Fall Meeting of The Southern California-Nevada Section of The Mathematical Association of America

Contributed Paper Session Abstracts

CSU Fullerton
October 18, 2025

SGMH 1308(Algebra)

11:25-11:40 in SGMH 1308

Presenter(s): Bobby Orozco, CSU Fullerton

Title: *Reconstructing Functions on Finite Abelian Groups with Autocorrelations*

Abstract: The higher-order autocorrelations of integer-valued or rational-valued gridded data sets appear naturally in X-ray crystallography, and have applications in computer vision systems, correlation tomography, correlation spectroscopy, and pattern recognition. In this talk, we consider the problem of reconstructing a gridded data set from its higher-order autocorrelations. We describe an explicit reconstruction algorithm, and mention that the autocorrelations up to order $3r + 3$ are always sufficient to determine the data up to translation, where r is the dimension of the grid. We also provide an explicit example of our algorithm in action.

Area(s): Algebra, Applied Math

11:45-12:00 in SGMH 1308

Presenter(s): Darren Okura, Fullerton Mathematical Circle & Laguna Hills High School

Title: *Three Interesting Algebra Problems*

Abstract: In 1821, Cauchy published his Cours d'analyse, which contained the first rigorous proof of the AM-GM inequality. In the first problem we present, the AM-GM inequality is used to prove the specified inequality, which is an example of its widespread utility. Another inequality that he used extensively is the triangle inequality, and we will also discuss a second problem based on the same inequality over the set of complex numbers. He also thoroughly investigated properties of certain sequences and their behavior at infinity. One sequence which behaves especially nicely at infinity is the sequence of iterations of Newton's method, which can be used to estimate square roots. However, when evaluating this sequence numerically, two of the terms that are added have a difference that equals c^n, where c is a constant determined by the initial guess and n is the number of iterations. In the special case $c = 1$, this difference remains constant and only one of the terms needs to be calculated. This property is used in the third problem we present, which concerns a sequential limiting process.

Area(s): Algebra

12:05-12:20 in SGMH 1308

Presenter(s): Ruilin Zhu, Troy High School and Fullerton Math Circle
Other Author(s): Research advisors: Drs. Bogdan Suceavă and Shoo Seto, California State University, Fullerton

Title: *Applications of Function–Inverse Graphical Relationships in Solving Challenging Algebraic Problems*

Abstract: The graphs of a function and its inverse are reflections of each other across the line $y = x$. This fundamental property provides powerful tools for addressing challenging algebraic problems. In this presentation, I will review these tools and illustrate their application through examples involving both equations and inequalities. By working through these problems, we can develop a deeper understanding of the relationship between a function and its inverse and become more proficient in employing these creative techniques to construct and solve challenging problems.

Audience: Algebra
Area(s): Algebra, Math Education/Pedagogy

SGMH 1307(Analysis)

11:25-11:40 in SGMH 1307

Presenter(s): John Rock, Cal Poly Pomona

Title: *Desmos and GeoGebra activities for analysis*

Abstract: Desmos and GeoGebra are free mathematical tools that allow us to visualize a wealth of mathematical concepts. This talk showcases a variety of Desmos and GeoGebra activities designed to illustrate and animate difficult definitions in analysis such as limit of a sequence, continuity, Riemann and Lebesgue integrals, pointwise and uniform convergence, and the Weierstrass Approximation Theorem via Bernstein polynomials. Bring a phone or tablet so you can take advantage of QR codes and play around with the activities yourself!
Audience: Calculus, Intro to Proofs, Real Analysis
Area(s): Real Analysis

11:45-12:00 in SGMH 1307

Presenter(s): Julia Aceron, Pomona College

Title: *Quantum metrics on standard and non-standard matrix products*

Abstract: Quantum metrics, which were originally introduced by Rieffel and motivated by Physics, provide new ways of extracting information from the data listed in a matrix. The standard matrix multiplication gives an important way to combine the information from two matrices, and there are known ways of how quantum metrics behave with respect to this product. However, there many other important matrix products besides standard matrix multiplication, such as the Cracovian product or Schur product, that also combine the information of two matrices in interesting ways, but there is much less information about how quantum metrics behave with respect to these products. In this project, we studied the way quantum metrics on matrices behave with these other matrix products as well as the standard product, while introducing a new matrix product (called the CraSH product) and also studying the effect the quantum metric has on this product. (This work is partially supported by NSF grant DMS-2316892).
Area(s): Analysis

