2022 Fall Seaway Meeting

Siena College

Contributed Talks

Cesar Aguilar, SUNY Geneseo
Title: Publishing LaTeX documents on the web

Abstract

In this talk, we will discuss some of the limitations of using PDF files to publish mathematically rich documents on the world wide web and demo currently available tools for publishing LaTeX documents in HTML.

Ahmad Almomani, SUNY Geneseo
Title: Algorithms for Sustainability Optimization

Abstract

Recently, many researchers have developed different types of optimization algorithms in various areas of sustainability and sustainable development. Many Optimization models for optimum efficiency in sustainability are established in environmental, economic, energy resources sustainability, and more. In this talk, I will introduce many examples of using optimization algorithms for various sustainability issues.

Jon Bannon, Siena College
Title: A Game Changer: Engaging Mathematics with the Lean Theorem Prover

Abstract

Computer proof assistants allow you to reinterpret theorems and their proofs as levels of a video game. Level design is the construction of the theorem statement, and "beating" the level amounts to constructing the (interactive) proof. In this session, we will play with the Lean Proof Assistant, and then discuss how the mathematics community is engaging with it and how to get involved.

Hossein Behforooz, Utica University
Title: Playing with Continued Radicals and Iterated Exponents

Abstract

In real analysis and number theory courses, the study of the Continued Radicals and Continued Fractions and Iterated Exponents are very popular and interesting subjects. In this talk we will present some notes on the calculation of the continued radicals and iterated exponents with integer elements and integer values by using splitting of the integers under radicals in a certain way which are very bizarre and interesting approaches. Since the time of the lecture is short I promise to state the theorems without proofs. That will change my presentation from theoretical approach lecture to a fun and amusement type of lecture. Yes, this talk is understandable to undergraduate students. Come and join us. MATH is FUN.

Matthew Coppenbarger, Rochester Institute of Technology
Title: An Impartial Combinatorial Game on a 3×3 Board with Magic Square Constraints

Abstract

An impartial combinatorial game on a 3×3 array with constraints used for magic squares is defined. Entries for the game are nonnegative integers from 0 to n. We show that Bob has a winning strategy for n = 1 and Alice has the winning strategy for all other values of n. A winning strategy for each case is provided.

Jack Graver, Syracuse University
Title: Distributing Points on the Sphere

Abstract

In the the 1920s A Dutch botanist P.M.L. Tammes was interested in the distribution of the pores on pollen grains: they seemed to be “evenly distributed.” In 1906 a physicist, J.J. Thompson, was also interested in this problem: negatively charged particles are attracted to the surface of a positively charged sphere - but repel each other and seem to be “evenly distributed.” The joints of Buckminster Fuller’s geodesic dome also seem to be “evenly distributed.” For computer scientists, the coordinates of a finite set of points on the sphere are the code words of a spherical code: the further apart the words are from one another the more accurately one can decode a message that includes some transmission errors. Finally, the golfball manufacturers distribute the dimples on their golfballs evenly!

Exactly what do we mean by “evenly distributed”?

Is it the same in all cases?

How would we find/construct such distributions?

One point is clearly “evenly distributed” on the sphere as are two antipodal points. Three points evenly distributed around an equator? The four vertices of an inscribed regular tetrahedron is pretty clearly the solution for four. Should we be able to use the inscribed platonic solids to get the solutions for 6 (octahedron), 8 (cube), 12 (icosahedron) and 20 (dodecahedron). But what about 5?, 7?, 9?, ... Come and we’ll talk about it.

Jeff Johannes, SUNY Geneseo
Title: Poisson’s exploration of complex line integrals

Abstract

In a 1820 paper published in the Journal de l’Ecole Polytechnique, Poisson wrote about complex line integrals. In one of the first hesitant steps in history, Poisson struggles with how to interpret line integrals in the complex plane, thinking that they potentially give rise to different values for associated real integrals. In this talk we will look at the details of the first complex line integrals and Poisson’s early considerations of the results.

