for R(z) appear as the number of iterates of R(z) increases. The 0 level curves, on the other hand, produce intricate images near the critical points of R^n that happen to land at 0 under n iterations. Since all critical points of the real part of R^n are saddle points, these level curves have surprising shapes like flowers, kaleidoscopes, and other images that resemble popular adult coloring book pages. In this talk we look at a variety of images produced, the simple Mathematica code used to produce the images, and how these images are related to complex rational maps.		

UT9.3	**Saturday 10:40:00 AM**	*Weakened Gallai-Ramsey Numbers*
Gabrielle Beam		Western Carolina University
Through the years, different mathematicians have constructed and derived many different generalizations of a t-colored Ramsey Number $r^t(n)$. The research this talk will be based upon is concentrated on the amalgamation of two such generalizations. Specifically, we will focus on weakened Ramsey Numbers and Gallai-Ramsey Numbers. Briefly defined, weakened Ramsey Numbers determine the existence of subgraphs spanned by edges containing at most *s* colors where ($s<t$), while Gallai-Ramsey Numbers consider only colorings that avoid rainbow triangle (meaning three vertices *x, y*, and *z* such that the edges of *xy, yz*, and *xz* are different colors).		

UP1.3	**Saturday 10:45:00 AM**	*An Examination of the RSA Cryptosystem*
Brooke Beeksma		Converse College
The following poster will survey the undergraduate senior seminar project, "An Examination of the RSA Cryptosystem." The project paper discusses the history of Cryptology and the RSA Cryptosystem and how Cryptology is used today. It then continues to explain some important math concepts involved with the process of the RSA Cryptosystem. It proceeds to explain, in detail, an original Diffie-Hellman-Merkle Key Exchange problem, the process of Successive Squaring, and the process of computing k roots modulo m. Finally, original RSA encryption and decryption problems are presented. This information will be presented, focusing on the original Diffie-Hellman-Merkle Key Exchange Problem, and a detailed presentation of the original RSA Cryptosystem problems. An understanding of RSA Cryptosystem will be communicated.		

SS4.5	**Saturday 11:20:00 AM**	*Using Kahoot! in your Classroom*
Jim Beuerle		Elon University
Kahoot! is an online quiz/poll/survey system that allows participants to use their own internet connected device to answer questions in real time. In this talk, the basic overview of the system will be discussed as it was used in the first several weeks of an introductory Statistics class. Bring your smartphone or other internet connected device to participate in a live Kahoot! session.		

PUB.3	**Friday 3:00:00 PM**	*Refresh Algebra and Trigonometry Skills and Improve Conceptual Understanding Through Visualization with WebAssign for Calculus*
Glenda Blake		Cengage Learning
Although the concepts of Calculus have not changed since Newton, the technology available to assist in their teaching continuously evolves. View the unique tools that will help students refresh algebra and trigonometry skills, before interactive assets aid the learning of the critical concepts of the dynamic Calculus course.		

UT5.2	**Saturday 10:20:00 AM**	*Partial Spanning Trees: A Strategy for Ticket to Ride*
Catherine Bowers		Birmingham Southern College
Partial spanning trees are trees (sets of acyclic, connected edges) within a graph that do not connect all of the graph's vertices. Minimum spanning trees connect all the vertices within a graph in a way that minimizes the sum of edge weights. Using graph theory to combine the concepts of partial and minimum spanning trees, we modify Prim's algorithm to solve a constraint maximization problem with respect to the board game Ticket to Ride. Partial minimum spanning trees provide strategies for where to claim routes on the board to collect the most points and, ultimately, win.		

SS3.6	**Friday 3:40:00 PM**	*Fixing Congressional Dysfunction with Polynomials*
Axel Brandt		Davidson College
Imagine how difficult it must be to effectively schedule committee meetings for the U.S. Congress without a representative having two meetings at the same time. And imagine how much harder it must be to effectively schedule committee meetings if you must work around the existing schedules of all 435 members of the House and all 100 members of the Senate. In this talk, we use these scheduling problems to motivate and discuss two types of graph colorings. Further, we will discuss how information can be stored in polynomials and then used to assist in coloring graphs. Some results using this technique will also be presented.		

UT3.1	**Friday 2:00:00 PM**	*Global Dynamics of a Colorectal Cancer Treatment Model with Cancer Stem Cells*
Kelsey Brown		High Point University
We present and analyze a mathematical model of the treatment of colorectal cancer using a system of nonlinear ordinary differential equations. The model describes the effectiveness of immunotherapy and chemotherapy for treatment of tumor cells and cancer stem cells (CSCs). The effects of CD8+T cells, natural killer cells, and interleukin proteins on tumor cells and CSCs under the influence of treatment are also illustrated. Using the method of localization of compact invariant sets, we present conditions on treatment parameters to guarantee a globally attracting tumor clearance state. Numerical simulations and sensitivity analyses of the model are examined using biologically sound parameters to assess the validity of the model.		

PUB.3	**Friday 3:00:00 PM**	*Refresh Algebra and Trigonometry Skills and Improve Conceptual Understanding Through Visualization with WebAssign for Calculus*
Shelita Brown		Cengage Learning
Although the concepts of Calculus have not changed since Newton, the technology available to assist in their teaching continuously evolves. View the unique tools that will help students refresh algebra and trigonometry skills, before interactive assets aid the learning of the critical concepts of the dynamic Calculus course.		

CP6.3	**Friday 11:20:00 AM**	*n-Good Hypergraphs*
Mark Budden		Western Carolina University
First defined by Burr and Erdos in 1983, an *n*-good graph *G* is a connected graph of order *m* such that the Ramsey number $R(G, K_n)=(m-1)(n-1)+1$. From this definition and Chvatal's work in 1977, it follows that all trees are *n*-good. In this talk, we will consider how one might go about defining ``*n*-good'' in the setting of *r*-uniform hypergraphs and consider the problem of determining whether or not *r*-uniform trees satisfy the conditions of this definition.		

SS2.3	**Friday 2:40:00 PM**	*Strategies for Identifying Good Undergraduate Research Problems*
Mark Budden		Western Carolina University
While a student's work ethic and academic abilities play a major role in the success of an undergraduate research project, the selection of a good research problem is critical. In this talk, we will consider the criteria for judging the quality of an undergraduate research problem and discuss some strategies for identifying good problems.		

SS1.1	**Friday 2:00:00 PM**	*Hidden Beauty in Penrose Tiling: Weavings, Lace & Skates*
Doug Burkholder		Lenoir Rhyne University
We explore Penrose's subdivision of kites and darts in search for hidden beauty. By dividing the kites and darts in half and selectively coloring them based only on their relative position, we create 15 unexpected and distinctive patterns hidden within Penrose tiling. These patterns tend to have the appearance of a weaving. Alternately, by selectively removing tiles as we subdivide, we can obtain fractal patterns that appear to be lace. Very different and beautiful artwork can be constructed by sketching pursuant curves within each tile tossed out in the previous construction.		

UP1.4	**Saturday 10:45:00 AM**	*Fibonacci and Finance: Finding Universal Solutions to Fibonacci's 3 problems from Liber Abaci*
Amy Burton		Erskine College
Though Leonardo Pisano is most famous for the Fibonacci sequence, his work in the world of economics spreads almost as wide. This poster closely examines three problems from Chapter 12 of Fibonacci's Book of Calculation: "On a Soldier Receiving Three Hundred Bezants for His Fief", "A Man Who Travelled through Twelve Cities", and "On a Man Who Leaves a City with Ten Doors". Fibonacci's methods of solution are analyzed and explained. Using present value analysis, the summation of series, and mathematical modeling, we show the connection between these problems and present day modern economic theory.		

CP5.1	**Saturday 10:00:00 AM**	*Informal Writing in the Calculus I Classroom*
Danielle Burton		University of Tennessee at Knoxville
We will explore how informal writing activities can be easily integrated into a mathematics classroom and can support course goals. We will discuss examples of prompts and student work from a Calculus I class.		

UT6.2	**Saturday 10:20:00 AM**	*A Prime Sieve Using Moduli and Closed Groups*
Anthony Bush		Georgia Southern University
The prime numbers is a subject that has intrigued mathematicians from ancient times to today. Currently, the primes find their usefulness largely in the field of computer science, where the ability to generate a list of prime numbers can quickly prove useful to several applications, such as hashing or public key cryptography. In such situations, a generating function for primes would be ideal; however, it seems that mankind's struggle to find such a function has come up empty. To date, the closest we have come is to implement algorithms called prime "sieves" that efficiently remove composite numbers from a list of candidate primes. This presentation will show how we can use certain moduli and closed groups to effectively sieve out composite numbers from a list of integers. Multiple tests have been conducted to determine the speed and efficiency of this sieve compared to other sieves.		

UT4.3	**Friday 2:40:00 PM**	*Abstract Withdrawn*

WS.2	**Friday** **10:00:00 AM**	*Speed Interviewing Marathon for Students*
Jenna Carpenter		Campbell University
Employers suggest that communication skills are a critical component when considering a mathematics major for a job. An important time to demonstrate good communication skills is during the job interview. This session for undergraduate students and graduate students will start with an overview of best practices and tips on job interviewing, then guide participants in several speed interviewing sessions of 10 minutes each, where they can practice what they have learned and hone their interviewing skills. Speed interviewing sessions will include individual feedback for participants, as well as opportunities to network with fellow interviewees.		

CP4.1	**Friday 2:00:00 PM**	*The Initial Impact of No-Cost Materials Engagement and Achievement in College Algebra.*
Samuel Cartwright		Fort Valley State University
The high cost of textbooks has negatively impacted students' ability to afford the rising cost of a college education. In order to minimize the cost of materials needed for the courses and the increasing of use student loans, Open stax resources were created to help students with online mathematical resources. Observing the increasingly high DWF grades and absentee rates in college algebra, the Math faculty observed that most students could not afford to purchase high cost textbooks. Therefore, the faculty redesigned college algebra using no cost e-textbook with a mandatory MATHXL Laboratory installed in the D2L (Brightspace) platform. Best practices information were provided on the course redesign to: make math affordable; increase minority achievement and technology usage; and share skills for adapting open resources in other future higher level math courses.		

UT5.3	**Saturday 10:40:00 AM**	*Network modelling of infectious disease: transmission, control and prevention*
Christina Chandler		Georgia Southern University
Many factors come into play when it comes to the transmission of infectious diseases. In disease control and prevention, it is inevitable to consider the general population and the relationships between individuals as a whole, which calls for advanced mathematical modeling approaches. We will use the concept of network flow and the modified Ford-Fulkerson algorithm to demonstrate the transmission of infectious diseases over a given period of time. Through our model one can observe what possible measures should be taken or improved upon in the case of an epidemic. We identify key nodes and edges in the resulted network, which will help determine an improved plan of disease prevention. This solution has been implemented through a Java code.		

GS2.1	**Friday 4:15:00 PM**	*Mathematical Celebrity Look-Alikes*
Tim Chartier		Davidson College
Who is your celebrity look alike? LeBron James? Jackie Chan? Adele? Rihanna? Vectors norms enable us to discern what celebrity looks most like a selected individual. Linear algebra allows us to explore what linear combination of celebrity photos best approximates a selected photo. Would you describe yourself as a cross between Ben Stiller and Hugh Jackman or possibly Marilyn Monroe and Jennifer Aniston? In this talk, we learn how to answer this question using linear algebra and on the way get a sense of how math aids in facial recognition.		