12:05-12:20 in SGMH 1307

Presenter(s): Anna Aboud, Westmont College
Other Author(s): Mary Vaughan, Texas State University; Patricia Alonso Ruiz, University of Jena, Friedrich-Schiller-Universität Jena

Title: *A New Graph-Directed Construction of Nonlocal Energies on the Unit Interval*

Abstract: Generalizations of iterated function systems, graph-directed fractals enable constructions well suited for modeling nonlocal processes. In this talk we use a graph-directed fractal structure to approximate the unit interval with a sequence of discrete, complete graphs with vertices at the dyadic rationals. We then construct graph-directed self-similar energies on the interval, ultimately showing the Mosco convergence of these energies to a nonlocal energy form.
Audience: Undergraduate Discrete Math
Area(s): Analysis

SGMH 1303(Number Theory)

11:25-11:40 in SGMH 1303

Presenter(s): W. Riley Casper, CSU Fullerton

Title: *Pascal's Matrix, Point Counting on Elliptic Curves and Prolate Spheroidal Functions*

Abstract: The eigenvectors of the $(N+1) \times (N+1)$ symmetric Pascal matrix T_N are analogs of prolate spheroidal wave functions in the discrete setting. The generating functions of the eigenvectors of T_N are prolate spheroidal functions in the sense that they are simultaneously eigenfunctions of a third-order differential operator and an integral operator over the critical line $\{z \in \mathbb{C} : \mathrm{Re}(z) = 1/2\}$. For even, positive integers N, we obtain an explicit formula for the generating function of an eigenvector of the symmetric pascal matrix with eigenvalue 1. When $N = p-1$ for an odd prime p, we show that the generating function is equivalent modulo p to $(\#E_z(\mathbb{F}_p) - 1)^2$, where $\#E_z(\mathbb{F}_p)$ is the number of points on the Legendre elliptic curve $y^2 = x(x-1)(x-z)$ over the finite field $\mathbb{F}_p$. Furthermore when $N = p^n - 1$, our generating function is the square of a period of E_z modulo p^n in the open p-adic unit disk.
Area(s): Algebra, Analysis, Number Theory

11:45-12:00 in SGMH 1303

Presenter(s): Maddox Lister, CSU Fullerton

Title: *Solution to AMM Problem 12419 — On the infinite signed sum of digits of the consecutive positive base 10 integers*

Abstract: The infinite signed sum of the digits of the consecutive positive base 10 integers has first few terms

$$1 - 2 + 3 - 4 + 5 - 6 + 7 - 8 + 9 - 1 + 0 - 1 + 1 \ldots$$

We are asked to prove that given an integer n, there are infinitely many partial sums of the sequence that equal n. We solve the problem using a clever trick or two and a lot of "shifty" algebra.
Audience: Anyone! No prior math knowledge required.
Area(s): Number Theory

SGMH 1112(Graph Theory/Combinatorics)

11:25-11:40 in SGMH 1112

Presenter(s): Max Hlavacek, Pomona College

Title: *Maximal tubings of the cycle graph*

Abstract: Fix a graph G with vertex set $V = [n] := \{1, 2, \ldots, n\}$. A *maximal tubing* $\mathcal{T}$ of a graph G is a maximal collection of compatible subsets of vertices called tubes of G. It is possible to construct a poset MTub(C) on the set of maximal tubes of G. Both the weak order and the Tamari lattices can be realized as MTub(G) and have several interesting properties: They are lattices, and furthermore, they are semidistributive and congruence-uniform. However, for some G, MTub(G) is not even a lattice. A fundamental open question in the field is to classify for which G is MTub(G) a lattice. In 2021, Barnard and McConville show that MTub(G) is a lattice if G is *filled*. In this talk, we consider the cycle graph, C_n, which is not a filled graph, and show that MTub(C_n) is a semidistributive and congruence-uniform lattice. In the process, we introduce and explore a specific map between tubings of the path graph and the cycle graph.
Area(s): Graph Theory/Combinatorics