Emelie Kenney, Siena College
Title: Writing and Teaching the History of Polish Mathematics

Abstract

An area of the history of mathematics that is lesser known, both in the general population and in the community of mathematicians, is the history of Polish mathematics, particularly in the Interbellum, during World War II, and immediately after that war. This history is rich with accomplishments, however, especially those of women who earned degrees and taught while in hiding from the Nazis, and deserves attention from a wider audience. Why is this history so little known? There are numerous reasons. In this talk, we discuss some of the issues and achievements of Polish women mathematicians, as well as reasons for their relative obscurity.

Daniel Look, St. Lawrence University
Title: Victims of Higher Space: Science Fiction for the Mathematics Classroom

Abstract

The late 1800s and early 1900s saw a flourish of activity in mathematics and physics with mathematicians laying the groundwork for non-Euclidean geometry and mathematical models for higher dimensions. These ideas were picked up by pseudo-scientists and occultists as explanations for spiritual and supernatural events, eventually making their way into popular culture fiction in the early 20th century via stories appearing in so-called pulp publications. We will examine examples of uses of higher dimensions, mathematics, and physics in these stories and discuss the veracity of the usage. We'll end with a brief discussion of how these stories and concepts can be folded into an upper level undergraduate course on popular culture and mathematics.

Mark McKinzie, St. John Fisher University
Title: Multiplication in Ethiopian Marketplaces and Russian Peasant Schools

Abstract

In 1896, an account of an interesting multiplication technique appeared in a French journal: this method, which was described as being used by Russian peasants, combined doubling (”duplation”), halving (”mediation”) and a bit of addition. Thirty-five years later this same method was observed by Leo Roberts in an Ethiopian marketplace. This talk will described the method, compare it to a similar multiplication algorithm found in ancient Egypt, and trace the history of how this method was introduced to people in the United States.

Sedar Ngoma, SUNY Geneseo
Title: Well-Posedness and higher regularity of an inverse source problem for a parabolic equation

Abstract

We consider an inverse time-dependent source problem for a parabolic partial differential equation with Neumann boundary conditions and subject to an integral constraint in a domain of $\mathbb{R}^n$, $n \geq 1$. We show the well-posedness and higher regularity of solutions in Hölder spaces. We then develop and implement an algorithm that we employed to approximate solutions of the inverse problem using a finite element discretization in space and the backward Euler scheme in time. The numerical experiments show that the proposed scheme is an accurate approach to approximate solutions of this inverse problem.

Olympia Nicodemi, SUNY Geneseo
Title: My Summer Vacation in Perspective.

Abstract

My summer travels had a theme: to follow the artists of the early renaissance in their development of perspective. My tour guide was the wonderful Danish historian, Kirsti Andersen. In this talk, I will follow her on a side trip that explores a sequence of diagrams found in the work of the early Renaissance artist and mathematician, Piero della Francesca (c. 1415-1492). In his De prospectiva pingendi ("On Perspective in Painting"), he presents an unusual approach to drawing a simple cube in perspective. His diagrams are not milestones in either art or mathematics, but they do provide an interesting look at how a pre-Cartesian artist/mathematician coordinated without coordinates.

Sam Northshield, SUNY Plattsburgh
Title: A short proof of Fermat's two-square theorem

Abstract

In 1990, Zagier proved, in one sentence, that every prime congruent to 1 modulo 4 is a sum of two squares. While attempting to understand Zagier's proof, I came up with my own short proof. A consequence is an easily implemented algorithm for finding the two numbers whose squares sum to a given prime.

James Parks, SUNY POTSDAM
Title: On a Geometry of Numbers

Abstract

A study of Primitive Pythagorean Triples (PPTs), which includes the planer graph of these triples, is considered. The patterns which appear in the graph are surprising, but easily explained when the triples are studied from a certain point of view. Prerequisites: High School algebra and some analytic geometry.