CP3.1	**Friday** **2:00:00 PM**	*Application of neural networks to Classification of handwritten Digits and short term stock returns*
Tracy Chen		University of North Carolina-Wilmington
Artificial Neural Networks (ANN) are a data mining method that borrows concepts from neuroscience to create an information synthesizing machine similar to the human brain. These sophisticated models have the ability to detect non-linear patterns that other data modeling tools fail to use in their predictions, making them very popular in recent literature. In this paper we explore the process of training and selecting neural network models for two different applications in handwritten Digits and short term stock returns. For the positive or negative short term stock returns with data from Facebook (FB), we further consider the decision fusion by combining the results from ANN with the methods of SVM and boosting to achieve better performance.		

UT8.1	**Saturday** **10:00:00 AM**	*Determinant of a Fibonacci matrix*
Hsin-Yun Ching		The Citadel
In this presentation I will show the solution of an open problem given in the journal Fibonacci Quarterly. The problem was to find the determinant of a matrix of order n with Fibonacci numbers as entries. If the square matrix have even number rows and columns, such as two by two matrix, the determinant of it would be zero. On the other hand, if it has odd number of rows and columns, such as three by three matrix, its determinant would be one. I will highlight some linear algebra techniques that I used to solve the problem and the solution has since been submitted for consideration to be published in the same journal mentioned earlier.		

UT2.3	**Friday** **2:40:00 PM**	*Using Mathematical Models to Rank the Members of Criminal Networks*
Lucas Chirino		High Point University
Different mathematical approaches to ranking were used to determine the level of importance of every member in two different data sets from the FBI consisting of phone records. The first data set consisted of call logs from a three year span of members of a drug ring. The second data set consisted of the call logs of members in a gang. Linear algebra was used to rank the data and then analysis was done to look at various mathematical properties of the two networks.		

CP7.1	**Saturday 2:20:00 PM**	*Comparing Two Populations Using Reaction Time Data*
Andrew Chockla		Western Carolina University
Comparing two population parameters is an important and useful topic of statistics. Hypothesis tests and confidence intervals are two types of statistical tests that can be utilized to make inferences regarding the populations of interest. Depending on the nature of the data collected, you may be interested in the difference between population mean values using matched pairs, the difference between population mean values not using matched pairs, or the difference in population proportion values. Classroom activities can be an exciting and helpful way for students to become engaged in learning various ways to apply statistics to this study of two populations. However, doing a different activity for each method could become tedious and time consuming. During this talk, we will look at one data collection activity and how it can be applied to various methods used to make an inference regarding two populations of interest.		

UT1.3	**Friday 2:40:00 PM**	*Random Unit Bar Visibility and Unit Bar Visibility Graphs*
Jiarui Chu		Davidson College
In visibility problems, two unit bars are visible to each other if an unobstructed vertical line of sight can be drawn between them. Similarly, two unit squares in a two-dimensional space are mutually visible if there is an unobstructed vertical or horizontal sightline between them. The study of visibility problems and visibility graphs are motivated by Very-Large-Scale-Integration (VLSI) layout design problems, and have applications in robot navigation, hidden-surface removal, and computer-aided software-engineering (CASE) tools. Although there is a rich body of research on visibility, no result has been published on the probabilistic aspects of visibility problems. We assume the locations of the bars and squares to be uniformly distributed, and study three problems. We derive the probability density function and expected value for the number of bars required to cover the top bar. Then we generalize the result to random squares in a two-dimensional space. Finally, we consider unit bar visibility as a model for random graphs by studying the probabilities that a random unit bar visibility graph has certain properties, such as being cyclic or connected.		

UP1.5	**Saturday 10:45:00 AM**	*Image Processing for Classification and Regression*
Danielle Chuang		University of North Carolina-Wilmington
This project focuses on identifying characteristics from a set of images of faces. These faces are from the MORPH-II dataset that use the Bio-Inspired-Feature technology at West Virginia University to extract meaningful data points from the images. Each image is quantified to 4,376 real value points and we use mathematical techniques to extract meaningful characteristics from the images. In order to predict characteristics from new images we can apply the same models that have learned from the old images. Thus, the project can be broken down into steps: 1) Dimension reduction and 2) Classification & regression. In order to save computational time, we use dimension reduction. Classification methods help us determine the genders, and regression helps determine the approximate ages.		

CP4.2	**Friday 2:20:00 PM**	*Strengthening Real World Skills with Math Courses*
Erin Cooke Church		Georgia State University
It is expected that math courses will focus on math skills to help students master the objectives. However, building students' real world skills can contribute to their success in math courses. This talk discusses important life skills that many students have not mastered and ways to present these in a course. These skills include time management, growth mindset, reducing anxiety and study strategies.		

CP1.6	**Friday 3:40:00 PM**	*Linear Inequalities: We Shouldn't Avoid Them*
Jeffery Clark		Elon University
This talk will review ways in which linear inequalities naturally occur in Game Theory and Linear Programming, and discuss Fourier-Motzkin Elimination, a method for handling small systems that should be better known.		

UP1.6	**Saturday 10:45:00 AM**	*The Fractional Calculus*
Laura Coker		University of Tennessee at Martin
The idea of one-third differintegrals started with the study of the text The Fractional Calculus by Keith B.Oldham and Jerome Spanier, which focuses on half differintegrals. We have been researching this topic with Dr. Curtis Kunkel on this project since June 2016. Then we started looking into one-third differintegrals and created a table of such differintegrals. The concept of a differintegral is basically the creation of an operator that does the same thing as a standard derivative only in multiple steps. For instance, if we apply the one-third differintegral to a function three times, it should be equivalent to taking the standard derivative of the same function. Throughout this poster, we will discuss aspects of the Gamma function, one-third differintegrals, and various proofs established during our research.		

UT6.5	**Saturday 11:20:00 AM**	*Elliptic curves induced by nice cubic polynomials*
Darien Converse		Armstrong State University
We say that a cubic polynomial f(x) is nice if it has integer roots and critical numbers. We will study elliptic curves of the form y^2=f(x). We will determine the set of nice cubic polynomials that induce elliptic curves with complex multiplication.		

UT7.5	**Saturday 11:20:00 AM**	*The O-C diagram and Its Application to Astrophysical Systems*
Kyle Corcoran		High Point University
Of all the directly observable quantities in astrophysics, time can be measured with the highest precision. Some eclipsing binary systems and pulsating stars show periodic brightness variations so stable that they can be used as astrophysical “clocks” spread throughout the universe. Using a Taylor series expansion, namely the Maclaurin series, one can calculate the predicted arrival times of the pulses in these variable systems. Once observations reveal the true arrival times, one can compare the two in what is called an “observed minus calculated” (O-C) diagram. This simple-but-powerful plot can reveal the presence of previously-unknown gravitating companions, pulsational variations in evolving variable stars, and even the spin-down of binary stars as they emit gravitational wave radiation. Here we present an overview of the O-C method and its applications to extreme eclipsing binary star systems.		

UT5.5	**Saturday** **11:20:00 AM**	*Effects of competition-mediated dispersal on the persistence of a population*
Emily Cosgrove		Auburn University at Montgomery
Dispersal of an organism plays an important role in individual fitness, population dynamics, and species distribution. In the literature, dispersal is loosely applied to movement over different spatial scales, e.g. movement between habitat patches separated in space from other areas. Recently, ecologists have found that the presence of a competitor can have a major impact on the dispersal of an organism, a phenomenon known as competition-mediated dispersal. Little is known regarding the patch-level consequences of habitat fragmentation of competing species in the presence of competition-mediated dispersal. In this talk, we will develop a patch-level model built on the reaction diffusion framework to explore effects of habitat fragmentation and competition-mediated dispersal. Our results will focus on a one-dimensional patch and methods from nonlinear analysis such as time map analysis (quadrature method) and linearized stability. We will also briefly explain the biological importance of our results.		

UT3.5	**Friday** **3:20:00 PM**	*A MATHEMATICAL ANALYSIS ON THE TRANSMISSION DYNAMICS OF NEISSERIA GONORRHOEAE*
Christine Craib		University of North Carolina-Wilmington
In this project, we analyze an epidemiological model describing the transmission of gonorrhea. We address two stratifications-one based on age groups, and one based on education levels-each with a core sexual activity class and two noncore sexual activity classes. Using parameters based on sexual behavior in the United States, we address the impact of the average number of partners per year for each sexual activity class on the behavior of the model around two equilibrium points, a disease-free equilibrium and an endemic equilibrium. The focus of the project is to identify the conditions leading to the existence of each of the equilibrium points, analyze the stability of these points, and discuss the results. Ultimately, the goal of the project is to find conditions for the bifurcation of the two equilibrium points, in order to find the conditions resulting in the eradication of gonorrhea.		

UT7.1	**Saturday 10:00:00 AM**	*The Quest for the Ultimate Team*
Henry Crosby		Birmingham Southern College
FanDuel, is the leading one-day online fantasy sports game in the world. For professional football, a player is given a salary cap of 60,000 dollars to draft a team of 9 professional football players ranging amongst every player in the NFL. A winning team must score in the upper 50th percentile amongst all other players. Players score points based a scoring system developed by FanDuel that is entirely based upon particular statistics. The goal of this paper is to mathematically (1) create a point predicting model for every player and then (2) optimize a drafted team based upon those predictions given the salary cap as a constraint and ultimately pick a winning team. The point predictor model is a linear regression model that is unique to every position; since each position will have particular statistics of interest over others. Then, an augmented version of the simplex algorithm was used to determine the best team given the salary constraint and the amount of players required. For an example, week 6 of 2016 is listed in the paper; projecting 155 FanDuel points and actually scoring 123.1 FanDuel points. This is slightly above the average score of a winning team which is approximately 120 points.		

UT7.3	**Saturday 10:40:00 AM**	*Differential Forms of Maxwell's Equations in Free Space*
Keisha Daughtry		High Point University
In the early 1900s, the theory of differential forms was developed by French mathematician Elie Cartan. The calculus of differential forms is used in concepts within theoretical physics including the theory of relativity and the theory of electromagnetism which is depicted by Maxwell's Equations. These particular equations can be expressed in three forms: integral form, standard differential form, as well as differential geometric form. Using Stokes' Theorem and the Divergence Theorem, the integral form of Maxwell's Equations can be rewritten in standard differential form. To express these equations in differential geometric form, the exterior derivative and Hodge star operator are used. The beauty of expressing Maxwell's Equations in this notation is that there is no limit on the dimension we can study. By using differential geometry, the mathematical analysis of curves and surfaces extends beyond the three-dimensional Euclidean space.		

CP4.6	Friday 10:00:00 AM	*Writing and Reading the AP Calculus Exam*
Stephen Davis		Davidson College
The AP Calculus Chief Reader discusses aspects of building and grading a high-stakes exam for a large student population. In particular, in the implementation year for an updated AP Calculus curriculum, we explore how a new curriculum framework and associated Mathematical Practices for AP Calculus impact both the development and scoring of the exam.		

UT2.1	Friday 2:00:00 PM	*Modeling a Ballistic Shot to the Moon*
Leo Degon		Savannah State University
This project studies about the odds that a projectile will strike the moon if fired from a cannon. A number of simplifications are made but certain parameters have been chosen as having stochastic error. The formulation of the dynamic equation is second order ordinary differential equation that is non-linear and inhomogeneous. The appropriate statistical model, such as Gaussian or uniform, for each term is determined by the certainty about measurements and the accuracy of formula. MATLAB is used as the modeling program to solve the equation numerically. Some consideration on the use of the Langevin Equation is given in brief. The system is chaotic with the uncertainty in the beginning having much greater effect than later in the shot due to the nonlinear drag of air. The research will show that the odds of a moonshot are low enough to be considered approximately zero.		

