Schedule and Abstracts for Student Talk Session

MAA So Cal-Nev Spring Mtg/Pacific Coast Undergraduate Mathematics Conference

California Lutheran University
March 14, 2015

Hum 107

1:30-1:45, Room Hum 107
Taom Sakal, UC Santa Barbara
Sequential Dynamical Systems and the Iterated Phase Space

Sequential Dynamical Systems make up a class of graph dynamical systems that can be seen as generalizations of cellular automata. In this talk we develop sequential dynamical systems and their basic ideas. We then introduce the idea of Iterated Phase Space and present some results on their structure.

1:50-2:05, Room Hum 107
William Hua, CSU Los Angeles
The Chromatic Number of Distance Graphs Generated by the Sets $\{2, 3, x, y, z\}$ *Where x,y, and z Are Unique Prime Numbers Greater Than 3*

My project involves coloring the real line with the forbidden distance set D. Let D be a set of positive integers and the distance graph generated by D has the set of all integers, $\mathbb{N}$, as the vertex set. If the absolute difference of two vertices falls in D, then the vertices are adjacent and must have different colorings. Determining the chromatic number of distance graphs, denoted by $\chi(D)$, for sets $D = 2, 3, x, y$ for all possible values of x and y has been completely solved. We took a similar approach for $D = 2, 3, x, y, z$ for prime values of x, y, and z. We utilize the density of sequences with missing differences and the parameter in the lonely runner conjecture. By calculating these two parameters and using the inequality below, we can determine the chromatic number for various D sets. Matlab is utilized to determine these two parameters for varying combinations of x, y, and z. (Senior thesis/project)

2:10-2:25, Room Hum 107
Sharat Chandra, UC Irvine
On the Morphology of Arithmetic Sums of Cantor Sets

It has been shown that the sum of two affine Cantor sets can be classified "morphologically" as either another Cantor set, an interval, or a hybrid of the two known as a Cantorval. Further for the middle λ Cantor set, C_λ and middle γ Cantor set, C_γ, the set $C_\lambda + C_\gamma$ is a Cantor set for points $(\lambda, \gamma) \in [0, 1]^2$ close to the origin , and it contains an interval for points far away from the origin. However, there existed a large, mysterious region in the parameter space where the morphology was unknown. Boris Solomyak showed that for almost every point in this region, the sum contained an interval. Our work seeks to generalize this result. We analyze the sum of two-parameter Cantor sets $C_{\alpha,\beta}$ with the middle third Cantor set and find there again exists a mysterious region where the morphology is unknown. We show that for a.e point in this region, the sum contains an interval.

Hum 108 (FR/SO

1:30-1:45, Room Hum 108
Jane Lee, Pepperdine University
Logarithmic Spirals

Logarithmic spirals appear frequently in different areas of mathematics and in nature. I explain a broad range of types of logarithmic spirals, their application, and how they relate to each other and the natural world. (Class project)

1:50-2:05, Room Hum 108
Chloe Avery and Talon Stark, UC Santa Barbara
A Really Great Presentation... Or Knot

The mathematical concept of a knot is one that is widely studied in mathematics, but has many applications in other fields such as quantum field theory, statistical mechanics, and DNA replication. Our talk will be on a combinatorial game that is played on diagram representations of these knots. We will introduce the mathematical concept of a knot, define a game that can be played with knot diagrams, and give some results that we found. No background knowledge of Knot Theory is required to understand this talk. (Class project)

2:10-2:25, Room Hum 108
Richard Carini, Nikola Kapamadzin and Connor Lemp, UC Santa Barbara
The World's NP-Hardest Game

The question of P versus NP is a well-known and tantalizing question in the fields of mathematics and theoretical computer science. Of particular interest are problems that can be classified as NP-Complete: in other words, problems whose solutions can be used to efficiently solve every other problem in NP. In our talk, we will be introducing *The World's Hardest Game*, a simplistic Flash-based game featuring a red square avatar which the player must use to navigate a maze of moving blue circles. We will then show that *The World's Hardest Game* is NP Complete.
No previous background knowledge is expected for this lecture. (Class project)

2:30-2:45, Room Hum 108
Nicholas Geis, Thien Hoang, Adam Reevesman and Mi Yu , UC Santa Barbara
The Game of Life

We will discuss Conway's Game of Life and some differences that occur when an update order is added to the rules. (Class project)

Hum 109

1:30-1:45, Room Hum 109
Nadia Salem, CSU Bakersfield
Pi to the Twenty-Fifth Digit Programming in Python

Using python and Chudnovsky algorithm to get PI to the 25th digit.

