USTARS

underrepresented students in topology and algebra research symposium

University of Iowa
Iowa City, Iowa
April 14-15, 2012

College of Liberal Arts & Sciences

National Science Foundation

VIGRE

Department of Mathematics

Center for Diversity & Enrichment

Symposium Agenda

Saturday, April 14

8:00-12:00pm **Registration**
Muhly Lounge
3 MacLean Hall

9:00-9:30am **Welcome and Opening remarks**
1505 Seamans Center

9:30-10:00am **Session I**
Two Families united as one: A Symmetric Functions Tale
Dr. Aba Mbirika, Bowdoin College
3505 Seamans Center

Toric Ideals of Hypergraphs
Elizabeth Gross, University of Illinois, Chicago
3321 Seamans Center

Note on Positive Semidefinite Maximum Nullity and Positive Semidefinite Zero Forcing Number of Partial 2-Trees
Jolie Roat, Iowa State University
3315 Seamans Center

10:15-10:45am **Session II**
Radio Numbers of Graphs of Order n and Diameter $n-2$
Katie Benson, University of Iowa
3505 Seamans Center

Contact Structures and Bypass Attachments in Contact Topology
Sayonita Ghosh Hajra, University of Georgia
3321 Seamans Center

On the adjoint representation of $\mathfrak{sl}_n$ and the Fibonacci numbers
Pamela Harris, University of Wisconsin, Milwaukee
3315 Seamans Center

10:45-11:15am **Coffee Break**

11:15-12:30pm **Invited Faculty Speaker**
Combinatorics of $CAT(0)$ Cube Complexes
Dr. Federico Ardila, San Francisco State University, Universidad de Los Andes, Colombia
1505 Seamans Center

12:30-1:30pm **Lunch**
Seamans Center

Saturday, April 14

1:30-2:00pm **Session III**
A Generalization of Group Automorphisms
Long Nguyen, Brigham Young University
3505 Seamans Center

The Isbell-Hull of a di-space.
Olivier Olela Otafudu, University of Cape Town
3321 Seamans Center

A mod four congruence in the real Schubert calculus and the Hermitian Grassmannian
Nickolas Hein, Texas A&M University
3315 Seamans Center

2:15-2:45pm **Session IV**
Riordan Matrix Representations of Euler's Constant γ and Euler's Number e.
Dr. Edray Goins, Purdue University
3505 Seamans Center

Cosmetic crossings and genus-one knots
Cheryl Balm, Michigan State University
3321 Seamans Center

Noether's Problem
Kevin Mugo, Purdue University
3315 Seamans Center

2:45-3:15pm **Coffee Break**

3:15-4:00pm **Poster Session**

4:15-5:30pm **Distinguished Scholar**
Hyperbolic structures on link complements
Anastasiia Tsvietkova, University of Tennessee
1505 Seamans Center

6:00-8:30pm **Symposium Banquet**
Sheraton Hotel, Carver Room

Sunday, April 15

9:00-9:30am	**Session V** *2-Selmer Groups of Elliptic Curves Associated with Cunningham Numbers* Jaime Weigandt, Purdue University 3505 Seamans Center *Ricci Flow on some Classes of Naturally Reductive Homogeneous Spaces* Tanya Hepburn-Lloyd, Saint Louis University 3321 Seamans Center *Spectral functions in the presence of background potentials* Pedro Morales, Baylor University 3315 Seamans Center
9:45-10:15am	**Session VI** *Computing the Grothendieck group of a noncommutative curve* Gautam Sisodia, University of Washington 3505 Seamans Center *Positive Semidefinite Zero Forcing and Vertex Spreads* Nicole Kingsley, Iowa State University 3321 Seamans Center *The Chromatic Polynomial of Signed Graphs* Mela Hardin, San Francisco State University 3315 Seamans Center
10:15-10:45am	**Coffee Break and Conference Photo**
10:45-11:15am	**Session VII** *The Homology of Filtered Algebras and A-infinity Structures* Cris Negron, Washington University 3505 Seamans Center *Arithmetic Progressions on Mordell Curves* Dr. Alejandra Alvarado, Purdue University 3321 Seamans Center *On the quasidiagonality of group C^*-algebras* José Lugo, Purdue University 3315 Seamans Center
11:30am- 2:00pm	**Networking Lunch and Symposium Closing** *Iowa Memorial Union, South Room* **Panelists:** Dr. Chelsea Walton, University of Washington Dr. Kendall Williams, United States Military Academy, West Point NY Dr. Phillip Kutzko, University of Iowa Carmen Wright, University of Iowa Leyda Almodovar, University of Iowa **Moderator:** Syvillia Averett