11:45-12:00 in SGMH 1112

Presenter(s): Joshua Bowman, Pepperdine University

Title: *Collapsing states in digraphs*

Abstract: Directed graphs, or digraphs, can be used to model a finite collection of "states" and the allowed "transitions" between them. They are therefore useful in combinatorial problems involving objects that can be built up from smaller pieces in controlled ways. This observation is at the heart of the transfer matrix method, which involves the determinant of a matrix whose rows and columns are labeled by the states of the digraph. We will show how the matrix is changed when states are removed by a "collapsing" process, and what effect this change has on the determinant. Because collapsing states results in a smaller matrix, this process can make calculation of the determinant easier. We will also explain how the collapsing process relates to a geometric interpretation of the determinant in terms of cycles in the digraph.
Area(s): Graph Theory/Combinatorics

12:05-12:20 in SGMH 1112

Presenter(s): Ayşegül Kula, Pomona College, Nitipon Moonwichit, Claremont Graduate University, and Deniz Tanaci, Pomona College
Other Author(s): Qiyue Feng, Pomona College, Shahriar Shahriari, Pomona College

Title: *On Uniform Chain Partitions of Normalized Matching Posets*

Abstract: Dilworth's theorem guarantees that every poset can be partitioned into as few chains as its width, but it gives no information about the structure of such partitions. A natural next question is: Can there be a Dilworth chain partition in which the chain sizes are as uniform as possible, differing by at most one? A still open conjecture of Füredi from 1985 says that the answer is yes for the poset of subsets of a finite set ordered by inclusion (i.e., finite boolean lattice). It has been proven that the answer is yes for the poset of subspaces of a finite-dimensional vector space over a finite field. A generalization of both of these families of posets is normalized matching posets (i.e., LYM posets). Since 2006, several authors have proposed strengthening F$\ddot{(}$u)redi's conjecture to normalized matching posets (possibly with unimodal and symmetric rank numbers). In our talk, we present infinite families of simple counterexamples, "whisker posets," to multiple versions of the stronger conjectures. We then discuss why the set of counterexamples may be limited and make a new conjecture. *Combinatorics of partially ordered sets*
Audience: Some Combinatorics experience is helpful but not necessary
Area(s): Graph Theory/Combinatorics

SGMH 1113(Graph Theory/Combinatorics)

11:25-11:40 in SGMH 1113

Presenter(s): Briana Foster-Greenwood, Cal Poly Pomona
Other Author(s): Christine Uhl, St. Bonaventure University

Title: *Metric Dimension of Direct Products of Complete Graphs*

Abstract: Imagine you are lost but can measure your distance to several landmarks. How many landmarks do you need to guarantee you can determine your location? This scenario is analogous to finding the metric dimension of a graph. We construct the optimal number of landmarks for a family of direct products of three complete graphs. Our strategy involves analyzing edge-colored hypergraphs and avoiding forbidden subgraphs. Watch out for shark teeth!
Audience: Graph Theory
Area(s): Graph Theory/Combinatorics

11:45-12:00 in SGMH 1113

Presenter(s): Leila Anicia Corrales, Cal Poly Pomona
Other Author(s): Dr. Steve Butler, Kimberly Hadaway, Iowa State University; Maya Mubayi, Northwestern University; Jennifer Rotter, University of Illinois Urbana-Champagne

Title: *Restricted Bounds on Parking Functions*

Abstract: Parking functions represent possible preferences of n cars that enter a one-way street where every car is able to park according to the following parking rules: each car (1) parks in their preferred spot if it is empty, or (2) parks at the next available spot if their preferred spot is filled. This paper discusses parking functions where the number of times a spot can be preferred is at most k. We provide multiple closed formulas, making use of both previously defined and newly introduced objects. We construct a bijection between ordered, unlabeled trees and our restricted parking functions, where the number of children each node has corresponds to the number of times a spot appears in the parking function. We also construct a bijection between k-paths (a modified Motzkin path that we define in the paper) and our restricted parking functions. Finally, we introduce lucky spots, which are spots that are parked in by a car that prefers it, and we construct the number of lucky spots in our restricted parking functions through an alteration of our main formula. As a further direction of research, we propose looking more closely at lucky spots and our restricted parking functions.
Audience: Permutations/Combinations
Area(s): Graph Theory/Combinatorics

SGMH 1109(Geometry/Topology)