1:50-2:05, Room Hum 109
Hanna Kristensen, Pepperdine University
Applications and mathematical challenges of digital image mosaicking

We have created an automatic algorithm that creates a mosaic of user-supplied digital images to reproduce a user-supplied single larger digital image. In creating the mosaic of smaller images to reproduce the larger image, the simplest approach in selecting which image to place in each larger image pixel location is simply to select the one image of all smaller images whose overall color or grayscale levels best matches that of the larger image at that pixel location. However, for a higher quality result, other additional considerations and issues arise, including: reshading of the smaller images to better match the color or grayscale value at each large image pixel location; how to best reproduce essentially solid (constant-valued) areas in the larger image; creating more smoothness between smaller images in the mosaic for a more visually pleasing large image; ensuring that all of the smaller user-supplied supplied images are used at least once in reproducing the larger image.

2:20-2:25, Room Hum 109
Erika Ordog, Pepperdine University
Digital Image Mosaicking: The Algorithm and Its Challenges with Color Images

We have created an automatic algorithm in MATLAB that creates a mosaic of user-supplied digital images to reproduce a user-supplied single larger digital image. In creating the mosaic of smaller images to reproduce the larger image, the simplest approach in selecting which image to place in each larger image pixel location is simply to select the one image of all smaller images whose overall color or grayscale levels best matches that of the larger image at that pixel location. We will discuss how this applies to color mosaicking as well as the current issues in the original algorithm.

2:30-2:45, Room Hum 109
Mahnoor Mian, MiraCosta College
Representing Natural Numbers as the Sum of Squares

Fermats sum of two squares theorem states which natural numbers can be written as the sum of two squares. When the natural number N is 2, or a prime number in the form 4k+1, it can always be written as the sum of two squares. A prime number in the form 4k+3 can be written as the sum of two squares if it is to an even power. This theorem provides a set of solutions to the N-Queen Problem, which seeks to find the arrangement of an N by N square, with N number of chess Queens so that they never hit each other. Prime numbers in the form 4k+1 and their sum of square integers provide a set of solutions to this problem. Lagranges sum of four squares theorem states that every natural number can be written as the sum of four square integers. A method to finding these integers can be consolidated into a computer program. This concept can be applied to field theory because a lattice ordered field is totally ordered when each square is positive.

Hum 110

1:50-2:05, Room Hum 110
Ksenia Zakirova, Harvey Mudd College
Inextensible Chain Dynamics

Problems in inextensible chain dynamics have recently gained renewed interest. While chains represent an extensively studied subject in physics, recent work in the field shows that there still exists unexplained behavior. We analytically derive the steady state solutions for the time invariant shape of the chain, and analyze the behavior of perturbations through the master wave equation. Perturbing the solution introduces moving waves along the steady state shape with components that propagate along and against the direction of travel of the chain. These results are corroborated by numerical simulations created in MATLAB. (Senior thesis/project)

2:10-2:25, Room Hum 110
Elizabeth Kelley, Harvey Mudd College
When Does a Curve Inscribe a Square?

We review the historical development of the inscribed square problem, a conjecture which claims that every continuous closed curve in the plane admits an inscribed square. This has been an open problem in geometry for over a hundred years. We particularly focus on the two weakest classes of curves for which the conjecture admits an affirmative solution: curves that are locally monotone and curves that admit a special trapezoid. We then verify the conjecture for the Koch snowflake and develop techniques for exploring the conjecture in the context of similar fractal curves. (Senior thesis/project)

2:30-2:45, Room Hum 110
Eric Stucky, Harvey Mudd College
An Exposition of Kasteleyn's Solution to the Dimer Model