UT3.4	Friday 3:00:00 PM	*Space Filling Curves*
Shaquille Dixon		Coastal Carolina University
A space filling curve is a function that maps the unit interval onto the unit square. This talk will describe a method for generating space filling curves, and explore some of their interesting properties and applications. In addition to mapping a seemingly smaller set onto a larger one, space filling curves fail to be one-to-one. And while the component functions are continuous, they fail to be differentiable at even a single point. One application of space filling curves is the ability to transform sounds into images.		

UP1.7	**Saturday** **10:45:00 AM**	*Prediction of international HIV Populations using the GDP based weights*
Hermine Djimoundi		Savannah State University
This study mainly addresses application of a new numerical approach to depict the number of patients. Based on the discrete dataset of international population with HIV from 1980 through 2015, we investigate the correlation between the number of HIV patients and the gross national product (GNP) in each country. We predict the number of near future patients by using linear and nonlinear regression curves which are obtained through the Least Square technique. Moreover, in order to emphasize the strong relevance with more recent year data, we suggest the weighted Least Square Method whose weight is developed based on countries' GNP values. Finally we analyze the each results and seek for the further work.		

UT1.4	**Friday** **3:00:00 PM**	*Creating a Topological Adventure with Dungeons and Dragons*
Tucker Dowell		Belmont University
Math, in itself, is a fascinating, beautiful world to be explored, but many of the concepts we study are only ever cataloged in our minds as abstractions. The goal of this talk is to present a fun way of becoming more familiar with and teaching mathematical ideas whose properties have always seemed a little out of reach to me. I will be talking about how I incorporated ideas such as the projective plane and Möbius strips into a Dungeons and Dragons campaign that I put together. By weaving these topological objects into an exciting, fantastical narrative, I was able to introduce a few friends who have never studied mathematics to some incredibly intriguing ideas, while coming to understand them more deeply myself as well. Even if we feel like we are lost on a nonorientable surface, we will surely enjoy ourselves as we embark on this adventure!		

UT1.5	**Friday** **3:20:00 PM**	*Super-SET*
Tucker Dowell		Belmont University
The card game SET has fascinated mathematicians for decades, and, this summer, the mathematics community saw huge leaps into the study of the game. A deck of SET cards is made up of cards having four attributes, each attribute having three possibilities. Typically, players race to find "sets" of three cards such that all three of the cards are either identical or completely different with respect to any attribute. Mathematicians have traditionally studied the smallest number of cards necessary to ensure that there is at least one "set" within the dealt cards. We define a variation of SET we call 'Super-SET' where players search for any two pairs of cards such that both pairs need the same card to complete a classic set. We study the smallest number of cards necessary to ensure that there is a super-set.		

UP1.8	**Saturday 10:45:00 AM**	*Games for Generalizing Finite Groups with Cross Product of Z2 and Finite Abelian Groups*
Ashly Earley		Converse College
I will present a study into the two games analyzed in the paper Impartial Achievement and Avoidance Games for Generating Finite Groups by Ernst and Sieben. These games were originally proposed by Anderson and Harary in a 1987 paper. In these games, two players alternatively select previously unselected elements within a finite group. For the first game, players will select elements with the intent of creating a generating set from their selected elements to win the game. For the second game, the player will select elements with the intent of not creating a new generating set from their selected elements to win. I will apply group theory, game theory, and probability concepts to these games to provide preliminary results on one of the proposed questions at the end of the paper of Ernst and Sieben. Specifically, this project contributes to the understanding of the nim-numbers of generalized dihedral groups from the cross product of Z2 and A, where A is a finite abelian group.		

CP3.5	**Friday 3:20:00 PM**	*Modeling the Role of Education in Ebola Virus Disease Outbreaks in Sudan*
Christina Edholm		University of Tennessee at Knoxville
In light of the Ebola outbreak in 2014, we worked on an Ebola model during our South African Mathematical Sciences Association Masmau program in 2014 and 2015. Our model partitions the population into those who take precautions against contracting the disease and those who do not. We consider new infections arising in both hospital settings as well as in the community, and include transmission from dead bodies and the environment. Our goal is to illustrate role of education in limiting a potential future Ebola outbreaks in Sudan using data and modeling. We considered implications of a new strain with respect to different death rates and recovery rates.		

UT8.2	**Saturday 10:20:00 AM**	*Creating a Field Structure for the Pythagorean Triples*
James Eskew		University of Tennessee at Martin
It is possible to construct maps from the Pythagorean triples to the extended rational numbers by plotting the triples as points on a unit circle, where the triple *(x, y, z)* is plotted as the point $(\frac{x}{z}, \frac{y}{z}, 1)$, and then taking the slope of the secant line between each triple and a fixed point on the circle. We will use these maps to create a field structure for the Pythagorean triples.		

CP6.1	**Saturday 10:00:00 AM**	*Enumerating cycles in the graph of overlapping permutations*
Brad Fox		Austin Peay State University
The graph of overlapping permutations is analogue to the De Bruijn graph that consists of permutations as its vertices and edges. Previous researchers have counted the cycles of a particular length within the De Bruijn graph, so we attempt to do this with the graph of overlapping permutations. In this talk, we will discuss the challenges that this graph poses and some successful enumerations we found in particular cases, such as counting 2-cycles and the counting number of vertices included in cycles of prime length.		

WS.1	**Friday 9:00:00 AM**	*Workshop for Directors of Mathematics Tournaments*
Chuck Garner		Rockdale Magnet High School
We estimate that there are over 40 math tournaments for high school students at colleges and universities each academic year in our section. There is virtually no coordination or collaboration between the tournament organizers and directors, and very little collaboration with local teacher organizations, such as NCTM Affiliate groups (like the Georgia Council of Teachers of Mathematics which oversees Georgia's State Math Championship). This workshop is offered as a step toward collaboration by sharing what works with your tournament and to ask colleagues for help with what doesn't. We also propose a more coordinated effort to voluntarily introduce targeted mathematical topics at tournaments, and to establish a more firm line of communication with regional and state-level teacher organizations. Although we will facilitate the discussion towards math tournaments for high school students, directors of tournaments for other student populations are encouraged to join in.		

UT1.6	**Friday 2:40:00 PM**	*Plugging in to the 3n+1 Problem*
Kailee Gerzema		Belmont University
Proving the Collatz Conjecture has been said to be outside of the realm of possibilities given the current advancement of mathematics, so, obviously, we thought it would be fun to play around with the famous problem. Our talk will not present a solution or proof for the 3n+1 problem, but we will discuss our approach to working toward a solution. This talk is as much a dialogue on what it means to wrestle with an unsolved problem and how that struggle can help one learn about the process of doing research as it is a discussion of our enlightening (if not helpful) perspective on the 3n+1 problem. Even if none of us ever solve a problem that has been open for decades or centuries during our lifetime, we suggest that failing to find solutions to such problems can be just as lucrative for the growth of the individual as a mathematician.		

CP3.3	**Friday 2:40:00 PM**	*Hybrid Chebyshev Polynomial Scheme for the Numerical Solution of Partial Differential Equations*
Balaram Ghimire		Alabama State University
In this talk, we propose hybrid Chebyshev polynomial scheme (HCPS), which combines two matrix systems of Chebyshev polynomial scheme into a single matrix system. This hybrid formulation requires solving only one system of equations and opens up the possibilities of solving large classes of partial differential equations (PDEs). We consider various boundary value problems and the inhomogeneous Cauchy-Navier equations. The solution is approximated by the sum of the particular solution and the homogeneous solution. Chebyshev polynomials are used to approximate a particular solution of a PDE. The Laplacian or biharmonic operator is kept on the left side and all other terms are moved to the right side and treated as a forcing term. Numerical results show that our approach is highly accurate and stable.		

CP3.6	**Friday 3:20:00 PM**	*Combinatorics of n-Colored Cyclic Compositions*
Meghann Moriah Gibbs		Georgia Southern University
Integer compositions and related enumerative problems have been of interest to combinatorialists and number theorists for a long time. The cyclic and colored analogues of this concept, although interesting, have not been extensively studied. As a result, we have chosen to explore the combinatorics of n-colored cyclic compositions, and we present generating functions, bijections, asymptotic formulas related to the number of such compositions, and the number of parts and restricted parts for certain types of compositions.		

CP3.2	**Friday 2:20:00 PM**	*Three Algorithms for Numeric Series Function Approximation*
Gregory Goeckel		Presbyterian College
When we teach power series, students are taught how to find the power series' interval of convergence and how to find how many terms are needed to calculate at certain degree of accuracy. What is almost always overlooked is that numerical calculations are not done with infinite precision. Loss of precision enters when a large number of calculations are performed, i.e, there is a large number of terms calculated. Also, loss of significant digits occurs when numbers of near equal values are subtracted. So, if the series is not always positive and the result has a magnitude smaller than the largest magnitude, then one may assume that the loss of digits is at least the difference between the two magnitudes. I will present algorithms, for the exponential, logarithmic, and Bessel (first kind, of integer order) functions, that use as few terms as possible and reduce the risk of loss of significant digits.		

SS5.2	**Saturday** **2:20:00 PM**	*Introducing Fun Research Through a One-credit Course*
Adam Graham-Squires		High Point University
In an effort to introduce research to undergraduates earlier in their mathematical career, we created a one-credit research course aimed at freshmen and sophomore students. The idea is to introduce students to a number of mathematical topics, with a focus on investigating topics as opposed to finding answers. We practice problem-solving skills and asking interesting questions in a variety of settings, most of which the students have never seen before. Topics have included number theory, mathematical games such as Set and Nim, Graph theory, math modeling, and the game of life, among others.		

CP1.4	**Friday** **3:00:00 PM**	*The Pathways of Colored Balls Lighting the Queen's Walk*
William G. Griffiths IV		Kennesaw State University
The Delannoy numbers have long been used to enumerate the number of paths from *(0,0)* to (*n,n)* using only the steps *(0,1), (1,0)*, and *(1,1)*. We have discovered a family of integer sequences we enumerate using configurations of colored balls, wherein the Delannoy numbers have appeared as a special case. We give a combinatorial equivalence between the traditional paths (originally described by Delannoy as a "Queen's Walk") and special sequences of colored balls. Properties of the family of sequences will be applied through the bijection, revealing interesting properties of this classic set of numbers.		

CP2.3	**Friday** **2:40:00 PM**	*A mathematical model of Mersenne's water jet experiment*
Charles Groetsch		The Citadel
In the first third of the 17th century Marin Mersenne, O.M. conducted experiments on gravity driven water jets to simulate Galileo's theoretical analysis of horizontally projected motion. He observed that the curve of the jet differed qualitatively from the idealized Galilean trajectory in a specific way. We provide a rigorous mathematical validation of Mersenne's observation, in a form accessible to undergraduates, for a dynamical model with Stokes resistance. This historical episode provides an opportunity for enrichment topics in courses in calculus, elementary differential equations and mathematical analysis.		

UP1.9	**Saturday 10:45:00 AM**	*Optimal Scheduling of an Educational Therapist's Sessions*
Rickie Grooms		Emmanuel College
This work presents a solution to the fluid scheduling problem that a therapist encounters. Schedules change weekly in this occupation and must be optimized to maximize time with clients and caseload. The difficulty appears when constraints such as travel time, client availability, and individual education plans are considered. Using the branch-and-bound approach with a look-ahead mechanism alongside a schedule generation scheme, the resources relevant to this application are assigned optimally within several possible rankings of the criterion. Through tweaking of the dominance rules, multiple, near-optimal schedules may be produced and ordered by user preferences.		

