2021

Program: 2021 Undergraduate Mathematics Day

University of Dayton. Department of Mathematics

University of Dayton

Undergraduate Mathematics Day

Saturday, November 6, 2021

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University of Dayton
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Program

8:45 – 9:30	Check In, Folder Pick-Up	Science Center Auditorium Lobby
9:30 – 10:50	Welcome to the Conference Introduction: Schraut Memorial Lecture Matt Cain, President University of Dayton Math Club The 21st Annual Kenneth C. Schraut Memorial Lecture: **One health: connecting humans, animals and the environment** Suzanne Lenhart, University of Tennessee	O'Leary Auditorium Miriam Hall 119
10:50 – 11:15	Break	Science Center Auditorium Lobby and Atrium
11:15 – 12:10 (11:15-11:30) (11:35-11:50) (11:55-12:10)	Contributed Paper Sessions	Various classrooms in the Science Center
12:10 – 1:30	**Lunch**	Science Center Auditorium Lobby
1:30 – 2:45	Introduction: Plenary Lecture Chris Hemsath, President University of Dayton's Chapter of Pi Mu Epsilon Invited Address: **The crossings of art, history and mathematics** Jennifer White, Saint Vincent College	O'Leary Auditorium Miriam Hall 119
2:45 – 3:15	Break	Science Center Auditorium Lobby and Atrium
3:15 – 4:10 (3:15-3:30) (3:35-3:50) (3:55-4:10)	Contributed Paper Sessions	Various classrooms in the Science Center

- Photographs and/or video will be taken at the event. By taking part in this event, you grant the event organizers full rights to use the images resulting. Please let us know if you have any objections (ychen4@udayton.edu).

Plenary Talks

O'Leary Auditorium, Miriam Hall, Rm 119

The Twenty-First Annual Kenneth C. Schraut Memorial Lecture
One Health: Connecting Humans, Animals and the Environment

Dr. Suzanne Lenhart
University of Tennessee

Abstract: 'One Health' is a multidisciplinary approach to improving the health of people, animals and the environment. Environmental, wildlife, domestic animal, and human health fall under the One Health concept. Mathematical models of infectious diseases involving animals, environmental features, and humans will be presented. These models can suggest management policies and predict disease spread. Examples including La Crosse virus and Zika virus will be discussed.

Suzanne Lenhart is a Chancellor's professor in the Mathematics Department at the University of Tennessee. She was a part-time research staff member at Oak Ridge National Laboratory from 1987-2009. Her research involves partial differential equations, ordinary differential equations and optimal control of biological and physical models.

Dr. Lenhart was the President of the Association for Women in Mathematics in 2001-2003. She received fellow awards from SIAM, AMS, AWM, and AAAS. She was the Associate Director for Education and Outreach of the National Institute for Mathematical and Biological Synthesis for the last 12 years. Dr. Lenhart has been the director of Research Experiences for Undergraduates summer programs at the University of Tennessee for 27 years.

Plenary Talks

O'Leary Auditorium, Miriam Hall, Rm 119

The Crossings of Art, History, and Mathematics

Jennifer White
Saint Vincent College

Abstract: In July 1944, Paul Turán worked near Budapest in a concentration camp brick factory. The challenges the workers faced when carting bricks from the kilns to storage areas led him to consider minimizing rail line crossings. Around 1958, artist Anthony Hill began investigating a similar question, how can a set of dots with all possible lines between them be arranged to have the fewest line crossings? These informed the foundation for major open conjectures regarding graph crossings. This talk will discuss the mathematics around these conjectures, related results, and open problems.

Jennifer White earned her bachelor's degree in mathematics and education at the University of Dayton. She then earned her master's and Ph.D. at the University of Colorado Denver. Her research interests are in graph theory and she is currently an Associate Professor at Saint Vincent College. She is a Project NExT fellow in Mathematical Association of America.

Contributed Paper Sessions

All rooms are in the Science Center

* denotes a graduate student

Unless otherwise denoted, all contributed talks are presented by undergraduate students

Session: 11:15 a.m. – 12:10 p.m.