In 1961, Kasteleyn and Temperley-Fisher both independently arrived at a solution to a seemingly simple counting problem: How many ways are there to tile a rectangular board with dominos (two unit squares placed side-by-side)? However, the formula they discovered is bizarre and almost unbelievable. In this expository talk, we attempt to provide a rudimentary explanation for the main quirk of this formula and explore the intersection of combinatorics and linear algebra that Kasteleyn used to crack the problem. (Senior thesis/project)

1:30-1:45, Room Hum 111
Kevin Howe, California Lutheran University
A Study of Pascal's Triangle, Square Pyramid, and Tetrahedron Fractal Dimensions and Patterns

Patterns in the numbers of Pascal's Triangle, Square Pyramid, and Tetrahedron were studied and fractals relating to them were made. A theorem was proven and formulas for dimensions were found. This led to the calculation of limits of the formulas for prime numbers approaching infinity. (Senior thesis/project)

1:50-2:05, Room Hum 111
Manuel Lopez and Majerle Reeves, CSU Fresno
Modeling an Influenza Virus

Every year before the influenza season begins, the United States focuses its efforts on vaccinating both the young and the elderly. This study uses data from the CDC, WHO, and CDPH and an SEIR model with a travel component to track the spread of the seasonal flu virus in California. The purpose of this study is to prove or disprove that the current immunization scheme is the most effective. The model will be used to find an effective vaccination scheme. The knowledge obtained will allow for earlier production of flu vaccines, a reduction of waste by preventing the over-vaccination of particular age groups, and help prevent spread of the influenza virus.

2:10-2:25, Room Hum 111
Sarah McGahan, CSU Fresno
Alexander- and Markov-type Theorems for Virtual Singular Links

A classical braid is a set of n strings passing between two horizontal bars. These strings may interact with one another but must always travel in the downward direction. If the two horizontal bars are brought together and each pair of string ends are glued together in order, the resulting structure will be a knot or a link which we call the closure of the braid. J.W. Alexander showed that any oriented classical link can be represented as the closure of a braid. In addition, it is well-known that two braids have isotopic closures if and only if they are related by braid isotopy and a finite series of the so-called Markov's moves. These two properties of braids are known as the Alexander and Markov Theorems. Analogous theorems have been proved for the set of virtual links as well as for the set of singular links. In this talk we first introduce the virtual singular braid monoid via generators and relations. We then prove Alexander and Markov-type theorems for virtual singular links. (Senior thesis/project)

2:30-2:45, Room Hum 111
Adam Rose, UC Santa Barbara
Curvature Properties of Non-Smooth Surfaces in Euclidean 3-Space

We consider a class of surfaces in Euclidean 3-space that are twice-differentiable but not continuously twice-differentiable. For such surfaces, the Gauss curvature can be defined but is not necessarily continuous. This leads to interesting phenomena, and it shows that a number of theorems about smooth surfaces do not extend to the case of twice-differentiable surfaces. This work is being done as part of my senior thesis project at UC Santa Barbara. (Senior thesis/project)

1:30-1:45, Room Hum 112
Christina Tran, CSU Fullerton
On Sophie Germain's Essays

Sophie Germain (1776-1831) is remembered today for introducing the mean curvature in differential geometry, and is better known for her work in number theory and elasticity. In our talk, we present an overview of Germain's academic and professional accomplishments and we discuss how relevant and interesting are her essays. We also present new translations of several fragments of her texts. (Historical/biographical)

1:50-2:05, Room Hum 112
Rudolph SaenzErick Ortega, CSU Fullerton
Importance of Sampling Pattern and Regularization in Under-Sampled Magnetic Resonance Imaging (MRI)

Our project seeks to optimize under-sampled Magnetic Resonance Imaging (MRI). We look at the effectiveness of accelerated acquisition and constrained reconstruction using the Shepp-Logan phantom. Our current research focuses on determining how different sampling methods can either improve or hinder the effect of reconstructing an object from incomplete frequency samples using a total variation regularization method. In our approach, we implemented a total variation reconstruction to an under-sampled Fourier data, where the sampling methods include Evenly Spaced (ES), Beginning-Middle-End (BME), and Low Frequency (LF) sampling. We analyze the relationship between an alpha constraint, the strength of the total variation regularizer, in our reconstruction and the amount of data that is collected during the sampling methods in order to determine the optimal alpha value. We found that the BME sampling method gave us the best performance in terms of the mean squared error.

