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Mathematics and Science.Mathematics.01

Erica Bajo Calderon

University of Central Oklahoma

Enhancing a Math for General Education Online Course

The University of Central Oklahoma Math for General Education online course is geared towards students who are not required to take a math course above the College Algebra level. Our goal was to tailor questions in this course to those that the students will see in their future careers. Some of these students will be taking the OGET or other licensing exams that require basic math skills, so we created some questions similar to the ones on those exams. We will show our approach for discovering the academic majors of the students who will be taking this course, the math skills needed for these students's potential careers and the method in which we created questions designed specifically for this course.

Mathematics and Science.Mathematics.04

GraceKelting

University of Central Oklahoma

Using R to Create and Solve Assessment Problems for an Online Math for General Education Course

Perhaps one of the most difficult tasks for teachers is creating appropriate assessment problems to ask their students. Additionally, it may be more difficult to create a large library of questions in order to avoid cheating and provide students multiple attempts on a particular type of problem to deepen their understanding. I have used the mathematical program R to alleviate some of the struggles a teacher may face creating these problems. Specifically, I have written programs that create and solve problems involving apportionment and graph theory for the University of Central Oklahoma's Math for General Education online course. Within the programs is a problem creator that builds a question using randomized numbers and solves it using a specified algorithm.

Mathematics and Science.Mathematics.05

Elizabeth Lane-Harvard

University of Central Oklahoma

Algebra Concepts for Calculus Success

With approximately 300,000 students enrolling in mainstream Calculus I at postsecondary institutions each year, a significant number of them do not successfully complete the course. The MAA reported that there is either something wrong with Calculus I admittance requirements or with instruction. This project considers the former. The purpose of this project is to develop an open-source inventory of the concepts necessary for students to succeed in a university Calculus I course. Research is currently being preformed at UCO, with commitments from other universities to pilot it at a later date. The project utilizes an exploratory, mixed methods, instrument design study approach incorporating both quantitative data (inventory responses vs. final grades) and qualitative data (interviews). This poster will present the current findings and student misconceptions as exposed in the interview process.

Mathematics and Science.Mathematics.06

Casey Skalla

University of Central Oklahoma

Exposing High School Students to Mathematical Problem Solving Through Math Circle

The Central Oklahoma Math Circle is a partnership between Del City High School and the University of Central Oklahoma. The purpose of this Math Circle is to expose high school students to mathematics not normally found in the classroom in an informal setting while encouraging problem-solving and exploration. This poster will present the format of a typical meeting, as well as activities that can be done. In particular, a blood spatter activity will be examined.

Mathematics and Science.Mathematics.07

Zachary King, Thomas Milligan

University of Central Oklahoma

Iterated Line Graphs of Graphs With Regular And Bi-Regular Partitions

Graph theory has many important applications to discrete mathematics and mathematical modeling. One tool that has been used to understand the underlying structure of graphs is the line graph. In 1965, van Rooij and Wilf first characterized iterated line graphs by the growth of their vertex count. In 2017, Balch, Milligan, and Lane-Harvard detailed the properties of the iterated line graphs of regular graphs, bi-regular graphs, and stars. This poster will detail new research being done to extend those results to larger classes of graphs, particularly graphs composed of regular and bi-regular subgraphs.

Mathematics and Science.Mathematics.08

Tessa Neeley

East Central University

Verifying Grad's 13th Moment Approximation

We recreate Grad's Thirteenth Moment Approximation by utilizing the Edgeworth Expansion. This expansion is centered at the Gaussian as opposed to the original centered about the Maxwellian distribution. We verify the validity of this expansion by examining the dimensional units, reduction to Grad's original approximation and creating a numerical approximation.