Time	11:15 a.m. – 11:30 a.m.	11:35 a.m. – 11:50 a.m.	11:55 a.m. – 12:10 p.m.
Room 107	***Why Won't People Stop Proving The Prime Number Theorem?*** Sarah Herr University of Dayton	***The Basel Problem: Euler's and Apostol's Proof*** Kathryn Reeg University of Dayton	***A Fascinating Double Integral*** Payton Reaver University of Dayton
Room 108	***Predictive Modeling of Loans to the Unbanked*** Manisha Kasturiratna Hanna Schmitt Northern Kentucky University	***The Cantor Set, Trees, and Compact Metric Spaces*** Wyatt Lee University of Dayton	***Finding an Effective Shape Parameter Strategy to obtain the Optimal Shape Parameter of the Oscillatory Radial Basis Function in the Method of approximate particular solutions*** Quinnlan Aiken Annika Murray Ohio Northern University
Room 128	***Triameter of Graphs - A brief discussion*** Maitreyo Bhattacharjee IACS, Kolkata	***Decompositions of Johnson Graphs*** Elijah Borgman University of Dayton	***Counting Hamiltonian Paths in Upset Tournaments*** Christopher Paul University of Dayton
Room 146	***Multi-State Comparison of SIR Models for COVID-19*** Annika Avula Centre College	***Cellular Automata Model for the Covid-19 Spread and the Kermack-McKendrick Infectious Disease Model*** Drew Ashurst University of Dayton	***Coronavirus Vaccine Distribution: A Real World Problem*** Allison Tracy University of Dayton
Room 150	***Efficient Conformal Binary Classification Under Nearest Neighbor Nonconformity*** Maxwell Lovig University of Louisiana - Lafayette	***Application of Tikhonov regularization towards a method of profiling optical turbulence*** Benjamin Wilson University of Dayton	***Am I doomed for retirement? A 401(k) analysis*** Megan Kessen University of Dayton

Session: 3:15 p.m. – 4:10 p.m.

Time	3:15 p.m. – 3:30 p.m.	3:35 p.m. – 3:50 p.m.	3:55 p.m. – 4:10 p.m.
Room 107	***Enhancing Respondent Trust in Randomized Response Technique Models*** Joia Zhang University of Washington, Seattle	***Using Circle Packing to Approximate H-functions*** Ella Wilson Kenyon College	***Game Theory and Strategy*** Alexa Passafiume University of Dayton
Room 108	***Transcending the Numbers: A Proof of the Transcendence of e*** Thomas Lehmenkuler University of Dayton	***The Method of Creative Telescoping, Zeilberger's Algorithm*** Sebastian Meinking University of Dayton	***Continued Fractions: Finding Representations of Our Favorite Numbers*** Aidan Hackett University of Dayton
Room 128	***Fixed Points of Functions Below the Line $y = x$*** Grace Fryling Harrison Rouse Baldwin Wallace University	***Taylor University Arboretum and Data Science*** Sarah Finlay Lucy Wilson Taylor University	***Cubic Splines for Curve Fitting*** Rachel Sebastian University of Dayton
Room 146	***A Topological Space with Its Properties*** Doria Lee Central State University	***The Possibility of Employing Planetary Scale Railguns for Spaceflight*** Nicholas Bradshaw* University of Dayton	
Room 150	***Visualizing lobal Carbon Emissions: Which nations are contributing the most to Climate Change?*** Anthony Lapham University of Dayton	***European option pricing under binomial and trinomial models*** Alex Pecho University of Dayton	

Abstract

11:15AM - 11:30AM

Why Won't People Stop Proving The Prime Number Theorem?

Sarah Herr
University of Dayton

Room 107 (Face-to-Face)

The prime counting function is a function that counts the number of primes less or equal to than a given integer n. The prime number theorem claims that function to be asymptotically equivalent to n/log(n), which offers valuable insights into the distribution of primes throughout the integers. A brief history of the prime number theorem and its most notable proofs will be explored. The first proofs appeared in 1896, and new proofs have appeared as recently as August of 2021. Special attention will be paid to the Erdos-Selberg elementary proofs.

Predictive Modeling of Loans to the Unbanked

Hanna Schmitt & Manisha Kasturiratna
Northern Kentucky University

Room 108 (Zoom)

Typically, when a client lacks traditional financial information such as credit scores, they are unlikely to obtain a loan. This project examined members of the unbanked population and attempted to use unconventional information to predict the ability to repay a loan. Working with a data set from over 300,000 loan applicants, machine learning techniques were used to build predictive models. Three models, with varied strengths, were found to be effective in predicting whether or not a client would encounter difficulties in repaying a loan.