2:10-2:25, Room Hum 112
Su Ji Hong, California Lutheran University
The Dual of Graph Invariants

My project describes invariants of simple undirected graph using the integer programming. An invariant is a property of a graph that must be shared with an isomorphic graph. Once the integer program for an invariant is set up, the dual of the integer programming is found using the linear programming relaxation of the integer programming problem. The dual problems have same solution. This property of dual problems will determine the relationships between invariants. I then analyzed the dual integer programming to discover the invariant it describes. (Senior thesis/project)

2:30-2:45, Room Hum 112
Kelsey Swerdfeger, Concordia University Irvine
Solving Linear Systems of Equations in Macaulay2

Macaulay2 is an open-source mathematical software program designed by and for mathematicians working in the field of algebra. In 2007, an open question was posted, asking for help to enable Macaulay2 to solve systems of equations. Although one package was created using Cramer's rule, this method does not work for all linear systems. This talk will review my work enabling Macaulay2 to solve linear systems using Gaussian elimination, which enables inconsistent systems and systems with free variables to be solved. (Senior thesis/project)

Hum 113
Special Session of CSU Alliance for PUMP Scholars

1:30-1:45, Room Hum 113
Brianna Amador and Govanni Granados, CSU Northridge
Limit Cycle Behavior of Intraguild Predation

Intraguild predation refers to ecological communities composed of three species: a basal prey (B), an intermediary predator (IGP), and a primary predator (IGP*). IGP and IGP* prey on B, but IGP* also preys on IGP. Existing models predict the extinction of IGP. In order to avoid extinction IGP is conjectured to have an exclusive resource Pe. Recently Sherman and Vakilian (S-V) developed a four-species two-patch intraguild model that solves this coexistence problem. S-V prove the existence of a nonempty subset of the parameter space in which a stable coexistence exists. We present three models based on S-V model. First, B and Pe are at their carrying capacities and IGP interacts with IGP* according to a nonlinear form. By Hopf bifurcation thm we prove the existence of a stable limit cycle. Second, only B is at its carrying capacity. By Routh-Hurwitz thm we prove the existence of stable coexistent equilibria. Third, the existence of a stable limit cycle is discussed for third model.

1:50-2:05, Room Hum 113
Pablo Chavarria and Samuel Fleischer, CSU Northridge
The Ecological Effects of Trait Variation in a u-Predator, v-Prey System

Predator and prey interaction is a ubiquitous interaction of natural populations which has captured the attention of both ecologists and mathematicians. Previous studies are mainly focused on the dynamics without taking into account the phenotypic and genetic variations within both populations. We formulate a new model for coevolution in generalized predator- prey systems by incorporating quantitative characters relevant to predation in both prey and predator. We attempt to study the impact of such trait variation in both prey and predator on the dynamics of the interactions by the means of theoretical analysis and numerical simulations. In particular, we start with the simplest case in which only one prey species and one predator species are considered, then we discuss more general cases by including more species. One of our final goals is to study the full dynamics of a 3-predator and 2-prey system.

2:10-2:25, Room Hum 113
Justin Mulvany, CSU San Marcos
Modeling Sleep and Wake Bout Phenomenon using Markov Processes

We propose a model that helps to explain and predict the sleep/wake bout patterns of rats, age two to twenty-one days old. While we are inclined to think of sleep and wake to be the only two behavioral states of interest, the model assumes that three wake states are present, accounting for what we refer to as "deeper wake". We note that the movement between the three wake states is modeled as a Markov Process with exponentially distributed transition rates between states. By utilizing this type of model, we assume that the model is inherently memoryless, and thus, each transition is independent of the last. We hope to show through simulating the Markov Chain that with just three wake state spaces, the total time spent in a given wake bout can be modeled as a power law distribution.

