KSMAA Section Meeting

April 14-15, 2023
Abstracts

Polya Lecture
Sarah Greenwald
Appalachian State University

Popular Culture and Mathematics: Broader Implications

Mathematics is pervasive in modern society, and on some level we all use mathematics in our daily lives. Have you ever known anyone who asserted that they do not have the "math gene"? Where do those messages come from? Popular culture can reveal, reflect, and even shape how society views mathematics and mathematicians, and we'll analyze examples from a variety of shows and films. We'll also discuss the active role that students and faculty can take to put theory into practice in and out of the classroom in order to counter messages about who can do mathematics. There are also opportunities to contribute to scholarship in this area.

MAA Visitor
Adriana Salerno
MAA Vice President
Bates College

The Stories We Tell

Stories are how we make sense of our world and ourselves. In a mathematics classroom, whether we notice it or not, we tell stories – about what mathematics is and who it's for. Additionally, each person in that classroom (teachers and students) brings in their own stories and experiences with mathematics. In this talk, I will share how acknowledging and making room for different stories has shaped my classroom and my own growth as an educator. And of course, there will be stories.

Andy Bennett
Kansas State University

What is Stochastic Calculus?

Brownian paths are nowhere differentiable with probability one. However, it is still possible to define a calculus with respect to such paths, which finds applications in optimal control, finance, and other areas. This will be an introductory talk explaining how stochastic integration is defined.

Soumya Bhoumik
Fort Hays State University

Cordial Labeling of Helms and Some Product Graphs

An injective function f from vertex set $V(G)$ of a graph G to the set $\{F_0, F_1, F_2, \cdots, F_n\}$, where F_i is the i^{th} Fibonacci number $(i = 0, 1, \cdots, n)$, is said to be Fibonacci cordial labeling if the induced function $f^*$from the edge set $E(G)$ the set $\{0, 1\}$ defined by $f^*(uv) = (f(u) + f(v))$ (mod 2) satisfies the condition $|e_f(0) - e_f(1)| \leq 1$, where $e_f(0)$ is the number of edges with label 0 and $e_f(1)$ is the number

of edges with label 1. A graph that admits Fibonacci cordial labeling is called Fibonacci cordial graph. In this presentation we discuss Fibonacci cordial labeling of helm graphs (open and Closed) and some other product graphs.

Mai Dao
Wichita State University

Bayesian Model Averaging in Data Analysis

Model selection is an important concept that attracts great theoretical and applied statistical research interests. In contrast to popular techniques that search for a final model, Bayesian model averaging (BMA) learns about parameters over the space of all candidate models that could have generated the data and combines such estimates using posterior probabilities of the associated models. This talk aims to provide a general review of BMA and its relevant aspects in prior selection, predictive performance, and computational consideration. An illustrative example that uses BMA for postprocessing model-based clustering results and quantifying model uncertainty is discussed to showcase its advantages in data analysis.

Keith Dreiling
Fort Hays State University

Locating Complex Roots Graphically

For several years I have taught students that a graphing calculator can be used to find real roots for quadratic functions. But recently I found information on how complex roots can also be found on a graphing calculator. Desmos will be used to illustrate how this is done and the mathematics behind the method.

Emilio Escamilla
Wichita State University

Bayesian quantile regression for binary responses

Quantile regression is a class of regression techniques that can provide comprehensive information about the relationship between the output and inputs at any quantile of interest. As quantile regression becomes popular in practice, its advantages are also desired in the context of binary regression. In many applications, to avoid overfitting, the process of variable selection is also greatly valued. This talk will discuss an efficient Gibbs sampler that can achieve simultaneous parameter estimation and variable selection for quantile regression with binary outcomes using a Bayesian hierarchical framework that incorporates the Laplace likelihood and priors. Simulation studies and an examination of the classical Pima Indian dataset show the efficiency and accuracy of the discussed method.

Thamod Fernando
Wichita State University

Color Quantization Analysis Using Mascots of Public Institutions of Higher Education in the United States

Colors play an important role in our lives and being able to recognize colors is extremely helpful in performing daily tasks. However, there are scenarios where people cannot easily identify colors, and automatic color recognition in such cases proves to be very beneficial. In this project, we use K-means clustering, a popular unsupervised machine learning algorithm, to initialize image quantization and perform color recognition. K-means clustering divides a colorful image into regions with pixels of similar hexadecimal color code values using the RBG (red, blue, green) color model and detects

the colors based on identified clusters. Furthermore, we aggregate the colors in the images by their proportions and provide the color blend visualization. Our method is applied to investigate colors of selected mascots of public higher-educational institutions in the United States using the open-source software R. The usefulness of the project can contribute to research efforts to help visually impaired people to quantize and recognize colors.

Sarah Ghazawneh
Wichita State University

EM Algorithm for Linear Quantile Regression

Quantile regression is a statistical technique used to estimate the conditional quantiles of a dependent variable given a set of independent variables. In this talk, we discuss the Expectation-Maximization (EM) algorithm to estimate the quantile regression parameters using the location-scale representation of the asymmetric Laplace error distribution. Not only does this approach offer a closed form estimator for the regression coefficients, but it is also computationally efficient. Results of simulation studies and application to the classical Engel data illustrate the advantages of this method over some existing approaches in the literature.

Samuel A. Hokamp
Sterling College

Spaces of Bounded Measurable Functions Invariant Under a Group Action

In this talk, we characterize spaces of L^∞-functions on a compact Hausdorff space that are invariant under a transitive and continuous group action. This work is analogous to established results concerning invariant spaces of continuous and measurable functions on a compact Hausdorff space. The case for L^∞-functions cannot be proved in the same way when endowed with the norm-topology, but a similar argument can be used when the space of L^∞-functions is given the weak*-topology.