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Oral Presentation Abstracts

Title: Arithmetic Progressions on Mordell Curves
Presenter: Dr. Alejandra Alvarado
Affiliation: Purdue University
Abstract: An r-term arithmetic progression (AP) is a collection of rational numbers $\{\ell_1, \ell_2, ..., \ell_r\}$ such that there is a common difference $d = \ell_{i+1} - \ell_i$. When we talk about an AP on the Mordell curve $y^2 = x^3 + k$, where k is a nonzero integer, we mean an AP in the x-coordinates. We will give a survey on what is known about arithmetic progressions on these curves.

Title: Combinatorics of $CAT(0)$ Cube Complexes
Presenter: Dr. Federico Ardila**
Affiliation: San Francisco State University and Universidad de Los Andes, Colombia
Abstract: A cube complex X is a space built by gluing cubes together. We say that X is "$CAT(0)$" if it has non-positive curvature - roughly speaking, this means that X is shaped like a saddle. $CAT(0)$ cube complexes play an important role in pure mathematics (group theory) and in applications (phylogenetics, robot motion planning).

We show that, surprisingly, $CAT(0)$ cube complexes can be described completely combinatorially. This description gives a proof of the conjecture that any d-dimensional $CAT(0)$ cube complex X "fits" in d-dimensional space. It also leads to an algorithm for finding the shortest path between two points in X (and hence to find the fastest way to move a robot from one position to another one).

The talk will describe joint work with Megan Owen and Seth Sullivant.

Title: Cosmetic crossings and genus-one knots
Presenter: Cheryl Balm
Affiliation: Michigan State University
Abstract:A cosmetic crossing in a knot diagram is a non-nugatory crossing where the overstrand and understrand can be switched without change the underlying knot type. We will demonstrate some obstructions to the existence of cosmetic crossings in genus-one knots using Seifert matrices and basic linear algebra. As an application, we prove the nugatory crossing conjecture (that cosmetic crossings, in fact, do not exist) for several genus-one families of knots.

Title: Radio Numbers of Graphs of Order n and Diameter $n-2$
Presenter: Katie Benson
Affiliation: University of Iowa
Abstract: A radio labeling of a simply connected graph G is a function $c : V(G) \to \mathbb{Z}_+$ such that for every two distinct vertices u and v of G, $d(u, v) + |c(u) - c(v)| \geq \text{diam}(G) + 1$. The radio number of a graph G is the smallest integer m for which there exists a labeling c with $c(v) \leq m$ for all $v \in V(G)$. In this talk, we will establish the radio numbers of graphs with n vertices and diameter $n-2$. We will give an upper bound for this radio number with a particular labeling and then outline a technique for finding a lower bound for the radio number that matches this upper bound. This will determine the radio number of these graphs.

Title: Contact Structures and Bypass Attachments in Contact Topology
Presenter: Sayonita Ghosh Hajra
Affiliation: University of Georgia
Abstract: A plane field ξ on a 3 manifold M is a field of hyperplanes. A plane field ξ on M is called a contact structure on M if there is a 1- form α (locally or globally) with $\xi = Ker(\alpha)$ and we have $\alpha \wedge d\alpha$ is non zero. I am going to talk about few examples of contact structures on R^3 and give a natural occurrence and application of contact structure. Also I will talk about what is a bypass triangle attachment and how it can be used to classify overtwisted contact structure in $S^2 \times [0, 1]$.

Title: Riordan Matrix Representations of Euler's Constant γ and Euler's Number e
Presenter: Dr. Edray Goins
Affiliation: Purdue University
Abstract: In 1999, it was shown by Kenter that the Euler-Mascheroni constant

$$\gamma = \lim_{n\to\infty}\left[\left(\sum_{m=1}^{n}\frac{1}{m}\right) - \ln n\right] = 0.5772156649\ldots$$

can be represented as a product of an infinite-dimensional row vector, the inverse of a lower triangular matrix, and an infinite-dimensional column vector:

$$\begin{pmatrix}1 & \frac{1}{2} & \frac{1}{3} & \cdots & \frac{1}{n} & \cdots\end{pmatrix}\begin{pmatrix}1 & & & & & \\ \frac{1}{2} & 1 & & & & \\ \frac{1}{3} & \frac{1}{2} & 1 & & & \\ \vdots & \vdots & \vdots & \ddots & & \\ \frac{1}{n} & \frac{1}{n-1} & \frac{1}{n-2} & \cdots & 1 & \\ \vdots & \vdots & \vdots & \cdots & \vdots & \ddots\end{pmatrix}^{-1}\begin{pmatrix}\frac{1}{2} \\ \frac{1}{3} \\ \frac{1}{4} \\ \vdots \\ \frac{1}{n+1} \\ \vdots\end{pmatrix}.$$

Kenter's proof uses induction, definite integrals, convergence of power series, and Abel's Theorem. In this paper, we recast this statement using the language of Riordan matrices. We exhibit another proof as well as a generalization: we show that the Euler-Mascheroni constant γ and Euler's number e can both be represented as a product of a Riordan matrix and certain row and column vectors.

This is joint work with Asamoah Nkwanta.

Title: Toric Ideals of Hypergraphs
Presenter: Elizabeth Gross
Affiliation: University of Illinois, Chicago
Abstract: The ideal of an edge subring of a graph is an object that appears when studying statistical models parameterized by the edges of a graph. There are many results that tell us the same beautiful story: we can understand these ideals, if we understand the combinatorics of the underlying graph. A natural extension is to consider the defining ideal of an edge subring of a hypergraph. In this talk we give some recent results on the toric ideals of hypergraphs, including how to tell when the ideal is generated in a fixed degree. This is joint work with Sonja Petrovic.

Title: The Chromatic Polynomial of Signed Graphs
Presenter: Mela Hardin
Affiliation: San Francisco State University
Abstract: Signed graphs have a chromatic polynomial with the same enumerative and algebraic properties as for unsigned graphs. We generalize the chromatic polynomial for signed graphs using the bivariate chromatic polynomial of Dohmen, Ponitz, and Tittmann and prove that specializations of this new polynomial recover polynomials which enumerate independence and antibalance.

Title: On the adjoint representation of $\mathfrak{sl}_n$ and the Fibonacci numbers
Presenter: Pamela Harris
Affiliation: University of Wisconsin, Milwaukee
Abstract: We decompose the adjoint representation of $\mathfrak{sl}_{r+1} = \mathfrak{sl}_{r+1}(\mathbb{C})$ by a purely combinatorial approach based on the introduction of a certain subset of the Weyl group called the *Weyl alternation set* associated to a pair of dominant integral weights. The cardinality of the Weyl alternation set associated to the highest root and zero weight of $\mathfrak{sl}_{r+1}$ is given by the r^{th} Fibonacci number. We then obtain the exponents of $\mathfrak{sl}_{r+1}$ from this point of view.

Title: A mod four congruence in the real Schubert calculus and the Hermitian Grassmannian
Presenter: Nickolas Hein
Affiliation: Texas A&M University
Abstract: Real Schubert problems satisfy #(real solutions) $\equiv$ #(complex solutions) mod 2 since nonreal solutions come in conjugate pairs. When the Schubert conditions exhibit certain symmetry we find a stronger congruence modulo 4. This curious congruence occurs when complex conjugation and a natural geometric involution act freely on the solutions. The key to understanding this phenomenon is the Hermitian Grassmannian, which has not been classically studied.

I will present the Hermitian Grassmannian and the real Lagrangian Grassmannian, and describe their connection to the symmetric real Schubert calculus. I will also describe degenerate symmetric cases in which the two involutions on the solutions do not act freely (and real solutions are only fixed mod 2).

Title: Ricci Flow on some Classes of Naturally Reductive Homogeneous Spaces
Presenter: Tanya Hepburn-Lloyd
Affiliation: Saint Louis University
Abstract: A homogeneous space $M = G/H$ of Lie Groups G and H, is called naturally reductive if it admits an ad(H)-invariant decomposition $g = h + m$. We will prove that the Ricci Flow on M is proportional to the Ricci Flow on G restricted to M.