2:30-2:45, Room Hum 113
Richard Adams and Janae Dixon, CSU Fresno
GRIM: Playing Games with Graphs

The game Grim is an impartial deletion game played on graphs by two players. A move consists of selecting a vertex and deleting it, along with all of its incident edges. Any vertices that become isolated are also deleted. The player to make the last legal move wins. Some was already known about Grim played on certain families of graphs but given that, not surprisingly, the analysis of the game gets very complex when the number of vertices grows, a new approach was necessary. We have used game theory techniques and a probabilistic approach to investigate what happens when Grim is played on large graphs. In this talk we will present results about what one should expect when the game is played on large graphs, and the Sprague-Grundy sequences of Grim when played on paths, cycles, and gears. Interesting connections to other games will also be discussed. (Senior thesis/project)

1:30-1:45, Room Hum 114
Farshud Sorourifar, MiraCosta
Squaring a Circle: Creative Solutions to an Irrational Problem

Almost every civilization with recorded history has tried to square a circle but none have succeeded. To construct a square with the same area as a given circle, using only a compass and straightedge is known as squaring a circle; one of the three problems of antiquity defined in Euclid's Elements. Tracing the third problem of antiquity throughout history, we witness the discovery of new mathematical concepts spanning from the origins of algebra to advanced systems such as hyperbolic and elliptic geometry. This journey has lead mankind to many creative solutions outside the realm of mathematics, contributing to humanities, and philosophy. It drove Thomas Hobbes to his dispute with The Royal Society, and inspired Leonardo Da Vinci to make the Vitruvian Man. The greatest achievements stem from the greatest problems; not by virtue of being the best solution, but as the knowledge gained from the process of refining an answer. (Historical/biographical; Mathematics education)

2:10-2:25, Room Hum 114
George Hou, Arcadia High School
Separating Mixed Signals in a Noisy Environment Using Global Optimization

We propose and analyze a class of blind source separation methods to recover mixed signals in a noisy environment. Blind source separation aims at recovering source signals from their mixtures without detailed knowledge of the source signals or the mixing process. By treating noise as a separate source signal, we formulate the source separation problem as a global optimization problem that minimizes the cross-correlation of the recovered signals. We provide precise solvability conditions and prove that our global optimization method gives an exact recovery of the original source signals up to a scaling and permutation. When the cross-correlation is small but nonzero, we perform stability analysis to show that our method can still give an accurate recovery with a small error. To the best of our knowledge, this is the first error analysis of blind source separation methods. The numerical results confirm our theoretical findings and demonstrate the robustness and accuracy of our method.

1:50-2:05, Room Hum 114
Shannon Condon, Fullerton College
A 21st Century Problem of Smale: What Are the Limits of Artificial and/or Human Intelligence?

In his 1999 paper entitled, "Mathematical problems for the next century," Stephen Smale listed eighteen open mathematical challenge problems, some in pure mathematics and others in an applied direction. In this talk, we focus on the last "Problem 18," which asks what the limits of artificial and/or human intelligence. (Problem from math journal)

2:30-2:45, Room Hum 114
Alexander Goldman, Fullerton College
Generalizing the Cross Product

It has been shown that there is no direct generalization of the cross product to n dimensions, where $n > 3$. However, there are many generalizations that, while not preserving every single property of the cross product, are close. In this talk I will discuss different ways the cross product can be generalized, and present an independent rediscovery of a near-exact generalization, using Hadamard matrices to illustrate key concepts. (Class project; Mathematics education)

1:50-2:05, Room Hum 116
Carlos Moran, California Lutheran University
Quantum Dynamics of Nonlinear Interactions Generating Nonclassical States

We study the time evolution of quantum systems including explicit time-dependent interactions. We are particularly interested in quantum control and the generation of non-classical states. We choose non-linear Hamiltonians and apply algebraic techniques to obtain an analytic expression for the evolution operator, which we then apply to special initial states. In particular we study nonlinear oscillators in Kerr media to look for the formation of Schrodinger-cat states from coherent states. We construct the Lie algebras corresponding to the operators of the Hamiltonian. This allows us to separate the complexity of the time-dependence from the complexity of the non-commuting operators. We also consider mean field approximations in the case that the interaction operators do not lead to a closed algebra. (REU project)

2:10-2:25, Room Hum 116
Matthew Buhr, University of South Dakota
Dynamics of Glial Cell Defense Mechanisms in Response to Ischemic Hypoxia in the Brain