Cynthia Huffman
Pittsburg State University

Rare Mathematical Books in Dublin

I recently completed a fellowship at Marsh's Library, the first public library in Ireland. During this talk, I will share images of some of the mathematical treasures from their collections, in particular, pertaining to the personal library of Archbishop Narcissus Marsh (1638-1713).

Yujie Jia
Wichita State University

A Robust Bayesian Estimate of the Concordance Correlation Coefficient

Agreement evaluations of different methods play an important role in statistical biomarker validation, and the concordance correlation coefficient (CCC) is a popular scaled index for such assessments. However, CCC shows a lack of robustness when small deviations from the normal assumptions could have a large impact on its point and interval estimates. In this talk, we present an alternative robust Bayesian approach to estimate CCC based on a multivariate Student's t-distribution. The simulation study and real data example using EEG measurements show that our method compares favorably to other existing alternatives in comparison.

Robbie Stansbury
Sterling College

To Vaccinate or Not to Vaccinate: That is the Key Question

"A novel coronavirus emerged late in 2019, causing a devastating pandemic (COVID-19). Numerous vaccines were developed, starting late in December 2020, in an effort to curtail and mitigate the burden of the pandemic effectively. Although the deployment of the approved vaccines has, no doubt, resulted in a dramatic reduction in the burden of the pandemic, their use has also resulted in vaccine-induced complications in some vaccinated individuals. When the more transmissible, but less deadly, Omicron variant became the predominant variant of COVID-19 in the United States, we used mathematical modeling to assess the impact of vaccination against the Omicron variant. The model employed is an extension of SIR-type modeling, with extra compartments to reflect aspects of COVID-19 and vaccination. Specifically, we quantify the net number of lives saved due to vaccination, the net economic impact of vaccination, and the net change in herd immunity levels. We fitted and simulated the mathematical model we developed using COVID-19 data for the fifty states of the United States and the District of Columbia. We showed that the vaccine has the greatest benefit when used early during a new wave of the disease. Furthermore, we found that not one of the states has actually achieved herd immunity and that the percentage of a state's population that is fully vaccinated did not have a significant impact on the size of its predicted COVID-19 outbreak. Therefore, this study suggests that vaccination should complement other control strategies rather than using it as our sole intervention."

James R. Valles, Jr.
Prairie View A & M University

PVAMU SUMS Scholars: Mathematics Mentoring

The Prairie View A & M University "Scholars in Undergraduate Math and Sciences" project (SUMS) is funded by the NSF S-STEM program. This is a multidisciplinary effort, with Biology, Chemistry, Physics, and Mathematics working together to provide a program for high-achieving students who demonstrate financial need and plan to enter the workforce or pursue a post-undergraduate degree or licensure in the aforementioned fields. Being housed at an HBCU (Historically Black College and University), this project seeks to provide a multiyear learning and mentoring experience designed to prepare students for undergraduate research, internship opportunities, and overall preparation for life after undergraduate studies. Currently, this project is in the end of its third year.

In this presentation, the SUMS project, with respect to aspects involving mathematics as part of the program, will be discussed. As part of this discussion, faculty mentoring and tutoring, student recruitment and matriculation, and other items will be explored.

Bill Weber
Fort Hays State University

Spaces of Bounded Measurable Functions Invariant Under a Group Action

This talk will be about what is sometimes termed the 100 Prisoner Problem. We will look at the details of the strategy which makes something with probability near 0 actually occur over 30% of the time.

Mark Yannotta
Clackamas Community College

Adapting lessons from inquiry-oriented curricula: A community college story

For more than 15 years, Clackamas Community College has offered an elective mathematics bridge course to its students. Designed to help orient students toward more advanced mathematics, two of the

more student-centered versions of the class use an inquiry-oriented curriculum designed for teaching abstract algebra (Larsen, 2013) or introductory analysis. Like the university mathematics students for which these inquiry-oriented curricula were initially designed, our students successfully reinvent the concept of group and/or define sequences with properties such as "eventually constant" and "unbounded above" enroute to proving larger conjectures, but they also experience the curriculum differently than their four-year counterparts. In the bridge course, we only adapted the first portion of these inquiry-oriented instructional units. In addition, the enactment of these instructional sequences is slowed down. However, the mathematical discourse is still quite strong and authentic within the mathematical setting the students are operating. With the additional time and low(er)-stakes environment, the bridge course fosters an opportunity for a more personalized journey as students generate mathematics through the enactment of individual and collective activities in the curricula.

This talk will overview both the Teaching Abstract Algebra for Understanding (TAAFU) and ASPIRE in Math curricula, which are web-based and free to use and adapt. In addition, the speaker will feature some of the mathematics from a TAAFU instructional unit and share some ideas of how some of these inquiry-oriented lessons can be adapted to be used in bridge courses, transition-to-proof courses, math club events, or even high school enrichment experiences.

Hong Biao Zeng
Fort Hays State University

Magic Candy Jar Revisited

In this paper, we revisit the Magic Candy Jar problem. Let $C_k(n)$ denote the number of ways to draw n candies, from a "magic candy jar" with infinity k different colors of candies, such that all colors are presented and the color of the last draw is unique. We first establish a recurrence relation of $C_{k+1}(n)$. Then we prove a closed formula of $C_k(n)$ for all k and $n \geq k$. We then prove that $f(n) = \frac{C_k(n)}{k^n}$ is a probability mass function. Finally we calculate the expectation of $f(n)$.