Mathematics and Science.Mathematics.09

SeanJesse

East Central University

Building on the Blockchain: A Cryptocurrency Mining Rig Data Analysis

The source of the data used in this project comes from a cryptocurrency-mining rig that serves as a node on the Ethereum Network and provides computing power to it in exchange for shares of the network's currency. In this case 8 Sapphire 11265-01-20G Radeon NITRO+ RX 580 graphics processing units (GPUs) have been repurposed with Claymore's Dual Ethereum AMD+NVIDIA GPU Miner v10.3 software to solve equations within the verification process the network uses, with 1 solution per second (Sol/s) being equivalent to 1 hash per second (H/s). Information from two GPUs on the mining rig such as temperature ($^{\circ}$ C), hashrate (H/s), relative fan speed with 0-33%, 34%-67%, and 67%-100% represented as Low, Medium, and High speed respectively, in addition to whether a GPU obtained a share or not when a share was received have been included. How much the hashrate influences the temperature for a GPU, if a higher hashrate makes a GPU more likely to receive a share, whether adjusting the fan speed from Low to Medium or High speeds to lower the temperature improves the hashrate for a GPU, and whether the mean hashrate of GPU 2 and 3 are different have been analyzed.

Mathematics and Science.Mathematics.10

BritneyHopkins

University of Central Oklahoma

Using Student Critique in a Mathematics Classroom

This poster describes activities that use peer review of student work in a semi-flipped mathematics course to enhance student understanding. By recognizing shared learning objectives for formal arguments in sophomore level composition courses, introductory proof-writing, and calculus courses, we designed an inquiry-based collaborative activity that prompted students--both in small groups and as a class--to identify, apply, and critique key elements in constructing valid arguments and supporting those arguments in both disciplinary contexts.

Mathematics and Science.Mathematics.11

EricaBajo Calderon, ScottWilliams

University of Central Oklahoma

Minimum Euclidean Function over the Eisenstein Integers

There are many ways of computing distance in the real world. For instance, the distance a crow flies between two locations as opposed to the distance you travel in your car. The same idea holds in mathematics, which brings up the question: Is there always one way which produces a smallest or minimal distance in the mathematical world? In 1949 T. Motzkin answered this question and discovered a recursive method for determining values of a function which computes this distance, or more specifically, this minimal Euclidean norm; however, this recursive method becomes computationally intensive. Over the integers, a closed form for this norm has been found. Our work is centered on the closed form over the Eisenstein integers, or $\mathbb{Z}[\omega]$ where $\omega = (-1 + \sqrt{-3})/2$. This poster will show how we have analyzed the structure of residue classes modulo $a + b\omega$, how this has allowed us to reduce the number of necessary computations to find the minimal norm and describe how these results can be applied to determine the closed form over $\mathbb{Z}[\omega]$. In addition, we will show a bit of code created to plot the values of the minimal norm.

Mathematics and Science.Mathematics.12

NicholasJacob

East Central University

Binning: Dividing Your Histogram

Visualizing large amounts of data is more important than ever. With terabytes of data at everyone's fingertips, effective strategies for organizing and synthesizing data need to be reexamined. This poster will examine different strategies for appropriately choosing how many bins a histogram might require. We will explore different techniques with distribution fitting in mind and examine some visualization tricks that can be used to manipulate the data displays. Special emphasis will be given to Excel and the python package matplotlib for how to make a histogram that tells the story of your data.

Mathematics and Science.Mathematics.13

EmilyHendryx

University of Central Oklahoma

Using Applied Mathematics to Identify Electrocardiogram Features

This work presents a framework for identifying features on a beat-by-beat basis in electrocardiogram (ECG) signals. Since each feature corresponds to a different part of the cardiac cycle, tracking changes in these features over time can provide insight regarding a patient's clinical status. Using tools from numerical linear algebra to first identify a representative subset of beats from a larger data set, we can then use clinical expertise and data science methods to identify individual beat features.

Mathematics and Science.Mathematics.14

ElizabethWissler

University of Central Oklahoma

Automating Problem Set Generation for an Online Math for General Education Course

Demand is rising for distance learning options, which has created a need for large libraries of problem sets. Creating these libraries manually is time-consuming and effort-intensive, which is an opportunity for automation. The availability of a virtually unlimited number of problem sets for a given topic gives teachers the ability to quickly create new examples, homework, and test problems without the need to purchase pre-made problem sets. In this project, we developed a method to automate problem set generation for the voting theory section taught as part of the University of Central Oklahoma's online Mathematics for General Education course.