Three models are introduced that explore the dual role of glial cells in the formation of / scar tissue and in the neural repair following hypoxia ischemia in the brain. Scar tissue helps / protect the brain during the acute phase of injury by limiting the spread of secondary damage, / but limits recovery by inhibiting the repair of damaged neurons. Scar formation is not ideal, / however repaired neurons are still susceptible to damage and do nothing to halt the spread / of ischemic injury. A stochastic, spatially explicit Cellular Automaton (CA) model is used to / capture the dynamics of neural tissue repair and the containment of damage by scar tissue. In / addition, two deterministic models are developed to approximate the stochastic process namely, / Mean Field (MFA) and Pair Approximation (OPA) models. We show that the MFA neglects / all spatial dependence among state variables. The OPA models the dynamics of state variables / evolving as pairs, where spatial adjacency matters. Our results compare ho (REU project)

2:30-2:45, Room Hum 116
Casey Peters, University of Redlands
Homotopy Equivalence and Irreduciblity in Digital Images

The field of digital topology has grown with the rise of computers and digital imaging. For digital images (digital spaces) there is an established notion of homotopy equivalence that mirrors the classical topology definition. Instead of focusing on grid like adjacency relations in Z^n, I work with a more abstract notion reminiscent of simple unlabeled graphs. Within each of the classes that arise from this homotopy equivalence relation there is a single image that is called the irreducible image. These irreducible images, which are also the smallest image in its class, are an excellent point from which to understand the underlying structure of homotopy equivalence in digital images. I will discuss my results on finding irreducible images on small numbers of vertices and other interesting properties. (REU project; Senior thesis/project)

1:30-1:45, Room Hum 117
Frank Madrid, CSU Bakersfield
A Bayesian Intra-Video Collusion Attack on Frame-by-Frame Video Watermarking

A common method to apply a digital watermark into a video is to independently watermark each frame. However, this method of watermarking is vulnerable upon statistical analysis between consecutive frames. We propose a Bayesian model to reduce the presence of a watermark for a given video. A significant advantage of this attack is that it does not require prior knowledge of the statistical distribution of the watermark. Experimental results show that the proposed algorithm significantly reduces the similarity of a given watermarked video using an informed watermark detector. Our results indicate that our attack has a similar effect on various statistical distributions of the watermark. Furthermore, we investigated various time-delay adjustments to improve the outcome of our initial attack. / / Keywords: Statistical Attack, Digital Video Watermarking, Intra-Video Collusion Attack, Bayesian Statistics, Gibbs Sampler (Senior thesis/project; Class project)

1:50-2:05, Room Hum 117
Dayna Mann, Pepperdine University
An Individual-based Model of Chaparral Response to Frequent Wildfires

Recently the Santa Monica Mountains have been plagued by frequent wildfires that threaten native chaparral species. Nonsprouting chaparral are completely killed by fire but their seeds germinate post-fire. Facultative sprouters both resprout and release seeds that germinate post-fire. This project is based on data collected since 1986 at a biological preserve adjacent to Pepperdine University with an average fire return interval of 7.5 years. We present a spatial model that simulates the growth, seed dispersal and resprouting behavior of individual shrubs that compete for space and resources. The model incorporates varying rainfall, fire frequency, and competition between plants for resources. Our simulation reproduces the change in plant community structure at our study site and predicts that frequent wildfires will drastically reduce the number and size of chaparral. A model of this system is important because reduced plant cover decreases slope stability, leading to landslides. (REU project)

2:10-2:25, Room Hum 117
Samantha Armstrong, Danielle Riethmiller and Danielle Watson, University of San Diego
Impossible Hierarchies with the Deegan Packel Power Index

We will analyze the relative power of players as determined by the Deegan-Packel power index in simple voting games. In particular, we investigate which strict hierarchies are achievable with respect to this power index power index. Inspired by previous work with other power indices, we focus particularly on weakly transparent, proper, simple voting games. We show that, under these conditions, any voting game with three to five players cannot have a strict hierarchy with respect to the Deegan-Packel power index. We then use simulation evidence to suggest that any game with more than five players can be constructed to have a strict hierarchy with respect to this index. (REU project)