Triameter of Graphs - A brief discussion

Maitreyo Bhattacharjee
IACS, Kolkata

Room 128 (Zoom)

Graphs Theory is a rich and broad field of study in Mathematics, Computer Science and many other disciplines. In this talk, we would discuss a relatively new graph geodesic, the triameter, which has been introduced recently, and has lead to some open problems and interesting questions. We would also discuss the relation between the triameter and other well known quantities of a graph, like the radius, diameter, chromatic number and some Nordhaus Gaddum type results.

Multi-State Comparison of SIR Models for COVID-19

Annika Avula
Centre College

Room 146 (Zoom)

COVID-19 is an infectious disease first detected in Wuhan, China in late 2019. Since then, it has become a world pandemic that has infected over 42 million people in the United States alone, with a death rate of 1.6 percent, amounting to 674,000 total deaths as of September 2021. We explore the spread of this disease using the SIR compartmental model for various states using dynamic parameters that account for changes in societal behavior and the efficacy of treatments over time. Parameter values were calculated for each state weekly over the period April 2020 - January 2021, so the impact of vaccine distribution was minimal. These parameter values were graphed versus time and the curves fit using exponential cubic functions that simulated the real data over the time period of interest. These curves were found to fit with a considerable degree of accuracy, even when there were lapses in state data.

Efficient Conformal Binary Classification Under Nearest Neighbor Nonconformity

Maxwell Lovig

University of Louisiana - Lafayette

Room 150 (Zoom)

There are many types of statistical inferences that can be used today, Frequentist, Bayesian, Fiducial, and others. However, Vovk introduced a new version of statistical inference known as Conformal Predictions (CP). The predictions were designed to reduce the assumptions of standard prediction methods (independent identically distributed). Instead of assuming all observations come from the same distribution we instead assume exchangeability, meaning all N! possible orderings of our N observations are equally likely. This is more applicable to fields such as machine learning where assumptions may not be easily satisfied. In the case of binary classification, Vovk provided the nearest neighbors measure which is a ratio of in versus our of class nearest distance. Later on, Papodopolous introduced normalizing constants for estimation. We prove that as the number of sample approach infinity for a bounded probability distribution that normalization produces a more efficient nearest neighbor nonconformity measure.

11:35AM - 11:50AM

The Basel Problem: Euler's and Apostol's Proof

Kathryn Reeg

University of Dayton

Room 107 (Zoom)

Calculating the infinite sum of the reciprocals of the perfect squares has long been a fascination of countless mathematicians. This calculation, known as the Basel problem, has several proofs that have been developed over the last few centuries. In this talk, we present some historical context and discuss two proofs of the problem. First, we will discuss Euler's original calculations using the Taylor series of $\sin x$. We will also show an alternate calculation by Apostol who calculates an improper iterated integral.

The Cantor Set, Trees, and Compact Metric Spaces

Wyatt Lee

University of Dayton

Room 108 (Zoom)

The Cantor Set is a famous topological set developed from an infinite process of starting with the interval [0,1] and, at each iteration, removing the middle third of the intervals remaining. Our goal is to determine some of the properties of this unintuitive set and to show that it is homeomorphic to any general compact metric space with similar properties. To do so, we show that the Cantor Set is topologically equivalent to a tree, a more familiar structure, and use this fact to establish a homeomorphism to the general compact metric space.

Decompositions of Johnson Graphs

Elijah Borgman

University of Dayton

Room 128 (Face-to-Face)

The Johnson graph, $J(n, k)$, is a graph whose vertices are the k-element subsets of an n-element set, with adjacent vertices sharing $k - 1$ elements. We will show that $J(n, k)$ can be decomposed into the complete graph of either $k + 1$ or $n - k + 1$. As well as showing the sufficient conditions for which $J(n, 2)$ can be decomposed into graph pairs of order 4.

Cellular Automata Model for the Covid-19 Spread and the Kermack-McKendrick Infectious Disease Model

Drew Ashurst

University of Dayton

Room 146 (Face-to-Face)

The goal of this numerical study is a comparison of the probabilistic and deterministic models of the spread of Covid-19. We consider the Kermack-McKendrick infectious disease model and approximate the solutions using cellular automata and the numerical solution of the system of differential equations using built in Python integration tools. Both of these solutions are in agreement of a good model for the spread of Covid-19. To do this, a grid is used with cells assigned a specific probability of being infected, recovered, or susceptible, then the results at each time will be graphed and compared to the Kermack-McKendrick model.