CP4.3	**Friday 2:40:00 PM**	*A GUEST Course in Statistics*
Bob Guest		University of Tennessee at Knoxville
Statistics is used in a large variety of fields by a large variety of people. Thus it is essential to provide an exceptional experience in college statistics courses that is approachable by students of any major. In the intro-level course Statistical Reasoning, we are implementing a redesign that is a hands-on approach to data collection and analysis. In this partially "flipped" class, students watch narrated videos at home and practice their skills in class. During class, students collect data from large, portable populations of Scrabble tiles, Uno cards, and dice. Then each data set is used in an assortment of lessons, allowing students to realize important ideas for themselves. This self-discovery facilitates deeper understanding of the material.		

SS3.5	**Friday 3:20:00 PM**	*On even k-uniform hypergraphs and a related extremal problem*
Arran Hamm		Winthrop University
We define an even k-graph to be a k-uniform hypergraph satisfying: every set of $k+1$ vertices contains an even number of edges. The case when $k=3$ has been studied extensively starting in the 1950's where researchers found connections with configurations of equiangular lines and switching classes of graphs among other things. On a (slightly) unrelated note, consider the following Turan-like problem: what is the largest number of edges a k-uniform hypergraph can have such that in any $k+1$ vertices the hypergraph has either 0 or 2 edges? This question has been analyzed for $k \leq 4$ and is open otherwise. This talk will discuss a few results related to the structure of even k-graphs and an application of these results to the stated extremal problem. No prior knowledge of hypergraphs is assumed.		

UT8.5	**Saturday 11:20:00 AM**	*Augmented Happy Function with Complex Variables*
Marcus Harbol		The Citadel
Let the Augmented Happy Function with Complex Variables be defined as follows. If $a = \sum_{j=0}^{n} a_j 10^j$ and $b = \sum_{j=0}^{m} b_j 10^j$, then define $G_{[c,d,q]}(a + bi) = c + di + \sum_{j=0}^{n} a_j^q + \sum_{j=0}^{m} (b_j i)^q$ for integers a_j, b_j , $0 \leq a_j \leq 9$, $0 \leq b_j \leq 9$. A fixed point in *G* is some complex integer *a+bi* such that for a constant *c,d,q*, $G_{[c,d,q]}(a + bi) = a + bi$. Given any complex constant, *c+di*, with positive integers *c,d*, there exist a finite number of fixed points in *G*. We prove properties of fixed points and under what circumstances fixed points can be restricted. We also extend these observations to arbitrary bases.		

UP1.10	**Saturday 10:45:00 AM**	*Essentially Unique Representations of Ternary Quadratic Forms*
Raymond Herbert		Samford University
Ternary quadratic forms are polynomials of the form [a,b,c,d,e,f]:=$ax^2+by^2+cz^2+dyz+exz+fxy$. Since ancient times, mathematicians have examined these forms to see what solutions are given when [a,b,c,d,e,f]=n. For specific forms [a,b,c,d,e,f], it was our goal to find a list of integers n that the form represented in essentially one way. By represented in essentially one way, we mean that there is only one solution if we take into account automorphs, which will be defined in the poster.		

CP9.3	**Saturday 10:40:00 AM**	*Nonlinear Oscillations, Elliptic Functions and Simulation Differential Equations in Simulink*
Russell Herman		University of North Carolina-Wilmington
We discuss differential equations, such as the nonlinear pendulum equation, which lead to solutions involving elliptic functions and elliptic integrals. These classic forms, accessible to undergraduates, are not often encountered in differential equation courses but are often left for advanced courses in complex analysis. We discuss the connection of elliptic functions to differential equations and show how graphical editors for designing simulations of systems, such as Simulink, can be used to model solutions of nonlinear oscillators.		

UT7.1	**Saturday 10:00:00 AM**	*The Quest for the Ultimate Team*
Stephen Himic		Birmingham Southern College
FanDuel, is the leading one-day online fantasy sports game in the world. For professional football, a player is given a salary cap of 60,000 dollars to draft a team of 9 professional football players ranging amongst every player in the NFL. A winning team must score in the upper 50th percentile amongst all other players. Players score points based a scoring system developed by FanDuel that is entirely based upon particular statistics. The goal of this paper is to mathematically (1) create a point predicting model for every player and then (2) optimize a drafted team based upon those predictions given the salary cap as a constraint and ultimately pick a winning team. The point predictor model is a linear regression model that is unique to every position; since each position will have particular statistics of interest over others. Then, an augmented version of the simplex algorithm was used to determine the best team given the salary constraint and the amount of players required. For an example, week 6 of 2016 is listed in the paper; projecting 155 FanDuel points and actually scoring 123.1 FanDuel points. This is slightly above the average score of a winning team which is approximately 120 points.		

UP1.11	**Saturday 10:45:00 AM**	*Optimizing Aircraft Boarding Strategies*
Qixuan Hou		Georgia Tech
In order to achieve high aircraft utilization, commercial airlines has made efforts to improve its turnaround performance, which is measured by the time between an airplane's arrival and its departure. Passenger boarding is one of the many factors which determine turnaround time. We simulate distinct airline boarding procedures with Python, such as outside-in, random, rear to front, reverse pyramid, rotating zone, zone/block style, and also provide a mathematical model to measure the goodness of each procedure. By analyzing the model, we want to evaluate distinct boarding processes and to identify the most efficient boarding strategy. Ideally, with field observations and data analysis, a new procedure will be proposed to optimize the boarding time and improve turnaround performance.		

UT5.4	**Saturday** **11:00:00 AM**	*Abstract Withdrawn*

CP2.1	**Friday** **2:00:00 PM**	*On a Generalization of Wolff's Ideal Theorem*
Andrew Incognito		Coastal Carolina University
We settle an open question to generalize Wolff's Ideal Theorem on certain uniformly closed subalgebrasof H_1(D). Also, some subalgebras where Wolff's Ideal Theorem holds true without the additional condition F(0) = 0 will be discussed.		

UT4.2	**Friday** **2:20:00 PM**	*Higher Degree Polynomials and Their Solvability by Radicals*
Peter Jakes		Elon University
For about 500 years, formulas have existed to find exact solutions to quadratic, cubic and quartic polynomials. However, it was proven later that not all solutions to quintic polynomials can be found exactly, or solved by radicals. As a result, a method was created in the 20th century using a property of each function called its Galois group in order to determine which degree five polynomials could be solved exactly and which could not. This project expands upon this discovery by exploring degree six polynomials. By using computer software, the Galois group of a degree six polynomial can be determined by only using two resolvent polynomials, improving upon prior methods. From this information, it can then be determined whether or not the polynomial is solvable by radicals. Further research can explore higher degree polynomials as well as reducible polynomials, as the current method is only viable for irreducible polynomials.		

UT9.4	**Saturday** **11:00:00 AM**	*Doughnuts of Many Colors*
Joseph Johnson		Lenoir Rhyne University
We will explore map coloring problems on tori with one or more holes. We start by finding which graphs can be embedded on a torus with no crossings. Using this, we create map colorings on the torus. With graph theory and the Euler characteristic we show that seven colors are necessary and sufficient to color the one-holed torus.		

PUB.1	Friday 11:00:00 AM	*Web Accessibility, New Courses, and Custom Tools*
Emily Judy		Hawkes Learning
Hawkes Learning will present new corequisite courses aligned with STEM and non-STEM pathways, the beta release of Calculus software, an overview of Web Accessibility basics, and new features for course customization, including the latest innovation in question-authoring technologies: Question Builder. Win a $25 Amazon gift card!		

UT9.1	Saturday 10:00:00 AM	*The Shapley Value of Digraph Games*
Krishna Khatri		Piedmont College
Digraph games are transferable utility (TU) games with limited cooperation among players, where players are represented by nodes. A restrictive relation between two adjacent players is established by a directed line segment. Directed line segments, connecting the initial player with the terminal player, form the coalition among players. Dominance relation is established between players and this relation determines whether or not a player wants to cooperate. To cooperate, we assume, player joins coalition where he/she is not dominated by any other players. The Shapley value is define as the average of marginal contribution vectors corresponding to all permutations that do not violate the subordination of players. The shapley value for various digraph games is calculated and analyzed. For a given characteristic function, a quick way to calculated Shapley values is formulated .		

UT3.3	Friday 2:40:00 PM	*Variable Step Implementation of an Extended Block Method in Solving Stiff Differential Equations*
Kindyl King		Austin Peay State University
We present a variable step method in solving first order ordinary differential equations (ODEs). Systems of stiff differential equations arise in many real-world applications. Thus, it is imperative for stable and accurate numerical methods to be developed. Traditionally, a constant step size is used in numerical methods. However, if the solution to the ODE changes rapidly, then the constant step size will result in large errors. To overcome this occurrence, a variable step method can be implemented so that if the error exceeds a certain magnitude at each point, the step size will be adjusted. Our method is based on Cash's Extended Backward Differentiation Formula and involves an extended block method. We will analyze stability and compare the accuracy of our method to the well-known predictor-corrector method.		

SS4.2	**Saturday 10:20:00 AM**	*Intuitive sense of mechanisms or misconceptions: investigating undergraduate students' comprehension of variability*
Oguz Koklu		University of Georgia
Research literature abounds cognitive studies that document student misconceptions for various content including the discipline of statistics. Researchers often investigated students' conceptions of a content by evaluating student understandings based on the normative meanings and researcher-way-of thinking, and students' "non-standard" ways of understandings have been called misconceptions and incorrect or incomplete understanding. The implications of these studies usually include that misconceptions should be confronted, overcome, and replaced by the valid forms of understandings (McCloskey, 1983). Although this body of research has provided invaluable resources on how student understand certain topics and concepts, these studies typically focus less on explaining how students' own conceptions could be instrumental in teaching the very same topic or concept that they hold misconceptions. In my study, I adopted diSessa's (1993) knowledge-in-pieces epistemological framework (KiP) for my investigation of college students' various ways of reasoning about variability for quantitative data. Viewing student conceptions with a KiP perspective, I conducted task-based interviews with four undergraduate students to understand how they conceptualize variability in different situations. The study provided an opportunity to observe students conceptions more thoroughly as against to calling students' partial and fragmented ways of understandings as mere misconceptions (and not furthering the investigation). The results of my study have also enabled to reveal some of the very fundamental and primitive foundations of understanding variability, which could play important roles in the development of the statistical variability concept for students. Overall, the presentation will showcase potential benefits of viewing students' understanding in more broad ways. Implications for practice such as classroom interventions will also be discussed.		

CP8.2	**Saturday 10:20:00 AM**	*Some interesting properties of p-regular partitions*
Louis W. Kolitsch		University of Tennessee at Martin
In this talk, p-regular partitions will be defined and some of their interesting properties will be discussed.		

UT7.2	**Saturday 10:20:00 AM**	*Optimizing Checkout Times*
Katie Kruzan		Belmont University
Most major supermarkets have both general checkout lanes and express lanes with item limits. What is the express lane item limit that will minimize the average customer's waiting time? A natural extension of this question concerned how might we apply our findings to minimizing congestion in other contexts? This required more advanced probabilistic and programing methods to optimize the system. This model and future improvements may help lead to efficiently simulate optimizing congestion and traffic flow.		

CP9.5	**Saturday 11:20:00 AM**	*Differential Equations with Hypergeometric Solutions of Degree 1 or 2*
Vijay J. Kunwar		Albany State University
Differential equations with hypergeometric solutions are very common in Combinatorics, Physics, and Engineering. If a second order differential equation arises from a convergent power series, then its solution can be expressed in "closed form" using hypergeometric functions. In this talk, we will discuss about our algorithms to solve second order linear differential equations in terms of hypergeometric solutions of degree 1 or 2.		