Mathematics and Science.Mathematics.15

MehmetAktas

University of Central Oklahoma

Classification of Turkish Makam Music: A Topological Approach

In this project we study Turkish makam music, a system of varied melodies and chords, computationally. Our main goal is to classify the makams using their notes. For this sake, we utilize the topology of complex networks. We first represent songs with weighted networks where nodes and edges correspond to musical notes and their co-occurrences respectively. We then define the diffusion Frechet function over the weighted networks to encode the network topology and finally reach our goal by combining the function values with machine learning algorithms. Our experiments show that such network representation with the diffusion Frechet function is promising in classifying makam music. We believe that our method can be extended to any music, not only makam music.

Mathematics and Science.Mathematics.16

SamundraRegmi

Cameron University

On a Fast Three Step Method for Solving Equation under Weak Conditions

We present a local convergence for a fast three step method in order to solve nonlinear equations under weak conditions.

Mathematics and Science.Mathematics.17

MichaelFulkerson

University of Central Oklahoma

Fermat Numbers and Finite Groups with Perfect Order Subsets

A finite group is said to have perfect order subsets if the number of elements of any given order divides the order of the group. In this poster, we investigate perfect order subset groups and their relationship to Fermat numbers, which are numbers having the form $(2^{2^n})+1$, where n is a positive integer.

Mathematics and Science.Mathematics.18

MichaelFulkerson

University of Central Oklahoma

The Zeta Function, Logarithmic Integrals, and the Prime Counting Function

The Prime Number Theorem (PNT) states that the number of primes less than a given value x is asymptotically equal to $x/\log(x)$. The PNT was first conjectured by Gauss, but it was not proved until over 100 years later (in 1896) by Hadamard and de la Vallée-Poussin. We explore the history of the PNT as well as results related to the prime counting function, the logarithmic integral function, and the zeta function.

Mathematics and Science.Mathematics.19

BrittanyBannish

University of Central Oklahoma

Got Milk? Modeling a Dairy Allergy: Oral Immunotherapy and the Immune Response

The Centers for Disease Control & Prevention reports that the prevalence of food allergies in children increased by 50 percent between 1997 and 2011, and continues to rise. There is no cure and treatment and diagnostic protocols are limited. Understanding the dynamics of one treatment strategy, Oral Immunotherapy, is crucial to uncovering the potential for a cure. We build a differential equations model to study the interaction of a dairy allergen with helper T-cells and dendritic cells. Specifically, we are interested in how consistent exposure to an allergen can switch the production of Th2 helper T-cells (responsible for anaphylaxis) into production of Th1 helper T-cells (which do not produce an allergic reaction). Taking into account Th2 cells, Th1 cells, naive helper T-cells, IL-4 and IL-2 cytokines, and dendritic cells, we model the immune response to allergen exposure. We present our model and results, identifying conditions under which the Th1 cells outnumber Th2 cells, thereby changing the body's reaction to an allergen. We conclude by discussing the dynamics for various parameters.

Mathematics and Science.Mathematics.20

WarrenKeil

University of Central Oklahoma

Attributed network clustering: A Topological Data Analysis Approach

This project proposes a new method to analyze attributed network data using the tools from topological data analysis along with other methods from network analysis. Attributed networks refer to network where each vertex in the network contain a list of features. The most common networks of this type of social networks such as facebook. We then break up the network into smaller subnetworks called ego-network centered around each individual vertex. We then apply a diffusion mapping to convert the attribute network into a weighted graph. We are then able to use the diffusion values to compute homology groups associated with each vertex. These homology groups contain the information about the shape of the data. We then use the Wasserstein distances to cluster the nodes using a hierarchical clustering algorithm.

This project is very interesting from a network analysts viewpoint as it provides a completely new method of clustering attributed network data. Being able to accurate detect clusters in datasets such as facebook is very valuable. This project is also significant from a topological data analyst's view since it provides a method of applying the other tools of topological data analysis to attributed network data.

Mathematics and Science.Mathematics.21

MichaelFulkerson

University of Central Oklahoma

An Investigation of M-Harmonic Functions

A real-valued function on the unit ball in n -dimensional complex space is said to be M -harmonic if it is annihilated by an operator called the invariant Laplacian. We investigate properties of M -harmonic functions and their relationship to holomorphic functions and automorphisms on the unit ball.