Application of Tikhonov regularization towards a method of profiling optical turbulence

Benjamin Wilson

University of Dayton

Room 150 (Face-to-Face)

An application of Tikhonov regularization is provided. By using a bank of cameras, an array of LED point sources was imaged over a 1.8 km slant path. The turbulence induced optical motion was measured and used to obtain a profile of optical turbulence along the imaging path. The algorithm used was very ill conditioned and the data collected was very prone to noise, so a Tikhonov regularization was used. The choice of the regularization parameter was optimized, and the method provided, along with results computed using a straight up pseudo-inverse. Results of the Tikhonov regularization are provided and compared to topology for two separate nights of data.

11:55AM - 12:10PM

A Fascinating Double Integral

Payton Reaver

University of Dayton

Room 107 (Face-to-Face)

Evaluating and discussing a unique double integral with an intuitive general formula to describe all possible solutions.

Finding an Effective Shape Parameter Strategy to obtain the Optimal Shape Parameter of the Oscillatory Radial Basis Function in the Method of approximate particular solutions

Quinnlan Aiken & Annika Murray

Ohio Northern University

Room 108 (Face-to-Face)

Recent research into using the Method of Approximate Particular Solutions to approximate PDEs, has shown promising results. High levels of accuracy can be obtained when implementing this method, however the success of this collocation method is dependent on a shape parameter that is found in nearly all RBFs. If the shape parameter is not appropriately chosen, then it can provide an unacceptable result. Two shape Parameter strategies were considered, a random variable shape parameter strategy and a Leave-one-out cross validation strategy. The main objective of this work is to assess the viability of using these shape parameter strategies with oscillatory radial basis function, and their ability to provide a consistent and accurate approximation.

Counting Hamiltonian Paths in Upset Tournaments

Christopher Paul

University of Dayton

Room 128 (Face-to-Face)

Upset tournaments are a particular category of tournaments, or oriented complete graphs. This talk focuses on certain patterns that emerge when counting the number of Hamiltonian paths in the two basic forms of upset tournaments: chain tournaments and loop tournaments. The pattern for chain tournaments is particularly interesting, as the number of Hamiltonian paths follows a tribbonaci-like sequence as the order of the tournament increases. Algorithms for counting combinations of these two kinds of upset tournaments are also discussed.

Coronavirus Vaccine Distribution: A Real World Problem

Allison Tracy

University of Dayton

Room 146 (Face-to-Face)

Coronavirus continues to be a growing problem throughout the world. Although a daunting topic, this conversation should not be avoided in the classroom. The paper will consist of the problem, background, motivation, assumptions, imagery, and the lesson plan. I will present a lesson plan and discussion of how to implement this conversation into the classroom. The lesson plan will be designed for a geometry classroom to look into a social justice issue. The students will design a solution to answer the problem of where a vaccination distribution center should be located in the state of Montana. They will base their location off of the distance from the three places where people can receive vaccinations in Montana. Students will connect their current situation to geometry through the use of graphing, forming circles, and radii. Through discussion students will defend their location to the class.

Am I doomed for retirement? A 401(k) analysis

Megan Kessen

University of Dayton

Room 150 (Face-to-Face)

Many individuals today are uninformed about how to save for retirement in order to maintain the same standard of living during retirement as throughout the working years. This project uses Excel spreadsheets to analyze the effects of factors such as age at which saving begins, asset allocation, real and nominal interest rates, as well as both individual and employer monthly contributions on saving for retirement through a 401(k) plan. We conclude that it is possible to maintain approximately the same standard of living during retirement as throughout the working years if an individual begins saving for retirement as soon as they start their career and gradually increases their contributions as they age toward retirement.

3:15PM - 3:30PM

Enhancing Respondent Trust in Randomized Response Technique Models

Joia Zhang

University of Washington, Seattle

Room 107 (Zoom)

When conducting surveys containing sensitive questions, Social Desirability Bias (SDB) often leads to low response rate or worse, untruthful responding. Randomized Response Techniques (RRT) combat SDB by allowing respondents to provide scrambled responses. However, if a respondent does not trust the RRT model, data accuracy will be compromised. Lack of trust in binary RRT models has been shown to lead to untruthfulness, and thus unreliable data and unreliable estimators. Yet, no quantitative RRT model currently accounts for lack of trust. We propose an Optional Enhanced Trust (OET) RRT model that extends Warner's Additive Model (1971) by allowing additional noise if the respondent does not trust the Warner Additive Model. In addition to estimating the sensitive trait, the trust level and sensitivity level may be estimated using a split sample approach (Gupta et al. 2010) and a two question approach (Sihm et al. 2016). Under the Unified Measure (Gupta et al. 2018), we demonstrate OET is superior to existing models theoretically and through simulations.