2:30-2:45, Room Hum 117
Khoi Vo, UCLA
The Weak Law of Large Numbers and Two Interesting Applications

Recent studies in Mathematical Analysis (around 20th century) have developed a new powerful tool called Measure Theory. Since then, many other branches of science, in particular, probability and statistics, have adopted this tool to solve many problems. This project considers, in particular, the Law of Large Numbers. We will start by establishing the critical background measure theory that we will be using. We will then consider applications, including the famous St Petersberg's Paradox and unfair fair games. (REU project)

1:30-1:45, Room Hum 118
Hillary Bese, CSU Fresno
The Well-Covered Dimension of Generalized Quadrangles with Regular Points

In this talk we discuss how to find the parameter well-covered dimension of the adjacency graph of a specific class of generalized quadrangles, called W(n). We will prove that these graphs are anti-well-covered, which means that their well-covered dimension is equal to zero. (Senior thesis/project; Graduate Student)

1:50-2:05, Room Hum 118
Gilbert Felix, Ozzy Gonzalez and Antonio Saucedo, CSU San Bernardino
Radio Number for Seventh Powered Path Graphs

Let G be a connected graph. For any two vertices u and v, let $d(u,v)$ denote the distance between u and v, which is the smallest length of any $u-v$ path in G. The diameter of G, denoted by diam(G), is the greatest distance between any pair of vertices in G. A $radio-labeling$ (or multi-level distance labeling) of G is a function f that assigns to each vertex with a label from the set {0,1,2,3,...} such that the following holds for any two vertices u and v: /

$$\mid f(u) - f(v) \mid \geq 1 + diam(G) - d(u,v)$$

/ The span of f is defined as $\max_{u,v \in V(G)}\{ \mid f(u) - f(v) \mid\}$. The radio number of G, denoted by $rn(G)$, is defined as the minimum span of all radio-labelings for G. The goal of this presentation is to discuss the progress we made towards finding the radio number for the seventh power of any path during a 2014 research program which is an MAA activity funded by NSF (grants DMS-1156582 and DMS-1359016). (REU project)

2:10-2:25, Room Hum 118
Linda Alegria, CSU San Bernardino
Radio Number of Fourth Power Paths

Let G be a connected graph. For any two vertices u and v, let $d(u,v)$ denote the distance between u and v in G. The maximum distance between any pair of vertices of G is called the diameter of G and denoted by diam(G). A *radio labeling* (or multi-level distance labeling) of G is a function f that assigns to each vertex with a label from the set $\{0,1,2,...\}$ such that the following holds for any vertices u and v : $|f(u) - f(v)| \geq diam(G) - d(u,v) + 1$. The span of f is defined as $\max_{u,v \in V(G)}\{|f(u) - f(v)|\}$. The *radio number* of G is the minimum span over all radio labelings of G. The *fourth power* of G is a graph constructed from G by adding edges between vertices of distance four or less apart in G. In this talk, we completely determine the radio number for the fourth power of any path, except when its order is congruent to 1 (mod 8). (Senior thesis/project; Graduate Student)

2:30-2:45, Room Hum 118
James Chater, CSU Channel Islands
Some Properties of Continued Fractions

Convergence and uniqueness of continued fractions are discussed. Continued fractions in number systems other than Real numbers are explored. Khinchin's constant for Real numbers is discussed. An analogue of Khinchin's constant for alternate number systems is explored. (Senior thesis/project; Graduate Student)

1:30-1:45, Room Hum 119
Alberto Acevedo, CSU San Bernardino
Distance sets and density parameters

For a given set D of positive integers, we discuss solutions and conjectures for the maximal density $\mu(D)$ among sets of non-negative integers in which no two elements differ by an element of D. To define $\mu(D)$ properly we begin with D-sequences. A sequence of integers S is called a D-sequence if $|x-y| \in D$ for any, $x, y \in S$. Now, Let S be a D-sequence and define $S(n)$ to be $|\cap\{0,1,2,...,n\}|$. The density of S, denoted by $\delta(S)$, is defined as $lim_{n\to\infty}\frac{S(n)}{n}$. Then $\mu(D) = sup\delta(S) : SisaD - sequence\}$. The cases $|D| \leq 2$ are completely known, and some cases of $|D| \geq 3$ are known. Techniques, background, results, and motivation are discussed.

