

2022 PME Conference Schedule

9:45–9:55: Welcome & Introduction

Sean Livingston, YSU PME Chapter President

| | Room 1 | Room 2 |
|-------------|----------------------------------------|---------------------------------------|
| 10:00-10:15 | Brandon Sharp | Robert Stilwell |
| 10:20-10:35 | Brianna Funderburk and Alaina Kelly | Janelle Pezzuti and Adeline Whaley |
| 10:40-10:55 | Alex Hanosh | Elizabeth Lees |
| 11:00-11:15 | Jamacyn Davis | Anish Chougule (COMAP) |
| 11:20-11:35 | Samuel Shannon | |
| 11:40-11:55 | Brian Nguyen | |

11:55: Closing Remarks

Morning Session 10:00-10:15

10:00-10:15

Brandon Sharp
Using Technical Analysis for Stock Trading
Youngstown State University
Advised by: Dr. Moon Nguyen

Room 1

There are technically two common ways to trade stocks. One being the use of financial analysis and decision making to understand the underlying features of a company to determine intrinsic value, allowing one to purchase or sell a security in the market in hopes of a profit. The other being technical analysis which uses statistical factors to determine the trend or momentum of the price of an asset. We demonstrate within this paper how to build a stock trading algorithm based on technical analysis to not only efficiently but consistently trade on selected stocks to yield a higher return than simply just holding it for the same period.

10:00-10:15

Robert Stilwell
An Exploratory Research Project on Negative Bases
Clarion University of Pennsylvania
Advised by: Dr. Michael McConnell

Room 2

For my undergraduate program at Clarion University, I took the idea of exploding dots to create a base negative two number system. My research involved working with Octave to form a generating function that produced the position of the base negative two numbers. I did this by converting binary numbers to integers using my base negative two conversion idea. This was then plotted using Excel and examined for patterns.

Morning Session 10:20-10:35

10:20-10:35

Brianna Funderburk and Alaina Kelley
The Impact of Competition on ART
Success Rates and Fertility Clinic Practices

Room 1

University of Mount Union
Advised by: Dr. Sara Crawford

Infertility impacts many people in the United States, and ART procedures can help these individuals conceive a child. Success rates and clinic practices for any clinic in the United States performing at least one cycle of ART are recorded by the CDC and published on a yearly basis; these statistics can be influential to a patient's decision of fertility clinic for ART procedure. The objective of the study was to determine if the proximity of competition of a fertility clinic is associated with its practices or its success rates. Competition was measured as the distance in kilometers from each clinic to the next closest clinic. Using the statistical computing environment R, we explored the relationship between this distance and the practice patterns and outcomes for each clinic using simple linear regression. While some of our tests indicated significance through p -values, most tests produced a small R -squared value; thus, we found little evidence that the distance to the nearest clinic is associated with the success rates and practice patterns of a fertility clinic.

10:20-10:35

Janelle Pezzuti and Adeline Whaley
Exploring the Fibonacci Sequence

Room 2

Youngstown State University
Advised by: Dr. Paddy Taylor

The Fibonacci Sequence is a sequence that appears in many surprising places. In our presentation, we will derive a formula for the n th term of the Fibonacci Sequence using second order linear difference equations. Then, we will show that the ratio of consecutive terms in the sequence is the golden ratio. Finally, we will share examples where the sequence is used to model, construct, or enhance objects found in everyday life.

Morning Session 10:40-10:55

10:40-10:55 **Alex Hanosh** **Room 1**
Case Studies in SIRV Model of the spread of infectious disease
Siena Heights University
Advised by: Dr. Nate Iverson

The study of the spread of infectious disease using compartmental models has been around for 100 years. The SIR model with compartments; S for susceptible, I for infected, and R for removed was first used in 1927 by Kermack and McKendrick. In this presentation we present our results of analyzing case studies of the SIRV model using Euler's Method. We study adding an addition compartment; V for vaccinated.