UT8.6	**Saturday 11:40:00 AM**	*The Relationship between Primes and Consecutive Integers*
Adam Kurbansho		Methodist University
Although number theorists have established myriad theorems regarding prime numbers, our preliminary study has exposed intriguing properties of primes and their decomposition into consecutive integers. In this paper, we develop a method for analyzing consecutive integers, note their relationship with prime numbers, and record the unique properties with the intent to augment the knowledge of the prime set. Our research demonstrates that there are several interesting connections between prime numbers and their decomposition into consecutive integers, which is promising for future research in this area. Analyzing the properties of consecutive integers through "integer tables" reveals several noticeable patterns, one of which suggests that there are certain cases where we can expand on the accuracy of Bertrand's Postulate. We also analyze the case of twin primes and note their unique status of sharing a consecutive integer that has a factor of three. Lastly, we explore the decomposition of primes into consecutive integers through tree diagrams. The relative scope of our methods spans across the fields of elementary number theory, set theory, and algebra.		

PUB.2	Friday 2:00:00 PM	*My MathLab*
Seanna Landry		Pearson
Pearson's MyMathLab continues to evolve in response to trends in today's math education. In this session, we're going to focus on features and innovations designed to support students taking Calculus and Differential Equations. Come see how MyMathLab solutions promote Just-In-Time help, Personalized Learning, Conceptual Understanding & In-Class Engagement.		

UP1.12	Saturday 10:45:00 AM	*Medieval Europe's Next Top Model: Using NetLogo to Model the Black Death*
Megan Lenaghan		Converse College
The bubonic plague, considered to be one of the most well-known and devastating pandemics in all of human history, has been studied at the biological level for years by the Center for Disease Control. In addition to biologists studying the disease, expert historians have attempted to estimate the numbers of casualties and the proportion of the population affected. Mathematical modeling has the potential to help us more accurately assess how this disease spread in a changing population, accounting for factors such as growth and deaths. Using the programmable modeling environment NetLogo and SIR continuous modeling principles, along with what is already known about the plague, a mathematical simulation has been designed to estimate the possible influence fleas, rats, and immunity had on how many survived the Black Death.		

UT1.2	Friday 2:20:00 PM	*Artificial Neural Networks for Stochastic Time Series Regression*
Andrew Linzie		Gardner-Webb University
Over the past decades, machine learning has become an essential area of research with relevant applications in classification and regression. Artificial intelligence techniques can be used for statistical analysis of stock markets which is one example of a time series. Within this research, we trained artificial neural network models for the purpose of stochastic time series regression. One of the models used is an Extreme Learning Machine, which is proposed by G. Huang, et. al; the other model is a Multi-Layer Perceptron using back-propagation, a method where the weights are iteratively modified according to learning the training set. The models use previous historical data to try and give estimates of the next days' closing price with the goal of positive correlation between the predicted and real time series. The stock market is just one example of a noisy system with applications in forecasting, and models for stochastic regression have far reaching applications in all STEM fields.		

CP1.1	**Friday 2:00:00 PM**	*Finite Ideal Factorization Domains*
Anna Litchford		Tennessee Tech University
In "Factorization in Integral Domains", D.D. Anderson, D.F. Anderson, and Zafrullah introduced the concept of a finite factorization domain, an integral domain in which every nonzero nonunit has a finite number of factorizations into a product of irreducibles. We introduce an analogous structure at the level of ideals, a finite ideal factorization domain, or FIFD, an integral domain in which every nonzero proper ideal has a finite number of factorizations into a product of nonfactorable ideals. We will explore polynomial-type domains and the classical D +M construction and examine under what conditions they are FIFDs.		

CP7.4	**Saturday 11:00:00 AM**	*Providing real-time instructor feedback about undergraduate learning through machine learning algorithms*
Alex Lyford		University of Georgia
Constructed-response questions, those in which students must respond to a posed question using their own words, have been shown to help researchers and instructors understand students' knowledge and understanding better than multiple choice questions. One principle advantage of these open-ended questions is that students are able to elaborate, often both correctly and incorrectly, about how they arrived at their answers. One effective approach is to leverage machine learning algorithms to make classifications about student responses. In this presentation, I will utilize several machine learning algorithms together in an ensemble to classify student responses and provide real-time instructor feedback. I will then demonstrate how these classifications can be used to improve instruction in all courses and offer unique perspective into student knowledge for large-lecture courses.		

UT5.1	**Saturday 10:00:00 AM**	*Finding a Better Concert Tour*
Caitlin McCurdy		Birmingham Southern College
Consider the scenario in which a performer is trying to find the best concert tour through a set of cities. Given a set of cities, with a benefit associated with each, a weighted complete graph is formed. Cities can be visited multiple times, although a recovery time dictates the amount of time that must pass before a city can be revisited. The goal is to find the path that maximizes the total benefit. First, we create a model and discuss the variables. Then we define three algorithms used to find paths and introduce MATLAB code for each. We then simulate a concert tour using the code. Finally, we analyze the results when allowing the recovery time to vary.		

CP5.2	**Saturday 10:20:00 AM**	*Exploring Virtual Reality in a Calculus III Class*
Erin McNelis		Western Carolina University
As Virtual Reality (VR) and Augmented Reality (AR) technology becomes more accessible for departments and individuals, how might we make appropriate use of it for our mathematics classes? This presentation will explore current uses of VR and AR in mathematics classes, issues to consider, and the steps taken to develop a virtual reality activity exploring the method of Lagrange multipliers.		

UT4.5	**Friday 3:20:00 PM**	*Constructing irreducible polynomials over prime fields using complex mulplication*
Tyler Melton		Armstrong State University
For a certain discriminant D and a prime field F, the Hilbert class polynomial H(D) has a high probability of being irreducible over F. We will use this fact and the Chinese Remainder Theorem to naively construct irreducible polynomials over F.		

CP9.2	**Saturday 10:20:00 AM**	*The Contributions of Women Mathematicians throughout the History of Athens State University*
Ronald L Merritt, Jr.		Athens State University
Athens State is a small liberal arts university in Athens, Alabama which will celebrate its bicentennial in 5 years. Athens State has a rich history of women mathematicians who have transformed the mathematics program throughout the last two centuries, conforming the program with the needs of the time. Moreover, they have made significant local, national and international impacts on humanity.		

UT4.6	**Friday 3:40:00 PM**	*The Classification of Timbres via Overtone Sequences*
Zhian Mi		Birmingham Southern College
Scientists commonly use “three elements of sound” to describe a certain sound: amplitude, frequency and timbre. Timbre, also known as tonal color, has the most complicated mechanism of the three, and it depends on the overtone sequence. Using software that can produce and edit sounds, I classify the timbres in a mathematical way, looking for mathematical description of musical categories.		

UT6.3	**Saturday 10:40:00 AM**	*Quantifying CDS Sortability of Permutations Using Strategic Piles*
Bethany Molokach		Western Carolina University
We investigate the sorting of permutations using context directed swaps (CDS). Sorting has important applications in mathematics and other disciplines, such as biology and computer science. Not all permutations are CDS sortable. We seek to quantify the degree of sortability. Prior work introduced the concept of fixed points, which represent permutations on which no more swaps can be made. We develop mathematical methods for quantifying the number of permutations from which a given number of fixed points can be reached. These methods incorporate fields such as combinatorics, algebra, and graph theory. We also consider this problem from a game theoretic perspective by exploring strategic methods for reaching specific fixed points. Our findings include formulas that explain both previously reported and newly collected data. These results clarify the role of CDS as a sorting operation.		

CP3.4	**Friday 3:00:00 PM**	*A Survey of Recent Work on the Collapse of the Tacoma Narrows Bridge*
George Moss		Union University
The Tacoma Narrows Bridge collapsed over 75 years ago, and its failure has been analyzed in great detail since then. The TNB experienced vertical oscillatory motion from the time of its construction until its destruction. On the morning of its collapse, it exhibited a new torsional motion that led to its demise. We examine several models from the literature in mathematics, engineering, and physics in an attempt to understand the behavior of suspension bridges and ultimately to try to determine why these torsional oscillations suddenly appeared.		

CP8.3	**Saturday 10:40:00 AM**	*Which Triangular Numbers are perfect*
Tilahun Muche		Savannah State University
A number n is perfect when $\sigma(n)=\sum_{0\le d<n,\, d\mid n}(d)$. It was Euclid who proved that if (2^k-1) is a prime number, Mersenne prime, then $N=2^{(k-1)}(2^k-1)$ is an even perfect number. Moreover, if N is an even perfect number then $N=T_m$ for some $m\in N$ and $m \ge 3$ is a triangular number where $T_m=\sum_{(i=1)^m}(i)$. In this paper we proved the necessary and sufficient condition for an even triangular number T_m to be a perfect number $N= 2^{(k-1)}(2^k-1)$ besides a triangular number T_m is $\not\equiv 4 \bmod 10$ and $T_m \not\equiv 2 \bmod 10$. .		

SS2.2	**Friday 2:20:00 PM**	*Solving open problems with students as a first research experience*
Antara Mukherjee		The Citadel
In this talk I will share some experiences about working with students on research projects. Instead of giving them problems from our own projects to work, my co-author and I use open problems from journals. Using these resources we have worked with several undergraduate and some graduate students giving them a taste of their first research experience. Many of these students have published their research in journals and won awards for their presentations and posters on their research projects. I will also describe how these projects were conducted and the various criteria we thought about when we found the right problems for the students to work on.		

SS3.3	**Friday 2:20:00 PM**	*Polytopes, Diagrams, and g-Vectors: Oh, My!*
Sarah A. Nelson		Lenoir Rhyne University
I bet you have encountered convex polytopes most of your life. The Platonic solids and 2-dimensional convex *n*-gons are some examples. In this talk, we will formalize this notion before introducing its associated Gale diagram. We will further discuss how to encode information about the polytope's faces in its associated flag-*f*- vector and toric *g*-vectors. In 1990, Carl Lee showed some interesting results for a special class of polytopes, which are classified as simplicial. As time permits, we will even share some exciting extensions to polytopes in general.		

SS4.3	**Saturday 10:40:00 AM**	*Who Can Better Predict of Their Own Performance? A Preliminary Report.*
Kedar Nepal		Mercer University
Research shows that low-achieving students are usually not aware of their weaknesses. As a result, many might fail to see the need to explore the subject matter more deeply, in order to improve their conceptual understanding and procedural fluency. This study investigates undergraduate mathematics students' self-assessment behaviors. Students from a wide range of mathematics courses were asked to predict their scores on in-class assignments, and those predictions were compared with the grades assigned by their instructors. The students were also asked to justify their predicted scores if they did not give themselves full points. Preliminary results showed that students overall overestimate their grades. There was a significant difference between expected and actual grades. As test scores increased, the difference increased from negative to positive. Students in the B-range (between 80-89%) were the most accurate predictors.		

UT4.1	**Friday** **2:00:00 PM**	*Exploring Patterns in the Hailstone (3n+1) Problem For Predictive Purposes*
Nathan Nickelson		Austin Peay State University
This Hailstone Problem (also known as the Syracuse Problem, the Collatz Conjecture, Ulam's Conjecture, or the 3n + 1 problem) has many predictable patterns with its integer sequences. The purpose of this study was to examine those patterns and their possible use in facilitating an eventual solution. Convergence of infinite series, combinatorics, and alternative boundary conditions are some of the techniques used to establish the patterns evident within the problem. Also explored were alternative methods for observing the progression of integers through the problem's iterations.		

UT4.4	**Friday** **3:00:00 PM**	*The Collatz Conjecture and Some Cousins*
Chelsea Noel		Lenoir Rhyne University
The Collatz function takes a natural number and halves it if it is even, and triples it and adds one if it is odd. The Collatz Conjecture says that iterating the Collatz function always results in a 1-4-2-1 loop. In this presentation, we will share results from our explorations of what sequences arise when we modify or create modulo 3 analogs of the Collatz function. This talk should be accessible to a general audience.		