Transcending the Numbers: A Proof of the Transcendence of e

Thomas Lehmenkuler

University of Dayton

Room 108 (Face-to-Face)

A real algebraic number is any real number that is the root of a non-zero polynomial with integer coefficients. Real numbers that are not algebraic are called transcendental numbers. Two famous examples of transcendental numbers are e and p. In this presentation, it is shown that the set of transcendental numbers is uncountably infinite. Then, the transcendence of e is shown, using a method developed by Hermite (1873).

Fixed Points of Functions Below the Line $y = x$

Grace Fryling & Harrison Rouse

Baldwin Wallace University

Room 128 (Zoom)

This paper concerns fixed points of functions whose graphs lie on or below the line $y = x$. Using the Monotone Convergence Theorem, we show that positive fixed points of such functions are "attracting on the right" so long as we include a couple of further assumptions about these functions near their fixed points. As an illustrative example, we confirm that this is the case for the function $y = x \sin x$; the positive fixed points of this function "attract on the right" and "repel on the left." Further, we generalize by showing that differentiability is in fact not needed to conclude that a fixed point is attracting on the right. Continuing in this direction, we identify a class of discontinuous functions whose fixed points are attracting on the right.

A Topological Space with Its Properties

Doria Lee

Central State University

Room 146 (Zoom)

In mathematics, Topology is the study of properties (of a geometric object) that are preserved under deformations such as twisting and stretching but not tearing. In this project, we define topological properties such as closed/open sets, neighborhood, interior, closure, basis, subspace, etc., for a very specific topological space and will generalize the properties using mathematical induction.

Visualizing Global Carbon Emissions: Which nations are contributing the most to Climate Change?

Anthony Lapham

University of Dayton

Room 150 (Zoom)

Climate Change is an ever-present concern and controversial topic. The underlying issue with regards to Climate Change is the abundance of Carbon being admitted into the atmosphere at a greater rate than it can be sequestered. This begs the question(s) of where the emissions are coming from and has there been any effort to suppress those emissions. This project takes the most up to date emissions data and utilizes it to show where those emissions are coming from, some underlying causes of those emissions, and whether or not there has been any effort to minimize output.

3:35PM - 3:50PM

Using Circle Packing to Approximate H-functions

Ella Wilson

Kenyon College

Room 107 (Face-to-Face)

Harmonic Measure Distribution Functions, h-functions encode information about the geometry of domains in the plane. Specifically, given a domain and a basepoint within it, for a fixed radius, r, the value $h(r)$ is the probability that a particle under infinite random motion first exits the domain within distance r of the basepoint. There are many domains for which we can do exact computation to find their h-functions such

as the disk and the inside and outside of a wedge. However, exact computation is often difficult or impossible for more complex domains, so we need methods for discrete approximation. The mathematical process we used to discretize the domain is known as circle packing. Over the summer, we came up with two main methods of approximating h-functions: one geometric and one probabilistic. In this talk, I discuss my explorations into finding a discrete analogue to h-functions using the technique of circle packing and connections to open questions in the field of h-functions.

The Method of Creative Telescoping, Zeilberger's Algorithm

Sebastian Meinking
University of Dayton

Room 108 (Face-to-Face)

The purpose of this presentation is to introduce a Method of Creative Telescoping along with show non-trivial examples of how this method can be applied. This Method of Creative Telescoping is an extension of Gosper's Algorithm, which we will demonstrate with examples. Maple is a very useful tool to demonstrate this Algorithm so examples in Maple will be demonstrated as well. Research for this project was conducted by observing the work of Doron Zeilberger as well as Marko Petkovsek and Herbert Wilf in their book "A=B". This method shows utility in finding recurrences in sums of hypergeometric terms as well as verifying binomial identities.

Taylor University Arboretum and Data Science

Sarah Finlay & Lucy Wilson
Taylor University

Room 128 (Zoom)

The health of forests is a concern for ecologists and the general public alike. Researchers at Taylor University have monitored the Taylor University Arboretum which is the largest contiguous forest remaining in Grant County, Indiana. By systematically measuring tree basal area, density, and frequency over time, they hope to determine healthy growth and classify various types of forest communities. We collaborated with the Biology Department to analyze the data and make conclusions about the arboretum's changes over time. We will share our experiences working with another discipline.