10:40-10:55 **Elizabeth Lees** **Room 2**
Exploring the Collatz Conjecture
Indiana University of Pennsylvania
Advised by: Dr. Rachelle Bouchat

The Collatz Conjecture is an open problem in mathematics that was first stated in 1937 by Lothar Collatz. It concerns a sequence of numbers formed in the following way. Start with any positive integer n . Then, each subsequent term is obtained from the previous term using the following rule:

- if the previous term is an even number, the next term is one half of that previous term, and
- if the previous term is an odd number, the next term is one more than three times that previous term.

The conjecture states that no matter what value of n you start with, you will always get to the number one. Our goal is to gain a better understanding of the conjecture, to learn properties of the function that gives the sequence of numbers, and to be able to expand the list of the starting numbers for which the conjecture holds true. In this presentation, we address sum and product properties of the function, as well visualizations of the that give insight into how the sequence is formed.

Morning Session 11:00-11:15

11:00-11:15

Jamacyn Davis
Sudoku: A Graph Coloring Problem
University of Mount Union
Advised by: Dr. Katherine Ritchey

Room 1

This project explores Sudoku as a graph coloring problem. It validates the chromatic number for a nine-by-nine Sudoku board by not only representing the board as a graph, but by utilizing a Java program that validates the completed board. The Java program stores the values inputted and creates an internal representation of the graph, so that it can properly assign the nine colors to the inputted board.

11:00-11:15

Anish Chougule
Algorithmic Trading
Youngstown State University
Advised by: Dr. Paddy Taylor

Room 2

This paper explores multiple methods of algorithmic investing using technical analysis of Bitcoin and Gold with Relative Strength Indicator (RSI), Moving Averages (MA) indicator, and Moving Averages Convergence and Divergence Indicator (MACD). The reliability of these three indicators is determined by measuring an individual stock's returns. Using the RSI for trading decisions, increased gold asset returns from 3% to 79.42%, and Bitcoin asset returns increased from 7% to 21.98%. Using the MA for making trading decisions, gold asset returns increased from 30% to 50% and Bitcoin returns from 4640% to 5257%. Using the MACD index for making trading decisions did not yield a significant increase in gold asset returns and gave returns (around 9000 percent) for bitcoin. This is Problem C from the 2022 MCM Modeling Contest. The statement of the problem is provided on Page 8 of this abstract book.

Morning Session 11:20-11:35

11:20-11:35

Samuel Shannon
Primitive Pythagorean Triples & Trig
Clarion University of Pennsylvania
Advised by: Dr. Mike McConnell

Room 1

This project will explore a topic of number theory, specifically, Pythagorean triples. Pythagorean triples are natural numbers a , b , and c such that $a^2 + b^2 = c^2$. For example, $3^2 + 4^2 = 5^2$. This idea can go further, into types of Pythagorean triples known as primitive Pythagorean triples. These still hold the form of $a^2 + b^2 = c^2$, however, a , b , and c must all be relatively prime to classify as primitive. The values for a , b , and c can be generated by the following: $a = st$, $b = s^2 - t^2$, $c = s^2 + t^2$, where s and t are odd and relatively prime. Another way to generate primitive Pythagorean triples, which is to be explored, is through the use of trigonometric identities. This can be done by using sum/difference formulas: $\sin(\theta \pm \phi) = \sin(\theta) \cos(\phi) \pm \cos(\theta) \sin(\phi)$ and $\cos(\theta \pm \phi) = \cos(\theta) \cos(\phi) \mp \sin(\theta) \sin(\phi)$.

Morning Session 11:40-11:55

11:40-11:55

Brian Nguyen
Analysis on an Extended Chronic Wound Model
Western Kentucky University
Advised by: Dr. Richard Schugart

Room 1

The healing of chronic wounds is regulated by the biological interactions between the substrate matrix metalloproteinases (MMPs), the tissue inhibitors of MMPs (TIMPS), and the extracellular matrix (ECM). Expression of MMPs play a role in degradation of substrates in the ECM essential for formation of new epithelium. A current issue of wound healing is the construction of a model that properly encapsulates all the primary factors that facilitate it. This work aims to extend, modify, and analyze the current mathematical model describing these biological interactions between MMPs, TIMPS, ECM, and additional inflammatory cells. Multiple steady state analyses were conducted on various progressions of the model. Using the data obtained from these analyses, the model was modified to improve the biological accuracy of the interactions. A structural identifiability test was then conducted on the final model to gain insight on the internal structure of the system by assessing determinable parameters. de-identified patient data, the model was curve-fitted via MONOLIX's Stochastic Approximation Expectation Maximization (SAEM) method. From the project, we were able to construct a model with calculated parameters.

