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Pi Day Abstracts

9:20 - 9:50  Nate Ritchey: Introduction To Game Theory

Invented by John von Neumann and Oscar Morgenstern, Game Theory is the study of how players should strategically play games. The goal is to play a particular game in such a way as to have an outcome that achieves the maximum possible benefit. To Win! Game Theory has been used to analyze, price wars between two companies, the arms race, bidding for cellular phone space, and even the football draft. In fact, six mathematicians have won Nobel prizes in economics. In this session, the basic notions of game theory will be introduced and solution methods explored. This new knowledge will be applied to some real life dilemmas, including how to choose the best date for the prom.

9:20 - 9:50  Gabby Jennings: Folding Cubes

This presentation investigates the maximum size of a cube that can be folded from the 11 nets of a cube, given dimensions of a rectangular sheet of paper. The discovery incorporated the use of Geogebra to conclude which net is to be used maximize the size of the cube meeting the dimensions of the rectangular sheet of paper.

9:20 - 9:50  Erin Sebulak: A Consistent $\pi$

Students will discover through measurement that the constant ratio between diameter and circumference is 1:3.14 for all circles.

9:20 - 9:35  Trish Hillman: Humans As Computers

Human computation was a technique used to perform long and tedious mathematical calculations that involved several “human computers” who would follow a “fixed set of rules and would never deviate from them” (according to Turing). This allowed pieces of a computation to be done in parallel. Rooms full of human computers would later be replaced by today’s electronic computer. This presentation will focus on the human computation of the digits of $\pi$.

9:20 - 9:35  Emily Sprague: Continued Fractions Of $\pi$

We are all familiar with the decimal approximation to the number $\pi$. In this activity we explore another way to represent $\pi$ by constructing its regular continued fraction. Participants will construct regular continued fraction representations of rational and irrational numbers, then examine some of the similarities and differences between the two representations of $\pi$. We will provide calculators although participants may certainly use their own.

9:40 - 9:55  John Hoggard: Finding $\pi$ In Buffon’s Stack Of Needles

An eighteenth century naturalist claimed he estimated $\pi$ by throwing loaves of bread, but the problem is usually described using needles. We’ll use something less sharp than needles (but sharper than bread) to conduct our own experiment, and consider some computer simulations. Along the way, we’ll brush against topics ranging from trigonometry to calculus, and end up wondering, "What does ‘random' really mean, anyway?"
9:40 - 9:55 Dan Bennett: How Fast Are These Computers Anyway?  
Ross 134

In this talk, we will take a look at how fast computers really are. Starting with the earliest computers, we will examine the speed of computers through time. The discussion will include a look at Moore’s law, and a prediction of the future.

10:00 - 10:30 Anne Quinn: Mathematics In The Game of SET  
Ross 136

The game of SET® is a fast paced game where three cards make a “SET” if, for each attribute, the values on the cards are either all the same or all different. Each card can be identified by four attributes, each of which has three values: number (1, 2, 3), color (red, green, purple), symbol (diamond, oval, squiggle), and shading (open, striped, solid). A sample of a “SET” is seen below.

This game can be played by students from elementary school to college, and it inspires questions from a wide variety of traditional mathematical topics, such as the multiplication principle, combinations and permutations, divisibility, modular arithmetic, and mathematical proof. The contents of my talk can be found in the Mathematics Teacher journal (1999) and a Mathematics Workbook (2011), published by www.setgame.com.

10:00 - 10:30 Frank Marzano: A History of π  
Ross 135

This talk traces the evolution in the various ways mathematicians have calculated π throughout the ages. We discuss ancient approximations using regular polygons as well as modern computations involving infinite series.

10:00 - 10:15 Larry Downey: Is That Image a Fake?  
Ross 138

The development of powerful image editing software has created the need to detect forgeries within digital images. Digital Image Forensics is a discipline (mostly mathematical) in which algorithms are created and used to expose forgeries which are not visible to the human eye. We will briefly discuss some of the mathematics involved and in real time attempt to detect alterations to images using state of the art software which started as an undergraduate research project.

10:00 - 10:15 Trish Hillman: Humans As Computers  
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10:00 - 10:15 Josh Doran: A Mind Controlled Robot  
Ross 139

An EEG detects the activity of the brain and translates it into a voltage that can be read by a computer. Within the last fifteen years, advances in computing technology and EEG technology has allowed researchers to bridge the gap between the human brain and a computer or a robot. The goal of this project is to employ a consumer grade EEG device to control simple robotics via the volition of the user. By using easily obtainable, low cost components and combining multiple assignments, a complex, interconnected system was developed into an operational, but hardware limited, brain controlled telepresence device.
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We are all familiar with the decimal approximation to the number \( \pi \). In this activity we explore another way to represent \( \pi \) by constructing its regular continued fraction. Participants will construct regular continued fraction representations of rational and irrational numbers, then examine some of the similarities and differences between the two representations of \( \pi \). We will provide calculators although participants may certainly use their own.

