

**Rose-Hulman Institute of Technology – 25th Undergraduate Mathematics Conference
Student Speaker Abstracts; Listed according to Presentation Times**

Friday Program

Friday 3:30 - 3:50 p.m., GM Room B-111, Moench Hall

Mathematical Models for Noise Removal in Image Processing

Jessica David

University of Evansville

Abstract: Partial differential equations play a significant role in image processing and providing successful image enhancement models. In our research, we focused on the models that decrease the amount of noise in an image and attempted to find the "good" image information and correct the added noise. Through the study of two image denoising algorithms, total variation and isotropic smoothing, we were able to see their individual effects on images what happened when noise removal was attempted. These observations included how edges were retained, knowing that edges could be confused with noise and preserving edges while smoothing images were two conflicting goals. We then combined the two methods and experimented with a threshold to see how the two methods worked together, as well as a stopping point. The results were seen in a C++ program written to implement the algorithms on black and white images and compared to each other.

Friday 4:00 - 4:20 p.m., GM Room B-111, Moench Hall

Numerical Beam Propagation

Megan Knilands

Rose-Hulman Institute of Technology

Abstract: Understanding what happens to a laser beam as it moves through material is essential to recognizing how gradient indexed optics behave. Our goal is to write a program which propagates a laser beam through excited state and two photon absorption materials. There are many issues in calculating the beam profile, even over a short distance. Estimation methods prove to be too inexact for these type of calculations, and exact methods are usually too time costly. We have created a program in Mathematica that solves the exact forms of the rate differential equations. These solutions closely follow other proven data. After non-linear effects are added to the equations, this program will be used in laboratory situations to try to better understand gradient optic materials.

Friday 4:40 - 5:00 p.m., GM Room B-111, Moench Hall

Families of Elliptic Curves over Finite Fields

Matthew Niemerg

Eastern Illinois University

Abstract: Our main interest lies in exploring isomorphisms of elliptic curves. In particular, we will look at certain properties regarding families of curves in a field. These properties arise naturally for fields with certain characteristics.

Saturday 10:10 - 10:30 a.m., GM Room B-111, Moench Hall

Monte Carlo Methods to predict Commodity Pricing

Kristin Reid

Siena Heights University

Abstract: Monte Carlo simulations can be used as a predictive data set. We implement Monte Carlo predictions for prices of a few commodities and compare results to actual data using Excel and MiniTab 15. We present our results along with a description of the set-up and process.

Saturday 10:40 - 11:00 a.m., GM Room B-111, Moench Hall

Implementation of the Cocke-Younger-Kasami Algorithm

Harley Eades

Millikin University

Abstract: The Cocke-Younger-Kasami (CYK) algorithm determines whether a word can be generated by a given context-free grammar in Chomsky normal form (CNF). The goal of my project was to create an implementation of the CYK algorithm. I implemented a graphical version of the CYK algorithm using the Java programming language. The structure of the user interface closely resembles JFLAP a Java based formal language theory suite. The application allows the user to enter a grammar in CNF using the same syntax they would be using with pencil and paper. The output also adheres to the syntax the student would normally be using. Not only does it adhere to the syntax the student is ordinarily used to, but it shows all of the intermediate steps a student would see while doing it by hand. This application could be used in a class room environment allowing the students the ability to check their work. This talk will focus on the data structures used to successfully implement the CYK algorithm. A short description of future research will follow as well as a demo of the finished implementation.

Saturday 11:20 - 11:40 a.m., GM Room B-111, Moench Hall

A Statistical Look at Mapping the Discrete Log

Nathan Lindle

Rose-Hulman Institute of Technology

Abstract: This talk will explore certain functional graphs generated using the transition function $x \rightarrow g^x \pmod{p}$ for some prime p and base g . Computing this transition is quite easy, but the inverse is much harder, and is the base of many cryptosystems we use today. While the graph samples appear to be similar to random functional graphs at first glance, certain parameters are quite different from the expected results. Some statistical tests are also applied to determine that the parameters which do appear similar are in fact the same.

Saturday 11:50 - 12:10 p.m., GM Room B-111, Moench Hall

With the First Pick in the NBA Draft: A Statistical Analysis of the 1997 - 2001 NBA Drafts

Matt Poisel

Franklin College

Abstract: This talk will explore certain functional graphs generated using the transition function $x \rightarrow g^x \pmod{p}$ for some prime p and base g . Computing this transition is quite easy, but the inverse is much harder, and is the base of many cryptosystems we use today. While the graph samples appear to be similar to random functional graphs at first glance, certain parameters are quite different from the expected results. Some statistical tests are also applied to determine that the parameters which do appear similar are in fact the same.

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