11:25-11:40 in SGMH 1109

Presenter(s): Puttipong Pongtanapaisan, Pitzer College

Title: *Knots, Systems of Linear Equations, and Categorification*

Abstract: By examining solutions of systems of linear equations, we can use linear algebra to distinguish knotted shapes. Building on an idea of Cho and Nelson, one can construct a directed graph whose vertices correspond to solutions of these systems, with edges connecting solutions that are related by certain rules. In this talk, we use these directed graphs to distinguish knotted objects that have the same number of solutions. This approach also provides undergraduate students with an accessible introduction to categorification, the process of promoting an algebraic object to one with additional structure. This talk is based on joint work with Tirasan Khandhawit, Korn Kruaykitanon, and Brandon Wang.
Area(s): Algebra, Topology

11:45-12:00 in SGMH 1109

Presenter(s): Levi Puga, CSU Channel Island

Title: *Field Extensions and Multiplication on their Induced Tori*

Abstract: We explore the relationships between quadratic fields and their respective rings of algebraic integers, focusing on two-dimensional rational vector spaces and two dimensional integer lattices. We investigate how these structures interact and examine their underlying algebraic and geometric properties. We delve into the ways in which the properties of quadratic fields influence the structure of two dimensional rational vector spaces and how their rings of algebraic integers influence two dimensional integer lattices. We also introduce a concept we call induced multiplication, which arises from vector space and Z-module isomorphisms. These isomorphisms link these distinct mathematical structures together. We leverage these relationships to construct lattices and tori which allows for geometric interpretations of quadratic fields and their integer rings. This provides valuable insight into their topological and algebraic properties, enhancing our understanding of the connection between algebra and geometry. We provide an investigation of the rational circle group, rational lattices and rational tori. Additionally, we study the endomorphisms of rational tori along with matrix representations for algebraic integers.
Area(s): Algebra, Geometry, Topology

12:05-12:20 in SGMH 1109

Presenter(s): louis ye, Harvey Mudd College

Title: *Unitary Actions and Equivariant Volumes of Symmetric Edge Polytope*

Abstract: The symmetric edge polytope (SEP) of a finite simple graph G is a centrally symmetric lattice polytope whose vertices are defined by the edges of the graph. Among the information encoded by these polytopes are the symmetries of the graph, which appear as symmetries of the polytope. We describe the rigid symmetries of these polytopes, and show that SEPs are unitarily equivalent exactly when their associated graphs are isomorphic. We then find an explicit relationship between the relative volumes of the subsets of the symmetric edge polytope SEP fixed by the natural action of symmetric group elements and the symmetric edge polytopes of smaller graphs to which the subsets are linearly equivalent. We also provide a vertex description of the fixed polytopes and find a description of the symmetric edge polytopes to which they are equivalent, in terms of contractions of the graph G induced by the cycle decompositions of the permutations under which the subsets are fixed. Specializations of our results provide equivalence and volume relationships for fixed polytopes of symmetric edge polytopes of complete graphs (equivalently, for fixed polytopes of root polytopes of type A_n), and describe the symmetry group of this family of polytopes.
Area(s): Geometry, Graph Theory/Combinatorics

SGMH 1406(Geometry/Topology)

11:25-11:40 in SGMH 1406

Presenter(s): Marshall Whittlesey, CSU San Marcos

Title: *A quaternion construction of the 'miraculous pentagram' on the sphere*

Abstract: The *pentagramma mirificum* ('miraculous pentagram') is a spherical star shaped polygon that arises naturally and unexpectedly in the study of spherical geometry. It can be used as a device to construct and understand the trigonometric relationships among the sides and angles of a spherical right triangle. We show how to construct the pentagram and show that its existence can be seen as a consequence of algebraic identities among quaternions.
Audience: Precalculus
Area(s): Geometry

11:45-12:00 in SGMH 1406

Presenter(s): Yorick Herrmann, Jimmy Nguyen, Murong Ning, UC Irvine

Title: *Sums of Cantor Sets Arising from Non-Autonomous Tent Map Systems*

Abstract: The standard tent map is a classical model in dynamical systems that exhibits chaotic behavior. The set of orbits that remain bounded is the middle third Cantor set, one of the best known and studied fractals. Studying fractal geometry involve studying different notions of dimension such as the box-counting dimension and Hausdorff dimension where dimension can be a non-integer. It is known that no interval is contained in the Minowski sum of two Cantor sets whose sum of upper box-counting dimension is less than one. In our setting, we study Cantor sets arising from non-autonomous tent map systems and their properties. One goal of this project includes determining sufficient conditions for when the sum of these Cantor sets contains intervals when the sum of their Hausdorff dimension is less than one. Through examining known results and considering geometric approaches, we were able to accomplish this goal.
Area(s): Geometry