John Peter, Utica University
Title: An Unexpected Expected Value

Abstract

We investigate what happens if we roll a die along an infinite gameboard with roll again spaces. We look at some special cases for certain board configurations, and for dice of various size.

Gabriel Prajitura, SUNY Brockport
Title: A Covering Property

Abstract

We will discuss the possible size of certain union of balls centered ar the rationals and of radiae the harmonic numbers. This is joint work with Gabriela Ileana Sebe from Polytechnic University of Bucharest The Institute of Mathematical Statistics and Applied Mathematics of the Romanian Academy.

Hossein Shahmohamad, R I T
Title: What Ate the Eight Root?

Abstract

This talk establishes a family of root reduction identities. In particular, radical expressions whose root is a power of two are reduced to radical expressions whose root is equal to two; i.e., a square root. One particular reduction identity is used to provide a solution to a problem posed in the 56th Putnam exam.

Naveen Somasunderam, SUNY, Plattsburgh
Title: The early history of compactness and its use in pedagogical design.

Abstract

The concept of compactness is arguably one of the most abstract and difficult concepts to grasp in undergraduate mathematics. It involves two seemingly disparate ideas, sequences and open covers, that nevertheless unify under some mild constraints of the underlying set.

In this talk, we examine the works of Dirichlet, Borel, and Lebesgue from the mid to late 1800s. These pioneers were influential in the further development of this concept by Frechet and Hausdorff in the 1900s. We shall also discuss how the historical development could be useful in pedagogical design of an advanced calculus course for undergraduates.

Robert Sulman, SUNY Oneonta
Title: Linear Functions (modulo n) and Associated Algebraic Structure

Abstract

We consider linear maps f(x) = ax+b (mod n) and explore the variety of "cycle graphs" produced by iteration. When gcd(a, n)=1, one additional condition enables us the determine the complete cycle structure without making any x/f(x) calculations. When gcd(a,n)1, "whiskers" will be present in the cycle graphs. We will also see symmetry in the distribution of inverse-pairs (in cycle graphs) among the units of the ring (Zn, +n, n). Finally, we examine the groups whose elements are linear maps (mod n). Several of the initial ideas have been introduced in this author's Liberal Arts Mathematics classes.

Jeff Suzuki, Brooklyn College
Title: How I Learned to Stop Worrying and Love Online Exams (Continued)

Abstract

During AY 2021-2022, we gave all our college algebra midterm exams online, but had an in-person final exam. To our surprise, student performance on the unmonitored midterm exams generally matched their performance on the in-person finals. This suggests that properly designed online exams can provide authentic and reliable measures of student understanding. We'll provide an overview of our approach.

Gary Towsley, SUNY Geneseo
Title: The Langlands Program a Few Centuries Back

Abstract

I have been attempting to understand the Langlands Program for awhile now. I have noticed similarities between the modern work and the problems of the solution of the quintic and of Fermat's efforts to generate primes. It is this similarity I wish to present.

Jue Wang, Union College
Title: Quaternions - Navigating in Space or inside the Human Body

Abstract

Quaternions are four dimensional extension of complex numbers. They are now widely used in computer graphics and video games to represent orientations in 3D. Although less intuitive than Euler angles for visualizing roll, pitch, and yaw, quaternions have proven to be a more robust and efficient tool for tracking rotational motions. Quaternion development is attributed to William R. Hamilton in 1843. His work became the first non-commutative algebra to be studied. I will demonstrate how a gimbal lock can occur with Euler angles. A well-known gimbal lock incident happened in the Apollo 11 Moon mission. I will show orientation tracking with quaternions applied to ultrasound imaging. 3D printing, inertial measurement unit, Arduino microprocessor, and ultrasound system are integrated for reconstructing 3D volumetric views of the inside of the human body.