1:50-2:05, Room Hum 119
Raemeon Cawon and Lauren White, CSU Northridge
The Igusa Zeta Function of a Quadratic Form

Let $f(x_1, \ldots, x_n)$ be a quadratic form over the p-adic integers, $\mathbf{Z}_p$, and $N_i(f)$ be the number of zeroes of f modulo p^i. The Poincare series, $P(t) = \sum_{i>0} \frac{N_i(f)}{p^{in}} t^i$, is a power series that organizes these zero counts. From the Poincare series one can obtain the Igusa zeta function using the relation $Z(s) = p^s - (p^s - 1)P(p^{-s})$. For s in the complex right half-plane, the Igusa zeta function is defined to be $Z(s) = \int_{\mathbf{Z}_p^n} |f(x_1, x_2, \ldots, x_n)|_p^s dx_1 \ldots dx_n$, where $|\cdot|_p$ is the p-adic absolute value and $dx_1 \ldots dx_n$ is a volume element. We calculate the Poincare series and the Igusa Zeta function for an arbitrary quadratic form over the p-adic integers, p an odd prime. After determining the number of zeroes modulo p using generating functions, we use Hensel lifting to recursively calculate the Poincare series of f, and thus the Igusa Zeta function. (REU project)

2:10-2:25, Room Hum 119
Julia Dandurand, CSU Northridge
Crossing Numbers of k-page Book Graphs

Determining the crossing number of a graph, that is, the minimum number of crossings among all drawings of the graph, is a problem in Discrete Geometry. In the 60s, Blažek and Koman found k-page book drawings of the complete graph with few crossings and conjectured that their drawings had the minimum possible number of crossings. This conjecture was recently settled for$k = 2$ but remains open for larger values of k. This talk presents our work in proving the conjecture when the ratio of the number of vertices to the number of pages is small. I am reporting on behalf of the CSUN Crossing Numbers Research Group. (Senior thesis/project)

2:30-2:45, Room Hum 119
Qi Yang, USC
Big Data: Learning Near-isometric Linear Embeddings

The large size of data acquired and processed by diverse modalities poses a challenge to current information processing systems. Thus, we propose two non-convex approaches for learning near-isometric linear embeddings of finite sets of data points. Both methods are then demonstrated to be more computationally efficient than previous convex approaches for a number of applications in machine learning and signal processing. (REU project)

1:30-1:45, Room Hum 120
Cristian Villatoro, Los Angeles Pierce College
Duodecimal: The Superior Name Base

This talk will highlight the strengths behind using Duodecimal (Dozenal) system over decimal and other number bases. (REU project; Mathematics education)

1:50-2:05, Room Hum 120
Branden Melrose-Ensign, Victor Valley College
Buffon's Impossible Needle

Buffon's needle is a geometrical probability problem that calculates the probability that a needle dropped on a plain of parallel lines will cross one of those lines. In an effort to show just how important the wonderful irrational constant pi I attempted to solve this problem from a purely mathematical approach while attempting to ignore pi's existence. A feat that proved much more difficult as how prevalent pi is became very obvious.

2:10-2:25, Room Hum 120
Parham Pourdavood, Santa Monica College
The Falling Ladder Paradox

The talk explains a paradox regarding the classic ladder problem in Calculus books: a ladder leans against a vertical wall; If the base of the ladder is moving away from the wall at a constant rate, how fast is the head of the ladder going down? However, there is a paradox in this problem which the textbooks don't mention; that is, as the ladder approaches the ground, the speed of the ladder's tip gets super fast and the ladder falls and it's tip leaves the wall at a specific point. The talk aims to resolve the paradox and solve the problem while paying attention to the critical height at which the ladder falls, and also it shows how to sketch the path of the ladder's tip from the critical moment it leaves the wall until when it hits the ground.

2:30-2:45, Room Hum 120
Armin Niakan, Moorpark College
Topics in General Topology and Questions

Interesting topics in general topology with interesting questions.