Student Talk Abstracts

Katharine Ahrens, Ithaca College
Orbits of Generalized Fibonacci Sequences with Complex Coefficients

Abstract: Consider the generalization of the Fibonacci sequence given by the recursion $f_n = cf_{n-1} + f_{n-2}$, where c is a complex number. We show that we can realize f_n as a complex polynomial in c. We explore some interesting cycling behavior occurs when $c = i$. We go on to show that for any even $p \geq 6$, there is a parameter c for which the sequence $\{f_n\}$ is periodic with period p. Finally, we prove that the set of f_n is bounded if the absolute value of c is less than 2 and unbounded otherwise.

Grace Crowell, Nazareth College
Are Manipulatives Just Toys?

Abstract: In this study I looked at how the use of fraction strips impacted fifth grade students' understanding of adding and subtracting fractions with like and unlike denominators. During this talk I will discuss how the use of manipulatives affected students' attitudes toward mathematics and their procedural and conceptual understanding. I will discuss my findings and the implications in the classroom and future research.

William Darman, Utica College
Finding Cyclotomic Polynomials using the Euclidean Algorithm

Abstract: For a positive integer n, the cyclotomic polynomial $\Phi_n(x)$ is a monic polynomial whose roots are primitive nth roots of unity. For primes $p < q$, the polynomial $\Phi_{pq}(x)$ is equal to the greatest common divisor of $\Phi_p(x^q)$ and $\Phi_q(x^p)$. In this talk, we investigate the number of division algorithm steps required in finding the greatest common divisor of these two polynomial.

Iancu Dima, Ithaca College
Applying the Laplace Transform on Special Functions

Abstract: The Laplace transform is one of the most utilized integral transforms in the fields of applied Mathematics, Physics and Engineering. It is known to have useful operational properties which have great use in ordinary differential equations. This project aims to review some known work and provide new results on the application of the Laplace transform on different special functions including a particular interest on the Dawson integral.

By combining the known properties of the Laplace transform and the Dawson integral, we hope to attain new outcomes using different approaches. Throughout the development of the project, we will make use of some other operators that will help us in our computations, such as convolution. The future goals of this project are to investigate other special functions like the Bessel function, which has applications ranging from electromagnetism to quantum physics.

Marcus Elia, SUNY Geneseo
Converging Chaos: The Collatz Conjecture

Abstract: Choose any positive integer n. If n is even, divide by two. If n is odd, multiply by three and add one. Repeat this with the new number, and so on. The conjecture states that all numbers eventually reach one. This tantalizing question, although simple to state, has stumped thousands of mathematicians over the years. We will talk about patterns we have found in how long it takes numbers to reach one, and our theorem about the situations where distinct numbers happen to reach one after the same number of iterations.

Cameron Fitch, Niagara University
Approval Ratings Response to Political Campaigns

Abstract: This presentation will consist of three main points. I will begin with a reflection on the M. L. Vidale and H. B. Wolfe differential equation. Solutions to this differential equation give a product's sales response to a given advertising function. After commenting on what each parameter within the model represents, the next step will then be to show a solution. The main focus will reside in the third point where I am going to present a connection between the Vidale-Wolfe sales advertising model and ratings within a presidential campaign. Through the use of an example that I have created, I will then show how advertising dollars can affect approval ratings during a presidential election. Using data from the 2008 presidential campaign, I will demonstrate that the adapted model gives accurate approval ratings. Possible limitations of applying the Vidale-Wolfe model to campaigns will be discussed as time permits.

Amreen Hemraj, D'Youville College
Real (Complicated, but not Complex) Dynamical Systems

Abstract: A dynamical system investigates how a function changes over the course of time. A value in a dynamical system is based on the previous outcome where $x_{n+1} = f(x_n)$. In this presentation I will focus on real dynamical systems and their application to Sharkovsky's Theorem. Sharkovsky's Theorem states that a there is an order as to when a specific period will begin. He further proves that a dynamical system with a period 3 cycle implies that all cycles with any other period are contained within the dynamical system. I will discuss the proof of Sharkovsky's Theorem and several examples that support this claim.

Heather Kappel, SUNY Fredonia
Varying Path-Perfect Graphs

Abstract: Let S be a finite subset of the set of positive integers, for example, $\{1, 2, 4, 5, 7, 8, 10, 11\}$. We sum the numbers in S, in this case giving us 48. Our next task is to find a graph which has that many edges. For example, the complete bipartite graph $K_{6,8}$ has 48 edges. We then ask, can the edges of the graph be decomposed into paths whose lengths are the elements of S? In our example, the answer is yes, the edges of $K_{6,8}$ can be decomposed into paths of length 1, 2, 4, 5, 7, 8, 10, and 11. In this talk, we will report on a number of results of this kind.

Rachael Kline, St. John Fisher College
Spread of an Idea on a Social Network with an Adoption Rate Driven by the Clustering Coefficient

Abstract: Though SIR (susceptible infected recovered) models are typically used to model epidemics, here we attempt to model the spread of ideas in a population. We depict an idea spreading through modification of the SIR model's parameters and relationships. Since a person's friends normally carry weight in his or her beliefs, we implement the clustering coefficient in the adoption rate as it is a representation of how interconnected one's friends are. Different adoption and resistance rates are explored through simulation.

Kyli Knickerbocker, Nazareth College
Up before Over: Informal Language before Formal Mathematical Vocabulary

Abstract: For this presentation, we will discuss the impact of informal mathematical language use and understanding on formal mathematical language use and understanding. Through literature review and classroom research, I identified the difficulties students have with formal mathematical language and how informal knowledge that students possess increased their understanding of formal mathematical language. We will specifically analyze different literacy strategies that build on students' informal language of slope, perpendicular and parallel lines. We will also look at how these relationships can be cultivated to build up formal mathematical understanding and language.