GS3.1	**Saturday** **8:45:00 AM**	*Gems of Ramanujan and their Lasting Impact on Mathematics*
Ken Ono		Emory University
Ramanujan's work has has a truly transformative effect on modern mathematics, and continues to do so as we understand further lines from his letters and notebooks. In this lecture, some of the studies of Ramanujan that are most accessible to the general public will be presented and how Ramanujan's findings fundamentally changed modern mathematics, and also influenced the lecturer's work, will be discussed. The speaker is an Associate Producer of the film The Man Who Knew Infinity (starring Dev Patel and Jeremy Irons) about Ramanujan. He will share several clips from the film in the lecture.		

UP1.5	**Saturday 10:45:00 AM**	*Image Processing for Classification and Regression*
Jacob Oullette		University of North Carolina-Wilmington
This project focuses on identifying characteristics from a set of images of faces. These faces are from the MORPH-II dataset that use the Bio-Inspired-Feature technology at West Virginia University to extract meaningful data points from the images. Each image is quantified to 4,376 real value points and we use mathematical techniques to extract meaningful characteristics from the images. In order to predict characteristics from new images we can apply the same models that have learned from the old images. Thus, the project can be broken down into steps: 1) Dimension reduction and 2) Classification & regression. In order to save computational time, we use dimension reduction. Classification methods help us determine the genders, and regression helps determine the approximate ages.		

SS2.1	**Friday 2:00:00 PM**	*Undergraduate research in the first year as a faculty member.*
Frank Patane		Samford University
In my first summer after joining the faculty of Samford University, I had the audacity to host an undergraduate research project. I will discuss this experience, and give pros/cons from a junior faculty member's perspective.		

CP9.4	**Saturday 11:00:00 AM**	*Porous Medium Equation and Its one parameter family of solutions with degenerate interface*
Laxmi Paudel		Albany State University
We reduce the porous medium equation into second order ordinary differential equation and prove the existence of one parameter family of solutions. The solution has degenerate interface that advances at a constant speed. We show that the interfaces occur under a very general initial conditions and the solutions are stable under certain class of perturbations. We also discuss the relevance of the solution to the flow of a thin layer of fluid on a horizontal surface under the action of gravity.		

UT2.6	**Friday 3:40:00 PM**	*Conway's Cats*
Emily Pazdera		Lenoir Rhyne University
Abstract. We examine whether the Trap-Neuter-Release (TNR) program can be effectively used to control the population of free-roaming feral cats. We do this by constructing a Game of Cats, which is similar to, but far more complex than, Conway's Game of Life. After construction of the game we are observing mathematical populations of cats to see the effects of sterilization of both randomly selected male and randomly selected female cats.		

CP1.2	**Friday 2:20:00 PM**	*Small Hausdorff Dimension in Finitely Constrained Groups*
Andrew Penland		Western Carolina University
Finitely constrained groups of tree automorphisms are compact groups defined by finite combinatorial "patterns", given by labeled graphs corresponding to finite quotient groups.The Hausdorff dimension of such a group is easy to calculate. All previously known examples of finitely constrained groups of binary tree automorphisms had relatively large Hausdorff dimension (close to 1). In this talk we discuss an infinite family of examples of finitely constrained groups whose Hausdorff dimension is just above 1/2.		

SS5.1	**Saturday 10:00:00 AM**	*Cellular Automata and Pseudorandom Number Generators*
Andrew Penland		Western Carolina University
Generating pseudorandom numbers is important to many scientific applications, including simulation and cryptography. One approach (initiated by Stephen Wolfram) is to use Cellular Automata (CAs) as pseudorandom bit generators (PRBGs); however, the specific class of rules considered by Wolfram have since been discovered to have an inherent algebraic property which makes them predictable and hence insecure. In this talk, we will discuss working with undergraduate students on a mathematical, computational, and experimental search for suitable PRBGs in a larger space of CAs.		

CP7.2	**Saturday 10:20:00 AM**	*Abstract Withdrawn*

UP1.13	**Saturday 10:45:00 AM**	*Infinite Donuts: Integrating in the p-adics over regions with many holes.*
Caleb Pierce		Wofford College
In this poster, we examine how to evaluate integrals of the form $\int_{(a+p\mathbb{Z}_p)+(a+p^2\mathbb{Z}_p)+(a+p^3\mathbb{Z}p)+\cdots(a+p^m\mathbb{Z}_p)} \chi\left(\frac{f(x)}{p^n}\right) dx$ using Jun-Ichi Igusa's Stationary Phase Formula.		

UT2.5	**Friday 3:20:00 PM**	*The Automatic Construction of Fractals of Arbitrary Dimension*
Nathan Pool		Elon University
Have you ever gazed into a work of art or a coastline on a map and noticed a repetitive pattern the closer that you observe it? This distinct quality is characteristic of fractals. These geometric figures diverge from the structure of traditional polygons with their fractional dimension. Not only do they have dimensions of non-integer value, but they have self-similarity. Kenneth Falconer addressed an equation for dimensions of self-similar sets – the iterated function systems used to construct fractals from initial figures. My investigation uses this equation by taking into account the number of similarity transformations to produce a fractal and the contraction factor used in the transformations. I began this research by writing an algorithm to construct fractals out of a regular polygon corresponding to the number of vertices inputted. The end product of this research will have the ability to construct fractals of any given dimension using just one function. With access to this data, people will be able to more adequately analyze the correlation and relationship between fractals' aesthetic characteristics and their corresponding dimensions. I hope to push this research even further by examining the connection between dimension and sound in the area of fractal music. As many classical composers made use of self-similar themes in their music, perhaps there is a way to portray that self-similar composition technique through the mapping fractals' coordinates to corresponding frequencies. Furthermore, dimension has the potential to be connected to the sound just as it has a connection to self-similarity. The existence of a successful algorithm for creating fractals of arbitrary dimension gives access to countless fractals varying in dimension in any way that researchers desire.		

UT6.1	**Saturday 10:00:00 AM**	*Topological and Combinatorial Characterizations of Factorization in Integral Domains*
Adam Pratt		Birmingham Southern College
We investigate the irreducible divisor simplicial complexes of elements in atomic domains, proving topological and combinatorial results concerning the homology of these complexes and a new classification for unique factorization domains.		

SS5.3	**Saturday 10:40:00 AM**	*An overview of metric distances between Cayley tables of finite groups*
Jesse Prince-Lubawy		University of North Alabama
Upper level proof courses provide a platform for undergraduates to refine their proof-writing techniques. Undergraduate research problems, on the other hand, give students a chance to wrestle with the unknown. These problems allow the student to see the process of discovery, through examples and counterexamples. The question at hand is how do we find an interesting problem and how do we motivate the student? In this talk we will discuss the process of finding a research problem targeted to a particular undergraduate math major, the process of working on the problem, and the process of motivating research talks at undergraduate conferences.		

CP4.4	**Friday 3:00:00 PM**	*Twenty Students, Four Faculty, and the University's Squirrel Population: An Undergraduate Research Project for Non-Calculus Ready Science Majors*
Jeff Pullen		Mercer University
Program in Integrative Science and Mathematics (PRISM) is a pilot project in its second year at Mercer University, designed to guide a selected cohort of our at-risk, non-calculus ready, incoming student population. In this program, students study Statistics, Precalculus, Biology, Physics, and Psychology in an integrated manner over the course of an entire academic year as they learn how to conduct an authentic research project using the squirrel population on campus. We will share our experiences, some assessment results, and planned changes for future installments.		

UP1.13	**Saturday 10:45:00 AM**	*Infinite Donuts: Integrating in the p-adics over regions with many holes.*
Aidan Quinlan		Wofford College
In this poster, we examine how to evaluate integrals of the form $\int_{(a+p\mathbb{Z}_p)+(a+p^2\mathbb{Z}_p)+(a+p^3\mathbb{Z}^p)+\cdots(a+p^m\mathbb{Z}_p)} \chi\left(\frac{f(x)}{p^n}\right) dx$ using Jun-Ichi Igusa's Stationary Phase Formula.		

CP2.4	**Friday 3:00:00 PM**	*Fractional differential equations and monotone iterative techniques*
Diego Ramirez		Savannah State University
In this work we first present the definition of a fractional derivative given by Caputo and some definitions and results of fractional calculus. We will finish the talk by proving the existence of coupled minimal and maximal solutions of initial value problems with fractional derivatives by using the method of lower and upper solutions combined with a monotone iterative technique.		

UT2.2	**Friday 2:20:00 PM**	*Mathematical Modeling of Prevention Methods of Dengue Fever*
Michelle Rave		Elon University
Dengue fever is a virus that is transmitted by mosquitos. It is prevalent in tropical areas of the world. There is no cure, but there are possible prevention methods such as vector control and vaccines. One method of vector control is a bacteria, Wolbachia. Wolbachia infected mosquitos are unlikely to transmit dengue between human hosts. We use ordinary differential equations (ODEs) and an SEIR (Susceptible, Exposed, Infectious and Recovered) model to model the transmission of dengue fever. The set of ODEs is then used to examine the possible prevention methods. Wolbachia is incorporated into the model by creating a Removed category of mosquitos that cannot transmit the disease. Vaccines are separately incorporated into the model by creating Vaccinated categories for humans. Computer simulations of the models are run yielding graphical results. The presence of Wolbachia infected mosquitos shortens the duration of the dengue fever presence in the human population. The greater the number of infected mosquitos released, the shorter the infection becomes. The use of vaccines also shortens the duration of dengue fever presence in the human population. This is dependent on a sufficient number of people being vaccinated in a timely manner.		

UT7.4	**Saturday 11:00:00 AM**	*Simulations on a Mathematical Model of Dengue Fever with a Focus on Mobility*
Kelly Reagan		Elon University
Dengue fever is a major public health threat, especially for countries in tropical climates. In order to investigate the spread of dengue fever in neighboring communities, an ordinary differential equation model is formulated based on two previous models of vector-borne diseases. The resulting SIR/SI model is used to simulate transmission of dengue fever in neighboring communities of differing population size with particular focus on cities in Sri Lanka. Initial infection details and relative population size may affect the dynamics of disease spread. An outbreak in a highly populated area may spread somewhat more rapidly through that area as well as neighboring communities than an outbreak beginning in a nearby rural area.		

UT7.6	**Saturday 11:40:00 AM**	*Generalization of Two Inequalities with AM, GM, and HM*
John Risher		University of South Carolina Salkehatchie
In 2016, Lai and Kim introduced two inequalities involving sums of arithmetic mean, geometric mean and harmonic mean of a finite sequence. In our study, using our own method we proved two old results by Hardy, Littlewood and Polya. We then use these results to generalize Lai and Kim's inequalities to the case of n sequences.		

CP4.5	**Friday** **3:20:00 PM**	*An Incentivized Early Remediation Program in Calculus 1: To Require Office Hours or Not?*
Lake Ritter		Kennesaw State University
Lack of readiness, in terms of prerequisite skills, can be a major impediment to student success in Calculus 1. One author has been using an early remediation intervention program for several years in which students are assessed at the beginning of the term. Students are then given the option to retake the assessment provided they perform targeted skill building tasks including required office hour attendance. This requirement, in particular, results in a significant workload for the instructor. In this study, we seek to determine the importance of this office hour requirement. Each author is teaching two sections of Calculus 1, one with and one without the office hour requirement. Through comparison of grades and student performance on select exam questions and through pre and post-surveys, we seek to determine whether there are appreciable differences in course outcomes and whether the office hour requirement impacts students' attitudes toward instructor office hours. The remediation program as well as preliminary results will be presented.		