10:20 - 10:35 Nikki Sickafouse: Find The Constellation Game  
Ross 134

This game creates a simulation of some of the constellations, or pieces of constellations, found in space. It reads data from a list of stars and uses the celestial coordinates to dynamically place the objects in the game. Apart from the dynamic creation, this game is a constellation finder – the point of the game is to find as many constellations as you can in five minutes.

10:20 - 10:35 Mike Coghill: Calculating \( \pi \) Through Parallel Computing  
Ross 139

Parallel Computing is the practice of utilizing a Beowulf Cluster to hasten complex numeric computations. The purpose of this research project is to explore the benefits and difficulties associated with parallel computing by using multiple numeric computations to calculate \( \pi \). Edinboro University's cluster accompanied by the C++ programming language and the MPI (Message Passing Interface) are standard. During this presentation each of the methods and their implementation will be discussed in detail as well why parallel computing is an effective choice. The efficiency and timing of adding additional nodes will be included as well as the issues parallel computing has with these computations.

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![Sample SET card](image)

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10:40 - 10:55 Reuben Jarrell Calculating \( \pi \) In Various Metrics  
Ross 135

Pi is one of the most well-known numbers in all of mathematics. For millennia mathematicians have been approximating the numerical value of \( \pi \). \( \pi \) is commonly approximated using 3.1415; however, this value is only true when distances are measured in the normal Euclidean sense. This project takes the formal definition of \( \pi \) and uses various metrics to investigate the notion that \( \pi \) is a mathematical constant.
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10:40 - 10:55 Robert Bragg: An Introduction to Cryptology and the RSA Algorithm

Cryptology is the study of encrypting "plain text" into "cipher text" and decrypting "cipher text" back into "plain text". Cryptology is used world wide, and is paramount to most all nations' security. Since this study is so vast, and there are many people yearning for more security with information, it is no surprise that hundreds of different algorithms have been developed. RSA is a specific type of asymmetric-key method that is widely regarded as one of the best encryption methods to utilize. This presentation will cover the basics of cryptology, the implementation of the RSA algorithm, and the number theory that backs it.

11:00 - 11:15 Shane Bradford: An Arithmetic Metric

A different way of defining a distance on the set of natural numbers is introduced. This definition uses divisibility properties of the naturals instead of the absolute value of real numbers.

11:00 - 11:15 Brett Rhodes: Mesh Generation

In large simulation, it is often necessary to divide a large problem space into many smaller similar problem spaces using a process called mesh generation. In traditional mesh generation, meshes can be difficult to create. MeshKit is a tool used to create meshes. This talk will introduce mesh generation and showcase MeshKit's functionality.

11:00 - 11:15 Travis Hamilton: Procedural Generation of Objective Based Narratives Through Genetic Algorithms

This project presents a study of interrelated, objective-based narratives generated through adaptive algorithms built around pseudo-random iteration and player modeling. Combining a summary of recent research involving player experience modeling, evolutionary algorithms, and procedural content generation, an example implementation will be provided. Specifically, the model of a pseudo-random world through two pieces is given. The first piece is a collection of objective-based narratives called quests. The second is a collection of two-dimensional maps called dungeons, containing interactive entities. Both pieces are initially undetermined, and through application of an entity generator, constrained by a player experience model, are led with specific characters, locations, and objects. Thus, every dungeon, quest, character, location, and object is provided a unique set of attributes relative to the expanding world narrative and dungeon record, which in turn is shaped by a growing player experience model.
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11:20 - 11:35 Dominic Sirianni: A Computational Study: THICA and its Reaction Intermediates

The nature of the photochemical decomposition of the cyclic molecule THICA has not been reported in the literature, and thus we seek to study this reaction's mechanism and pathway. To do this, computations are done in accordance with quantum theory in order to study the structures and chemical properties of the species involved with the reaction. The results of these calculations show that the theoretical Lewis structures of these molecules are incorrect, and thus these chemicals do not behave in a currently predictable manner. This research therefore focuses on the elucidation of the correct structures of these species, so that their behaviors can be predicted according to quantum mechanics and therefore better understood.

11:20 - 11:35 Dave Dampier: 3D Viewing And The Oculus Rift

An explanation of how three dimensional images are generated and displayed using the Oculus Rift will be given.