12:05-12:20 in SGMH 1406

Presenter(s): Mark Maldonado, California Polytechnic State University Pomona
Other Author(s): Thesis Advisor: Dr. Arlo Caine, California Polytechnic State University Pomona

Title: *An Investigation of the Čech Homology Groups of the Sierpinski Gasket*

Abstract: We present what we believe to be a unique approach to the computation of the Betti numbers of the Čech homology groups of the Sierpinski Gasket inspired by Vanessa Robins's (Ph.D. Mathematics) work on computational topology. We introduce the fundamental concepts of fractal geometry needed to construct the Sierpinski Gasket, for which we formally construct a model of Sierpinski's Gasket, based on its iterates constructed from an iterated function system of dilations, using 0, 1, and 2 simplices where vertices are indexed using a base-3 system. We then compute the Betti numbers of all simplicial homology groups of the iterates, for which we transition into inverse limit systems from both a topological and group perspective. Using the approach of inverse limit systems to define Čech homology groups, we construct a sequence of open covers of the Sierpinski Gasket and construct their Nerves in order to rigorously verify that the 1st Čech homology group of the Sierpinski Gasket has an infinite Betti number and the 0th Čech homology group of the Sierpinski Gasket has Betti number equal to 1.
Audience: Fractal Geometry, Algebraic Topology (a basic understanding of simplicial homology will be helpful)
Area(s): Fractal Geometry, Algebraic Topology, Real Analysis

SGMH 2201(Math Education/Pedagogy)

11:25-11:40 in SGMH 2201

Presenter(s): Jeffrey Pair and David Chi, California State University, Long Beach

Title: *Graph Theory Research in a Transition-to-Proof Course*

Abstract: In this study, we report on a pure mathematics Course-Based Undergraduate Research Experience (CURE) implemented within a transition-to-proof course where students learned about graph theory research. Through the CURE, students worked independently and collaboratively as they learned about fundamental concepts of graph theory, watched videos of graph theorists discussing their work, and made sense of a theorem from published research papers. As a result of the CURE, students reported learning about the practices of mathematicians—they were impressed with the time and effort mathematicians put into proving the conjectures; students also believed they developed skills and confidence to pursue advanced mathematics.
Audience: Mathematics Instructors, Mathematics Education Researchers
Area(s): Math Education/Pedagogy

11:45-12:00 in SGMH 2201

Presenter(s): Rasha Issa, Dr. Sara Lapan, UC Riverside

Title: *From Noticing to Reflection: Graduate Teaching Assistants' Experiences with Written Classroom Accounts*

Abstract: Noticing is the first step to reflective teaching. Mathematics graduate teachers (MGTs) used 'brief-but-vivid' classroom accounts to reflect on teaching, documenting weekly moments and discussing them in facilitated groups. Two major themes emerged: (1) Collaborative Learning and Shared Reflection, where peer interaction fostered camaraderie, accountability, and co-construction of professional knowledge; and (2) Capturing Fleeting Moments, emphasizing subtle classroom dynamics, student behavior, and practical strategies. Participants focused more on pedagogy than content, highlighting early instructors' priorities. Findings demonstrate that socially mediated reflection shapes teaching identity, informs instructional decisions, and links individual noticing to collective learning, with implications for designing more effective teaching professional development.
Area(s): Math Education/Pedagogy

SGMH 2205(Math Education/Pedagogy)

11:25-11:40 in SGMH 2205

Presenter(s): Mariela Rivas, Caylor Davis

Title: *Transfer is the Goal: Helping Students Apply Statistical Knowledge Across Disciplines*

Abstract: Statistics is a foundational discipline, but students often struggle with knowledge transfer—the ability to apply concepts across different contexts and build upon them for advanced learning. This talk introduces a curriculum developed at CourseKata.org that addresses this challenge by integrating principles from the learning sciences (Fries et al., 2020), specifically targeting two forms of transfer. First, generalization, which refers to applying statistical methods, such as regression, to diverse domains like biology and business. Second, preparation for future learning by building foundational concepts to master more complex topics. We've designed an interactive statistics curriculum that includes a set of core interactive textbooks and Jupyter notebooks. This curriculum is currently being used in introductory courses across various fields, including mathematics, psychology, sociology, and business. Our materials continuously improve (the "Kata") based on student data and feedback from instructors and researchers, allowing us to refine the learning experience. This presentation will explore the design principles of a transfer-focused curriculum and discuss how this approach can equip students with flexible and highly transferable statistical skills.
Area(s): Math Education/Pedagogy