2022 MCM / ICM - COMAP Modeling Problem C

Trading Strategies

You have been asked by a trader to develop a model that uses only the past stream of daily prices to date to determine each day if the trader should buy, hold, or sell their assets in their portfolio. You will start with \$1000 on 9/11/2016. You will use the five-year trading period, from 9/11/2016 to 9/10/2021. On each trading day, the trader will have a portfolio consisting of cash, gold, and bitcoin [C, G, B] in U.S. dollars, troy ounces, and bitcoins, respectively. The initial state is [1000, 0, 0]. The commission for each transaction (purchase or sale) costs α % of the amount traded. Assume $\alpha_{\text{gold}} = 1\%$ and $\alpha_{\text{bitcoin}} = 2\%$. There is no cost to hold an asset. Note that bitcoin can be traded every day, but gold is only traded on days the market is open, as reflected in the pricing data files LBMA-GOLD.csv and BCHAIN-MKPRU.csv. Your model should account for this trading schedule. To develop your model, you may only use the data in the two spreadsheets provided: LBMA-GOLD.csv and BCHAIN-MKPRU.csv.

- Develop a model that gives the best daily trading strategy based only on price data up to that day. How much is the initial \$1000 investment worth on 9/10/2021 using your model and strategy?
- Present evidence that your model provides the best strategy.
- Determine how sensitive the strategy is to transaction costs. How do transaction costs affect the strategy and results?
- Communicate your strategy, model, and results to the trader in a memorandum of at most two pages.

2022 MCM-COMAP Participants from YSU

| | | |
|---------------------|-----------------|-----------------|
| Bishal Lamichhane | Emily Cappelli | Janelle Pezzuti |
| Gyaneshwar Agrahari | Nataie Dando | Rasul Jafarli |
| Pradip Rimal | Adeline Whaley | Elizabeth Saur |
| Christian Miner | Nishan Adhikari | |
| Cayden Agnone | Abhinav Giri | |
| Eric Balderas | Anish Chougule | |

Ohio Section of MAA Spring Meeting

The Ohio Section of the Mathematical Association of America will hold its annual spring meeting on March 25 and 26 at Xavier University in Cincinnati, Ohio. The meeting consists of talks by mathematics faculty, graduate students, and undergraduates from around the state. The Section especially welcomes talks and participation by undergraduate students. In addition to student talks, there is an undergraduate problem solving competition with cash prizes. We encourage you to give a talk at the meeting or participate in the competition.

If you are participating in the problem solving competition, we ask that you register at:

<http://constum.ohiomaa.org/>

If you have any questions, please do not hesitate to contact Tom Wakefield by phone 330-941-3302 or by email tpwakefield@ysu.edu.

A Warm Welcome to the Participating Schools:

- Baldwin Wallace University
- Bennington College
- Chatham University
- Clarion University of Pennsylvania
- Fairmont State University
- Indiana University of Pennsylvania
- Lakeland Community College
- Penn State Erie, The Behrend College
- Siena Heights University
- Slippery Rock University
- University of Mount Union
- University of Pittsburgh at Greensburg
- Western Kentucky University
- Westminster College
- Youngstown State University

YSU Pi Mu Epsilon Officers

President: Sean Livingston

Treasurer: Kyle Gamble

Vice President: Anoushka Khayar

Historian: Victoria Messuri

Secretary: Rachael Thomas

Webmaster: Alyssa Leone

Pi Mu Epsilon Faculty Advisors

Dr. G. Jay Kerns

Dr. Thomas Madsen

Dr. Alicia Prieto Langarica

Dr. Thomas Wakefield