Student Talks

Dominic Altamura, SUNY Oswego
Title: Computational Symbolic Integration Differentiation

Abstract

As part of an honors thesis project, I am developing a computational symbolic integration and differentiation program. The program uses the Wolfram engine for simplification of given expressions, but the symbolic representation, integration, and differentiation algorithms are performed in the program and were designed by me with the goal of making the code understandable to a typical mathematics or computer science undergraduate student. In this talk, I'll be discussing how the program represents expressions and how the program integrates and differentiates those expressions.

Kaitlyn Bordone, SUNY ONEONTA
Title: A Brief Look at Curves and the Isoperimetric Inequality

Abstract

To provide some context for our investigation of curves, we will first review a few fundamental concepts from advanced Calculus, such as vector fields and line integrals. Based on these concepts, we will then look at the Isoperimetric Inequality, seen as an application of the famous Green's theorem.

Joseph Martino, Niagara University
Title: On the number of steps of the odd greedy algorithm

Abstract

Given a rational number x/y with y odd, the odd greedy algorithm starts with the largest odd denominator unit fraction at most x/y, adds the largest odd denominator unit fraction so the sum is at most x/y, and continues as long as the sum is less than x/y. It is an open question whether this algorithm always terminates. We characterize the rational numbers for which it terminates in two steps and the rational numbers of the form $3/y$ for which it terminates in three steps.

AnnMarie Persad, SUNY ONEONTA
Title: A Brief Look at Curves and the Isoperimetric Inequality

Abstract

To provide some context for our investigation of curves, we will first review a few fundamental concepts from advanced Calculus, such as vector fields and line integrals. Based on these concepts, we will then look at the Isoperimetric Inequality, seen as an application of the famous Green's theorem.

Earth Sonrod, Ithaca College
Title: Some Properties of Fibonacci-Pascal Triangle

Abstract

Pascal's triangle is a triangular array that has 1 on the boundary and each of the remaining is the sum of the nearest two numbers in the row above. Combinatorially, each entry represents a distinct binomial coefficient that leads to several applications such as combinatorics, algebra, and probability. The Hosoya triangle is defined as a set containing products of two Fibonacci numbers $H_{m,n} = F_{m-n+1}F_{n+1}$ for all $0 \leq n \leq m$. This present work introduces a new triangular array modified from the Hosoya triangle and Pascal's triangle and explores some properties, including row sum and entry expression. We also apply the results to illustrate a generalization of Pascal's triangle through a combinatorial interpretation.

Dean Walck, Niagara University
Title: Topological Implications of Simplicial Complexes

Abstract

Simplicial Complexes are objects commonly found in algebraic topology which have an array of applications ranging from neurodynamical theories to hypothetical models of quantum gravity. They lead to ideas like Fundamental Groups and topological invariance, which have wide applications in, among other things, developing field theories which describe the world around us. Therefore, understanding what Simplicial Complexes are, how they relate to each other topologically, and how they are used in computations can be an exciting beginning to a mathematical odyssey which can be shown succinctly in a Simplicial proof to Brouwer's Fixed Point Theorem using Sperner's Lemma.

Yutong Wu, Rochester Institute of Technology
Title: Failed Positive Semidefinite Zero Forcing

Abstract

Given a simple, undirected graph G, consider each vertex in $V(G)$ as either "filled" or "unfilled". Let S be the set of vertices that are filled. The positive semidefinite zero forcing rule is as follows: for each component G_i of $G - S$, consider $G_i + A$, where A is the set neighbors of the vertices in G_i. Apply zero forcing color change rule to $G_i + A$. That is, an unfilled vertex is forced to be filled if it is the only unfilled neighbor of a filled vertex. Update S and repeat. The failed positive semidefinite zero forcing number, denoted by $F^+(G)$, is the maximum size of a set of filled vertices that fails to fill all vertices of G while applying the positive semidefinite zero forcing rule. We will discuss the parameter $F^+(G)$ for different types of graphs, including the Cartesian products of two graphs, the characterization of graphs with large and small $F^+(G)$.