DS.2	**Friday** **10:00:00 AM**	*The Game of Hex and its Surprising Implications*
Stephen Robinson		Wake Forest University
Hex is a simple two-player game that is well known to both mathematicians and non-mathematicians. Two players, Blue and Red, take turns placing tiles on a board until one of them has created a path connecting their sides. East and West for Blue, and North and South for Red. Unlike some other familiar games, such as tic-tac-toe, Hex is guaranteed to have a winner. This is known as The Hex Theorem. It turns out that this simple game, and its associated theorem, captures some deep and beautiful mathematical ideas that have been fundamental to mathematical progress over the last century. In particular, as David Gale demonstrated in a 1980 article in the Mathematical Monthly, The Hex Theorem is equivalent to the Brouwer Fixed Point Theorem in the plane. The main goal of this talk is to discuss the connection between these two theorems. The proofs are accessible to anybody who can play the game, draw some pictures, and contemplate continuity. Given time I will mention further implications that are near and dear to my heart.		

SS4.6	**Saturday 11:40:00 AM**	*Initial Findings about Graduate Teaching Assistants' Training Needs to Foster Active Learning in Statistics*
Kristen E. Roland		University of Georgia
As enrollment in introductory statistics courses across the country rises, more instructors for these courses are needed. Many statistics courses are now taught by Graduate Teaching Assistants (GTAs). Little is known, however, about the training needs of GTAs to foster active learning and promote conceptual understanding, critical recommendations of the GAISE guidelines to improve undergraduate learning in statistics. This talk will discuss some active learning activities and the corresponding GTA training program we have developed for our introductory statistics course. We will discuss the activities and the lessons learned about GTA development through the two-year pilot program. Specifically, we have found that GTAs struggle with connecting their theoretical knowledge to the conceptual ideas that are the focus of the new activities. This talk will focus on changes in our training program with a specific example of GTAs conceptual understanding and ability to facilitate activities focused on the conceptual understanding of confidence intervals for on population proportion. The research for this talk is from an NSF project (DUE 1504587) that will provide classroom materials to foster active learning in statistics as well as research results on student outcomes and needs for GTA training associated with the instructional practice of fostering active learning. This talk will discuss some of the initial results of a project designed to add active learning activities and companion training material for an introductory statistics course.		

SS1.5	**Friday 3:20:00 PM**	*Origami in Teacher Education*
Alan Russell		Elon University
I introduced a class of pre-service mathematics teachers to an origami manipulative. This session explores the model, its flexibility as a teaching aid, and the ways in which my students used the model to design lessons for K-8 mathematics classrooms. I will also share how I use the manipulative in various college math settings.		

CP9.1	Saturday 10:00:00 AM	*The Seven Tellings of Time: The Mathematics and Politics Behind the Hands on Your Clock*
Damon Scott		Francis Marion University
We show how time of day was reckoned according to seven methods, in their historical order: (1) Primitive Time, which leads to reckoning time by the sun's altitude above the horizon; (2) Seasonal Hours; (3) Equinoctial Hours, also called Apparent Solar Time or Pure Sundial Time; (4) Local Mean Time; (5) Apolitical Standardized Time; (6) Politicized Standardized Time; and (7) Politicized Standardized Time with Daylight Saving Time component. Civil Time, by definition, is the time after all politics have played themselves out, which currently is Method 7. Charts will be provided showing how the seven methods reckon time in comparison with one another. We also intend to provide a qualitative explanation of the celestial mechanics and spherical geometry behind the Equation of Time, which is the departure of Method 4 from Method 3.		

UT8.6	Saturday 11:40:00 AM	*The Relationship between Primes and Consecutive Integers*
David Shane		Methodist University
Although number theorists have established myriad theorems regarding prime numbers, our preliminary study has exposed intriguing properties of primes and their decomposition into consecutive integers. In this paper, we develop a method for analyzing consecutive integers, note their relationship with prime numbers, and record the unique properties with the intent to augment the knowledge of the prime set. Our research demonstrates that there are several interesting connections between prime numbers and their decomposition into consecutive integers, which is promising for future research in this area. Analyzing the properties of consecutive integers through "integer tables" reveals several noticeable patterns, one of which suggests that there are certain cases where we can expand on the accuracy of Bertrand's Postulate. We also analyze the case of twin primes and note their unique status of sharing a consecutive integer that has a factor of three. Lastly, we explore the decomposition of primes into consecutive integers through tree diagrams. The relative scope of our methods spans across the fields of elementary number theory, set theory, and algebra.		

UP1.6	Saturday 10:45:00 AM	*The Fractional Calculus*
Anna Shelton		University of Tennessee at Martin
The idea of one-third differintegrals started with the study of the text The Fractional Calculus by Keith B.Oldham and Jerome Spanier, which focuses on half differintegrals. We have been researching this topic with Dr. Curtis Kunkel on this project since June 2016. Then we started looking into one-third differintegrals and created a table of such differintegrals. The concept of a differintegral is basically the creation of an operator that does the same thing as a standard derivative only in multiple steps. For instance, if we apply the one-third differintegral to a function three times, it should be equivalent to taking the standard derivative of the same function. Throughout this poster, we will discuss aspects of the Gamma function, one-third differintegrals, and various proofs established during our research.		

CP1.3	**Friday 2:40:00 PM**	*Canonical bases for subspaces of a vector space and applications*
Uladzimir Shtukar		North Carolina Central University
Canonical bases are introduced in the report, and they are illustrated by the real evaluation for the 6-dimensional Lie algebra of Lorentz group. Then the general cases of canonical bases for (n-1)-dimensional subspaces and (n-2)-dimensional subspaces of a n-dimensional vector space will be found and represented. Meanwhile all reduced row echelon forms for mxn matrices of the ranks (n-1) and (n-2) will be found also. Canonical bases generalize the well known Gauss-Jordan elimination method. Finally, the method of canonical bases is applied to find all subalgebras of some real Lie algebras.		

CP1.5	**Friday 3:20:00 PM**	*Diophantine Eclipses*
Andrew Simoson		King University
We apply a little number theory to show how to predict when solar eclipses occur. In particular, let ω≈1.085196 be the ratio of the moon's synodic (lunation) period and its draconic period. We find two consecutive continued fraction convergents to ω, which correspond to 223 and 358 lunations. Given a central solar eclipse occurring at lunation 0, if the Diophantine equation *223x+358y=c* has a solution (where *c* is an integer number of lunations and where the extreme integer values for *x* and *y* are subject to a rule of thumb convention) then there should be a solar eclipse at lunation *C*. Finally, we check our results versus NASA's dates for solar eclipses.		

UP1.14	**Saturday 10:45:00 AM**	*Golf: Rapid, Optimal Driver Fitting for a Player*
Andrew Smith		Emmanuel College
A golf swing is extremely complex; involving significant mathematics and physics in modeling and statistical analysis. Many times one little adjustment can make a vital impact on a person's game. Therefore, when many people buy a driver, they get fitted to try to find the best driver to improve their game. However, most of the time these fittings either take too long to find out what the person likes, or they are fitted too quickly and improperly. This project is to determine a quick and efficient way to proper fit a player. This project will not deal with improving the player's swing, but rather it will determine what information about the player and their swing are necessary to model them and fit them properly. This information will include parameters like face angle, club head speed, and swing speed. The project investigated a basic formula for distance; linear models for the rates of change dependent upon different shafts, and other factors and functional relationships used to model the distance the subject's ball would travel with that driver. Using this model and optimization, results were developed to create an optimal driver recommendation.		

UT2.4	**Friday 3:00:00 PM**	*An Area Based Fan Beam Projection Model*
Richard Steele		Georgia Southern University
Area based projection models mitigate errors by treating X-Rays as beams, whereas traditional line based projection models treat an X-Ray like a line and not a beam, which generates significant error. In the area based fan beam projection model a rotation matrix, Q, is used to simulate the rotation of the emitter detector pair. This reduces the computational load at the cost of introducing approximations. When the grid is rotated, the squares will no longer align with each other. To eliminate approximations we derive an exact formula for the entries of Q. Using a rotation of axes and by considering the neighboring cell's contribution to the area, the result has formulations for the exact calculation of the matrix Q. Thus the phasing out of approximations allows for the minimization of error in the projection data for image reconstruction.		

UP1.15	**Saturday 10:45:00 AM**	*Can Cellular Automata Improve Data Security?*
Bailey Stillman		Western Carolina University
The technological advances of the 20th century led to an increase in demand for random numbers, especially in the field of cryptography. Due to the difficulty of gathering random numbers, Pseudo-Random Number Generators (PRNGs) were developed. Recently extreme weaknesses in commonly implemented PRNGs which were once thought to have been secure were discovered. An alternative number generator, Cellular Automata, first proposed by John von Neumann are now proffered as a solution. The use of Cellular Automata as PRNGs was proposed by Dr. Stephen Wolfram, who conjectured that some Cellular Automata had inherently random properties. Wolfram separated Cellular Automata into classes ranging from homogeneous patterns to automata capable of universal computation. We will evaluate the frequency of randomness in each class using a small battery of tests designed by the National Institute of Standards and Technology. A discussion will be initiated on whether the Cellular Automata we examined are suitable as PRNGs.		

SS3.1	**Friday 2:00:00 PM**	*The Devastation of Hemlock Trees in the Great Smoky Mountains*
Jillian Stupiansky		University of North Alabama
Recently there has been a great decline in the health and number of Eastern hemlock trees found in the Great Smoky Mountains National Park. This is due to the presence of the Hemlock Woolly Adelgid, an insect which prevents the spread of nutrients through a tree by feeding on the tree's sap. We have created a model that represents the spread of the devastation. The ultimate goal is that the analysis of this model can be used to help find a solution that will revive the hemlock population.		

UP1.16	**Saturday 10:45:00 AM**	*Measles and the Importance of Vaccination*
Abigail Sweet		Converse College
Measles is a highly contagious virus often associated with childhood. It was thought to be eradicated from the United States in 2000 due to high vaccination rates of the MMR vaccine. However, in recent years the anti-vaccination movement has caused the vaccination rates to drop below the 93% necessary for herd immunity to be effective. This has caused new outbreaks to occur. While no epidemics have been reported so far, the threat is real. The following simulation modifies a basic SIR model and makes use of Net Logo to model an outbreak of measles with vaccinations and births/deaths. The Net Logo simulation gives a visual representation for the spread of measles through a population with some key assumptions. The model allows the user to change certain aspects such as the initial population or death rate. From this, we can observe the necessity of vaccines and the consequences of low vaccination rates.		

CP5.4	**Saturday 11:00:00 AM**	*A Comparative Analysis of Turkish Textbooks through Shape Thinking Perspective*
Halil Tasova		University of Georgia
Moore and Thompson (2015) introduced a construct called shape thinking in two forms–static and emergent–that characterizes individuals' ways of thinking for graphs. Static shape thinking refers to thinking of a graph as an object in and of itself (i.e., a piece-as-wire in terms of features of its shape). In contrast, emergent shape thinking refers to imagining a graph as a locus or an in-progress trace representing two quantities' values simultaneously in the respective coordinate system. We have found shape thinking to be useful construct in investigating curriculum materials in order to hypothesize students' opportunities to learn functions and their graphs. In this presentation, we present results from our investigating two Turkish mathematics textbooks (i.e., Pasifik and Milli Egitim Bakaligi [MEB] publishing house) that have been most widely used in grade 9. We specifically focus on the topics of linear functions and slope. We present three main different features in these textbooks. Firstly, MEB allocates a specific section for description of the graph of a function, emphasizing that a function's graph consists of infinitely many pairs of points relating x- and y-values correspondingly. Pasifik does not include such a section. Secondly, Pasifik introduces a method in which students are expected to learn properties of the slope by looking at the direction of line (e.g., upward from left to right means positive slope). MEB, however, conveys positive or negative slope as a measure of how x-values increase or decrease with variations in y-values without emphasizing the visual steepness of those lines. Thirdly, while Pasifik provides a method for calculating the slope of the object of the line provided two points, MEB emphasizes that the calculation involves changes in x- and y-values by indicating the amount of change in one quantity's values with respect to amount of change in another quantity's values. Yet, we note that in the worked and practice examples, both textbooks provide questions that do not emphasize thinking of graphs emergently. Collectively, we illustrate that Pasifik conveys intended meanings associated with static shape thinking whereas MEB conveys some meanings associated with emergent shape thinking. Against the backdrop of these differences, we discuss instructional implications and future directions.		