11:45-12:00 in SGMH 2205

Presenter(s): Joan Horvath, Nonscriptum LLC

Title: *Teaching Calculus with LEGOs and 3D Prints*

Abstract: Calculus is usually presented as the culmination of years of algebra and geometry. However, suppose instead one could describe the core concepts purely in terms of physical models like LEGO bricks, 3D prints, and household items? Then, after the student has a firm grasp of these ideas, there is more motivation to learn the algebra needed to compute specific cases and build for the future. We asked the question, "What would have happened if Newton had been able to use a 3D printer to explain calculus?" and developed a set of models that became our book "Make: Calculus" (2022, Make: Community LLC, https://www.makershed.com/products/make-calculus-print) and its associated open-source Github repository of 3D printable files written in the OpenSCAD constructive-geometry language. I will demonstrate how we have used our models to teach elementary-age students. This approach is also inherently accessible to populations like the visually impaired who are not served well with equations on a blackboard, and is a boon to others who are "underprepared" for calculus.
Area(s): Math Education/Pedagogy

SGMH 1506(Applied Math)

11:25-11:40 in SGMH 1506

Presenter(s): Lara Kassab, CSU Fullerton

Title: *How to Build Rankings from Noisy Pairwise Comparisons*

Abstract: Suppose you want to rank teams in a sports league, movies on a streaming site, or search results on the web. Often, what we have are not full rankings but only pairwise comparisons—who beat who, or which movie someone liked more. From this incomplete and sometimes noisy data, can we still recover a good overall ranking? In this talk, we show how stochastic gradient descent approaches, particularly the Kaczmarz method, can be used to uncover the underlying ranking efficiently. We'll present theoretical convergence guarantees and share insights into how much data is enough, how noise affects the results, and why these methods are both mathematically interesting and practically useful.
Area(s): Applied Math

11:45-12:00 in SGMH 1506

Presenter(s): Yolanda Ba, Cole Plepel, Harvey Mudd College

Title: *Efficient Tensor Decomposition: Column Space Convergence and Randomized Least Squares Solvers*

Abstract: Tensors are high-dimensional generalizations of vectors and matrices that can be thought of as n-dimensional arrays of numbers. Many applications, from chemometrics to medical imaging, benefit from tensor decompositions, such as the CP decomposition, in which an arbitrary tensor is expressed as a sum of rank-one tensors, allowing for easier analysis and interpretation. CP decompositions are typically computed via the Alternating Least Squares (ALS) algorithm, which reduces tensor decomposition to solving repeated overdetermined linear least squares problems with Khatri-Rao structure. We investigate variants of the ALS algorithms based around efficient approximate least squares subroutines, identifying key aspects of these subroutines affecting ALS convergence, such as the ability to quickly learn the correct column spaces of the CP factors. In particular, we show under mild conditions that the ALS algorithm identifies the correct column space of each factor matrix after one iteration, and preserves this information through future iterations. We also propose and evaluate an efficient family of least squares solvers, taking advantage of the Katri-Rao structure.
Area(s): Applied Math

12:05-12:20 in SGMH 1506

Presenter(s): Sylvia Wagner, California State Polytechnic University, Pomona

Title: *Multi-Visit Drone and Truck Delivery Scheduling*

Abstract: In this project we investigate the problem of package delivery scheduling. More specifically, to increase the efficiency of last mile delivery, we consider a joint truck and drone setting. Each truck carries a fleet of heterogeneous drones possessing varying capabilities. Drones can be launched and retrieved at each customer delivery location along their truck's route. We consider the multi-visit scenario where each drone can deliver to one or more customers before returning to its truck. Following and expanding upon work by Y. Jiang, M. Liu, X. Jia, and Q. Xue, we formulate a mixed integer programming problem whose solution yields an optimal delivery schedule which minimizes the route completion time. Finally, we present numerical results demonstrating optimal schedules and the impact of various truck and drone characteristics.
Area(s): Applied Math, Operations Research, Linear Programming