The Possibility of Employing Planetary Scale Railguns for Spaceflight

Nicholas Bradshaw
University of Dayton

Room 146 (Face-to-Face)

A railgun uses electromagnetic forces to accelerate projectiles along a barrel to hypersonic velocities; powerful enough for the U.S. Navy to employ them as weapons. If aimed skyward, no (known) railgun could launch a projectile into orbit or beyond. However, the only factor limiting speed is the length of the barrel. Theoretically, it could be extended through the entire planet, piercing the core to the opposing side of the Earth. Though infeasible on this planet due to the planet's interior properties, other planets and celestial bodies harbor no such issue. This initial research project sought to determine if such a projectile launcher is theoretically useful for any celestial bodies within the solar system. Classical Newtonian Mechanics was employed to the planet's gravitational acceleration and railgun's applied acceleration. Then, a second order ODE initial value problem was constructed with respect to displacement in time. The resultant exit velocity from the barrel was compared to the necessary escape velocity. If the produced velocity failed to exceed that needed to escape the planet, the system was deemed a failure. 270 celestial bodies were assessed at survivable accelerations. Hundreds of viable options were found. From this, the possibility of using planetary scale railguns for spaceflight is deemed plausible and worthy of additional feasibility studies.

European option pricing under binomial and trinomial models

Alex Pecho

University of Dayton

Room 150 (Face-to-Face)

In this project, binomial and trinomial trees are used to model stock prices, and European options, priced under risk-neutral probabilities. The relation of the binomial model to the trinomial model and Black-Scholes model is studied, and the convergence of the binomial model to the Black-Scholes model is shown.

3:55PM - 4:10PM

Game Theory and Strategy

Alexa Passafiume

University of Dayton

Room 107 (Face-to-Face)

The purpose of this presentation is to present a classic problem by William Davenport that is given in Phillip Straffin's "Game Theory and Strategy." The presentation will cover general topics of game theory in order to lay the foundation of what this problem is based on. These topics include a zero-sum game, a two-person game, pure strategies, mixed strategies, payoffs and optimal strategies. The work of Davenport is related to an anthropological approach to game theory as it relies on the idea of functionalism. The point of his problem is to show how fishermen who work on the banks of Jamaica seem to follow a game theory approach due to the idea of functionalism; the fisherman must weigh the risks and rewards of certain strategies, even when their opponent (the current of the sea) is not a reasoning being. This idea is interesting to consider because it strays from the typical understanding in game theory that both players are making decisions with reason. The goal of the presentation is to describe this problem, to walk through the mathematics and matrices that are involved in solving the problem, to explain the findings, to consider why the results are worth noting, and to present some opposing ideas to this approach. The goal is not to critique this problem, as many have done, rather objectively present the findings of Davenport and why they are interesting in the context of this problem.

Continued Fractions: Finding Representations of Our Favorite Numbers

Aidan Hackett

University of Dayton

Room 108 (Face-to-Face)

Continued fractions have been a useful tool in some of the significant results in Diophantine Analysis. This talk provides a gentle introduction into what continued fractions are, how to find them, and why they are useful. The talk begins with simple calculation of continued fractions, followed by a brief detour into the golden ratio and metallic means, and finally an overview of Roth's Theorem.

Cubic Splines for Curve Fitting

Rachel Sebastian

University of Dayton

Room 128 (Face-to-Face)

Cubic splines are piecewise cubic polynomials satisfying sufficient smoothness at the knots of the spline. In general, splines fit curves or data better than polynomials due to the introduction of knots. In this talk, the method of least squares is applied to high temperature data to fit a cubic spline to that data. A cubic polynomial is also employed to fit the same data. A visual comparison of cubic splines and cubic polynomial fits applied to the temperature data will be presented to illustrate the motivation for the use of splines. As a further application of splines, the statistical concept of prediction intervals is introduced and used to test the consistency of temperature data from different years.

We would like to acknowledge the following for the generous support of this conference.

The Kenneth C. Schraut Memorial Fund,

The University of Dayton Mathematics Department,

The University of Dayton, Bookstore,

All of our generous Alums who donate to the University of Dayton Mathematics Department and the Kenneth C. Schraut Memorial Fund.