UT8.3	**Saturday 10:40:00 AM**	*A Rational Fibonacci to the n Identity*
Luke Tiscareno		The Citadel
The Fibonacci sequence is a recursive sequence with the values of 1, 1, 2, 3, 5, 8,…, which has many interesting properties. Working with Fibonacci and Lucas sequences, my collaborator Marcus Harbol and I solved several open problems. Those problems where submitted for consideration to be published in the journal Fibonacci Quarterly. We began working on an open problem from Fibonacci Quarterly. The problem is an identity involving a quotient of sums of n-power of Fibonacci numbers. In solving this problem, we found some additional open problems and their solutions using limits that gave rise to the Golden Ratio. In this presentation, I will discuss the detailed solutions of the above-mentioned problems and I will also highlight some properties of the Fibonacci and Lucas numbers.		

CP7.3	**Saturday 10:40:00 AM**	*Math Placement at Western Carolina University*
John Wagaman		Western Carolina University
In this talk, we will discuss some of the recent changes made at Western Carolina University in regard to math placement. As recently as three years ago, incoming students were placed using SAT/ACT only, but we have recently adopted a model which uses both SAT/ACT score and high school GPA to place incoming students who are taking their first college mathematics course. We will discuss other variables considered and future directions of our placement strategy.		

CP6.2	**Saturday 11:00:00 AM**	*Ascending Subgraph Decompositions of Tournaments Minus an (Almost) Perfect Matching*
Brian Wagner		University of Tennessee at Martin
A digraph *D* with $\binom{n+1}{2}+k$ arcs $(0 \le k \le n)$ has an ascending subgraph decomposition (ASD) if there exists a partition of the arc set of *D* into *n* sets of size *1,2,3,…, n-1, n+k* such that the digraphs D_1, D_2, …, D_{n-1}, D_n induced by the *n* sets of arcs in the partition have the property that for all *i=1,2,3,…, n-1*, D_i is isomorphic to a subgraph of D_{i+1}. We will discuss the problem of finding an ASD for tournaments minus an (almost) perfect matching.		

UT1.1	**Friday 2:00:00 PM**	*Modeling Emergency Room Arrivals Using Non-Homogeneous Poisson Processes*
Rachel Wagner		Coastal Carolina University
The purpose of this research is to determine a function that describes the rate at which people arrive in the emergency room at a local hospital. We assume that the rate of patient arrivals follows a repeating trend. The cyclic rate function has the form $\lambda(t) = e^{h_\theta(m,t)}$ where $h_\theta(m,t)$ consists of two components. The components are a trigonometric component to capture the cyclic behavior. The second component is a polynomial of degree *m* which represents the general behavior over time. Additionally, θ is the vector consisting of all unknown parameters that will be estimated using parameter estimation techniques. The data obtained includes arrival times from randomly selected days at the local hospital. The rate function will then be applied to the Non-Homogeneous Poisson Process in order to obtain the expected number of arrivals in a day or certain time interval and predict when the arrivals will occur. Such information is important for hospitals aiming to efficiently allocate resources.		

UT3.2	**Friday 2:20:00 PM**	*Mathematically Modeling Subdiffusive Protein Movement in Cells*
Stephanie Waldrep		Birmingham Southern College
FRAP is a microscopy technique that is used to determine the rate of diusion of molecules in cells. Because of the congested nature of cells, particles move at a slower rate than that modeled by the normal diusion equation. Therefore, fractional calculus is required to modify the normal diusion equation to correctly model the movement of particles within cells. Physicists have found that the time-fractional diusion equation, which is similar to the normal diusion equation but relies on a fractional derivative time component, better models diusion in more crowded systems such as cells. In this paper, we rearrange the time-fractional diusion equation using fractional calculus and then solve it using Fourier and Laplace transforms, their inverses, and special functions.		

CP5.3	**Saturday 10:40:00 AM**	*Drawing Phase Plane Portraits on the Computer using Differential Equations*
Barrett Walls		Georgia State University
The phase plane for certain differential equations are parameter dependent. This leads to the investigation of the existence of limit cycles. These problems are not solvable analytically but with computers calculating the phase plane diagrams it becomes possible to see and understand these limit cycles. We present a good way of having student create their own diagrams using computers. Examples will include the Van der Pol equation, predator-prey models and others.		

UT6.6	**Saturday 11:40:00 AM**	*Solve B-1196 form The Fibonacci Quarterly*
Welfare Wang		The Citadel
I will discuss how I solved an open problem from the Fibonacci Quarterly. The problem that I solved is an identity involves Lucas and Fibonacci numbers. This problem was submitted for consideration.		

PUB.3	**Friday 3:00:00 PM**	*Refresh Algebra and Trigonometry Skills and Improve Conceptual Understanding Through Visualization with WebAssign for Calculus*
Ballard Ward		Cengage Learning
Although the concepts of Calculus have not changed since Newton, the technology available to assist in their teaching continuously evolves. View the unique tools that will help students refresh algebra and trigonometry skills, before interactive assets aid the learning of the critical concepts of the dynamic Calculus course.		

SS4.1	**Saturday 10:00:00 AM**	*Drawings of People "Doing Math": What We Can Learn*
Ben Westcoatt		Valdosta State University
As STEM disciplines become increasingly important in our society, understanding attitudes and beliefs held by people about mathematics grows in importance. In this talk, I will discuss my use of drawing research to explore beliefs people have about doing math. Pre-service teachers (PSTs) drew various pictures, such as mathematicians doing math, themselves doing math, and a general person doing math. The results of the analysis show that the PSTs' views of mathematics were limited by their experiences. As research indicates that teachers pass on their mathematical beliefs to students, this current analysis suggests that future students could possibly be dissuaded from following a mathematics-based discipline.		

UP1.18	**Saturday 10:45:00 AM**	*Efficacy of Epidemic Surveillance systems in Response to Water-Based Bioterrorism*
Caleb Andrew Williams		Rhodes College
Water supply and distribution systems have historically represented prime targets for terrorist activity, both in the United States and internationally among developed nations. A disruption is supply or quality of water systems could lead to serious medical, public health, and economic consequences. Currently, the public is poorly prepared to detect or defend themselves from water-related disease resulting from intentional contamination. The purpose of this research is to address this critical information gap, to present simulations of what such an attack would look like both with and without safe-guards, and to prescribe which prerequisites would need to be met to most effectively minimize the damage of such an attack. Modeling such an attack comprises a host of different parameters including rate and efficacy of various biological agents to spread through a water supply and population, security of infrastructure, and efficacy of disease control methods within the population utilizing that water source. Using model analysis, specifically agent-based modeling, I have simulated such attacks for a range of parameter sets. As has been seen in outbreaks of similar pathogens, few factors are more important in prevention and control of the agent throughout a population as the efficacy of healthcare workers to identify and treat the disease. Examples of successful surveillance systems have combined the education of healthcare workers towards signs of a growing epidemic, predetermined contingency plans for a myriad of issues in the process of containing the pathogen, and use of laboratory confirmation of pathogens.		

SS3.2	**Friday 2:40:00 PM**	*A Novice Attempt at IBL Real Analysis*
Jessica Williams		Converse College
Real Analysis is an upper level course often taken as an elective in the later stages of a student's undergraduate career. At least one semester of a Real Analysis course is typically offered as part of the undergraduate mathematics curriculum at four-year institutions. Encouraged by research supporting the effectiveness of inquiry-based learning in undergraduate proof-based courses, a first attempt at employing IBL was made in an undergraduate real analysis course at a small college. Structure of the overall course, breakdowns of typical class periods, resources utilized, and modifications made will be discussed. Challenges and successes of teaching in an IBL fashion for the first time will be the focus, along with anecdotal evidence of changes in student's attitudes and beliefs gathered from surveys and written assignments.		

UP1.19	**Saturday 10:45:00 AM**	*Exploring Symmetries with Complex-Valued Functions and Group Theory*
Kelsey Windham		Georgia College and State University
Symmetrical patterns are present in many areas such as: architecture, art, music, and mathematics. The connection between math and art has been known for thousands of years. Using Fourier analysis, we construct wallpaper, color-reversing wallpaper and color-turning wallpaper functions to generate symmetry groups. In addition, we create unique visualizations of these functions with the help of the domain-coloring algorithm and a software.		

GS.1	**Friday 1:45:00 PM**	*A Traipse through the Mathematical Art Gallery*
Carolyn Yackel		Mercer University
During this talk, we will consider a number of pieces of mathematical art and think carefully about the questions mathematical artists must ask themselves when trying to create a piece of mathematical art. In doing so, we will investigate several artworks from a highly mathematical standpoint.		

SS1.3	**Friday 2:40:00 PM**	*Art with Truchet Tiles*
Carolyn Yackel		Mercer University
We discuss ideas and mathematics associated with using Truchet tiles and variants for making mathematical art.		

SS4.4	**Saturday 11:00:00 AM**	*Growth Mindset Interventions*
Laurie Zack		High Point University
In an effort to increase student interest, interaction, and depth of the pursuit of knowledge, our department created a set of growth mindset interventions. These interventions were intended to be done of the first day of class in order to set the stage for the semester. In this talk, I will discuss the interventions that were created, how they were implemented and talk about the outcomes that we are measuring.		

CP8.1	**Saturday 10:00:00 AM**	*Integer Complexity and P-Adic Expansions of Rational Numbers*
Joshua Zelinsky		Birmingham Southern College
Define $||n||$ to be the *complexity* of *n*, the smallest number of 1's needed to write *n* using an arbitrary combination of addition and multiplication. John Selfridge showed that $||n|\geq 3\log_3 n$ for all *n*, and Guy noted the trivial upper bound that $||n|| \leq 3\log_2 n$ for all *n*>1 by writing *n* in base 2. An upper bound for almost all *n* was provided by de Reyna and Jan Van de Lune. We discuss better upper bounds and how further improvements relate to understanding the *p*-adic expansions of rational numbers of the form $-1/m$ for various *m*.		

UT9.2	**Saturday 10:20:00 AM**	*Ramsey Theory*
Eric Zhang		Coastal Carolina University
The purpose of this talk is to introduce graph coloring results known as Ramsey Theory. We will prove R(3, 3) = 6 and use induction to estimate R(3, 3, ..., 3). We will also discuss other Ramsey numbers and applications.		

CP2.2	**Friday 2:20:00 PM**	*Randomized algorithm for estimating largest p elements in implicitly defined matrices*
Yilian Zhang		University of South Carolina at Aiken
Finding largest element of a matrix is of importance in many practical applications. In many situation, it is very costly to compute the explicit form of the matrix. We propose an algorithm that computes a reliable estimate of the largest p elements of matrix A. The matrix A is only accessed through matrix-matrix or matrix-vector multiplications. The algorithm is based on randomized algorithms and variant power iteration methods. Numerical experiments show the effectiveness of the algorithm.		