Courtney Larkin, Nazareth College
How Can We Accelerate Our Advanced Common Core Students?

Abstract: With the implementation of the Common Core State Standards, New York has no specified program for advanced students. This means that the districts have the ability to determine how they will set up the Common Core curriculum to accelerate advanced students. The two districts I looked at implemented grade telescoping for their accelerated program, but each did it differently, causing teachers to choose mathematical content to be left out. In this study I looked at two eighth grade accelerated math classes to see how they used grade telescoping, and how that affected the students success on practice exams. I used eighth grade and ninth grade practice exams to compare with the previous year and across districts. In this presentation I will talk about the effect of the teachers' implementation of the curriculum, and their districts' method for telescoping advanced students. I will also discuss what curriculum the teachers and students prefer for future use in research.

Rachel Lee, Ithaca College
Chaotic Elections: Constructing and Decomposing an Election Profile Using Various Voting Procedures

Abstract: While elections and voting methods mainly seem to be political matters, they are closely related to mathematics. Based on *Chaotic Elections!: A Mathematician Looks at Voting*, by Donald G. Saari (2001), this projects looks at various voting procedures, mainly focusing on positional methods (including plurality, anti-plurality, and Borda Count) and pairwise comparisons. Due to their different mathematical properties, the voting procedures often lead to different election outcomes, which become chaotic. The goal of this project is to explore some of the properties of certain voting procedures and develop ways to represent voter profiles and different outcomes in geometric ways. Therefore, this study shows that an election outcome reflects which procedure is used, rather than what voters *really* want.

The second half of this study looks at different ways to decompose a profile, using reversal, Condorcet, basic, and kernel effects. The decomposition, thus, shows how a single profile can lead to different election rankings depending on the voting procedure. Extending Saari's study with three-candidate elections, which can be modeled with a triangle, we attempt to construct an analogous decomposition for four-candidate elections using a tetrahedron. Therefore, we are able to decompose any four-candidate election profile and explain its characteristics.

Sam Lloyd, Ithaca College
A Combinatoric Approach to n-Dimensional Figurate Numbers

Abstract: This presentation begins with readily understood concepts like triangular and square numbers, and from there progress to show how we can use Pascal's triangle to visualize these figures in higher dimensions. We begin by analyzing the patterns in ordinary 2-dimensional figurate numbers, then show how we can construct these into a matrix. Using techniques from linear algebra, including polynomial curve fitting through Vandermonde matrices, we show that our approach is logically and mathematically sound. We then show that the matrix we created is equivalent to a generalization of Pascal's triangle. Using our knowledge of that generalization, we are then able to create an expression for the x^{th} m-sided figurate number in the n^{th} dimension. This includes not only triangles, hexagons, and dodecagons, but tetrahedrons, pentagonal pyramids, and those in the fourth dimension and beyond. We approach the problem purposefully so that the visualizations of these higher dimensional concepts are readily understood.

Mary Losing, Nazareth College
Do You Suffer from Calculus Phobia?

Abstract: Research shows that there are not enough skilled workers to fulfill the current U.S. job market demands in the STEM field. Furthermore, an increased amount of students are dropping their declared STEM major after beginning their course requirements. Although there is not one factor responsible for this, there is reason to believe that students' struggling with Calculus I is to blame. Calculus has a history for making students aware of their mathematical weaknesses, which deflates their confidence and motivation. Through observations, focus groups, and interviews, I collected data regarding this phenomenon. I will present these findings to provide more insight to future teachers and students in hopes of creating an easier transition into college mathematics and sustaining students in their declared STEM majors.

Dang Minh Nguyen, Colgate University
Constructing Rings with Condensed Zero-divisor Graph as Star Graphs

Abstract: This talk is on the relations between commutative rings with unity and their condensed zero-divisor graph, in which each vertex is a class of elements with the same annihilator, and two vertices are connected if the product of two elements in each class is zero. The condensed zero divisor graph was introduced in a paper by Sandra Spiroff and Cameron Wickham, in which they questioned whether or not condensed zero-divisor graphs that are star graphs of any number of vertices can be achieved. Another paper has shown that certain number of vertices are achievable, but not all number under 100 has been demonstrated. In our research, we proposed an alternative construction based on polynomial rings on fields of order 2n. Our method expands on the current literature, providing some number not previously achieved. We have also come up with a new method using irregular pattern, and with the help of computers, able to realize star graphs with number of vertices that cover all numbers under 100. We hope to generalize our method for all integers.

Sven Thomas, Alfred University
Approximating Functions

Abstract: Logarithms and arctangent can be "difficult" to compute using standard approaches, but they are both important functions to the sciences. In speed-critical situations, such as in signal processing, or computer graphics, we need to apply some tricks to quickly compute logs and arctangent. In this talk, we will introduce some of these tricks to create "efficient" functions that approximate arctangent and the natural logarithm, and compare this technique to some existing techniques.

Jamal Williams, DYouville College
Cool Integral Problem

Abstract: An integral problem was posted in The American Mathematical Monthly, Vol. 113, Number 5, Problem 11225; I will show the process in which I found a solution.

Erika Wilson, SUNY Oswego
Tackling an Immense Data Set: Big Data for Young Researchers

Abstract: How do researchers work with copious amounts of data? Even something as simple as sorting can turn out to be a very complex, time-consuming task, especially for a junior researcher with limited programming skills or software licenses. Come learn how I figured out how to jump start the analysis of a large astrophysics dataset using Boolean algebra.