Title: Positive Semidefinite Zero Forcing and Vertex Spreads
Presenter: Nicole Kingsley
Affiliation: Iowa State University
Abstract: A graph is denoted $G = (V, E)$, where V is a nonempty set of vertices, E is a set of edges, and each edge is two-element subset of the set of vertices V. Our research focuses on simple undirected graphs and a type of graph parameter called a zero forcing number. A specific type of zero forcing number, positive semidefinite zero forcing number, was introduced by Barioli, et al. in 2010. A positive semidefinite zero forcing set for a graph G is a subset B of V, such that when B is initially colored black, all vertices of G are colored black when the positive semidefinite color change rule is carried out to completion. We call the minimum cardinality over all such B the positive semidefinite zero forcing number of G, and denote this quantity $Z_+(G)$. A positive semidefinite matrix representation of a graph G on n vertices is an n-square positive semidefinite matrix $A = [a_{ij}]$, where a_{ij} is nonzero if the vertices i and j of G are adjacent and zero otherwise. Two interesting parameters based on the family of positive semidefinite matrices representing a graph G are positive semidefinite minimum rank and positive semidefinite maximum nullity of G, denoted by $mr_+(G)$ and $M_+(G)$. It is well known that $M_+(G) \leq Z_+(G)$ for all graphs. We investigate the effect of deleting one vertex of G, along with its adjacent edges, on the parameters $mr_+(G)$, $M_+(G)$, and $Z_+(G)$.

Title: On the quasidiagonality of group C^*-algebras
Presenter: José Luis Lugo
Affiliation: Purdue University
Abstract: The notion of amenability for groups was introduced by John von Neumann in his study of the Banach-Tarski paradox. Given a group G, we can associate to it its reduced group C^*-algebra $C_r^*(G)$, which is a certain completion of the group ring $\mathbb{C}[G]$. In 1987 Jonathan Rosenberg proved that if G is at most countable and $C_r^*(G)$ is quasidiagonal, then the group G is necessarily amenable. Whether the converse is true is still an open question. We discuss this and a special class of groups for which the converse holds.

Title: Two families united as one: A Symmetric Functions Tale
Presenter: Dr. Aba Mbirika
Affiliation: Bowdoin College
Abstract: A fundamental tool used to study various algebraic and topological objects is symmetric functions. They arise in a variety of areas from algebraic, combinatorial, and geometric perspectives. Symmetric functions are polynomials in the ring $\mathbb{Z}[x_1, x_2, \ldots, x_n]$ that are fixed by a natural action of the symmetric group $\mathfrak{S}_n$ on the variables $\{x_1, x_2, \ldots, x_n\}$. Truncated symmetric functions, on the other hand, are polynomials symmetric in a subset of these variables. The main objects of our interest are truncated elementary symmetric functions (TESF) and truncated complete symmetric functions (TCSF). In this talk, we give a number of identities involving these two different families of functions, culminating in a remarkable identity relating TESF to TCSF. From the family of TESF, we construct ideals that generalize the Tanisaki ideal which arises in Springer theory. From the family of TCSF, we build Gröbner bases for this family of generalized Tanisaki ideals. The corresponding polynomial quotient rings easily yield the Betti numbers for the cohomology rings of an important generalization of the Springer variety, called regular nilpotent Hessenberg varieties.

Title: Spectral functions in the presence of background potentials
Presenter: Pedro Morales
Affiliation: Baylor University
Abstract: In this talk, we present how the presence of background potentials and the geometry of a manifold can affect the behavior of spectral functions, as well as their relation with topological invariants such as the heat kernel coefficients.

Title: Noether's Problem
Presenter: Kevin Mugo
Affiliation: Purdue University
Abstract: Let G be a finite group that acts faithfully as permutations on a finite set of indeterminates, $\{x_1, x_2, \ldots, x_n\}$. Determining whether the fixed field $K(x_1, x_2, \ldots, x_n)^G$ is purely transcendental over K is called Noether's problem, explore its relationship to Galois Theory and discuss a connection to Elliptic Curves.

Title: The Homology of Filtered Algebras and A-infinity Structures
Presenter: Cris Negron
Affiliation: University of Washington
Abstract: Koszul algebras are a special class of $\mathbf{N}$-graded algebras, over a field $\mathbf{k}$, which are generated in degree one and have relations generated in degree 2. Koszul duality is a relationship between a Koszul algebra and its "Koszul dual" algebra $\mathrm{Ext}_A(\mathbf{k}, \mathbf{k})$. This relationship exists as a certain equivalence of categories, but has other more tangible interpretations as well.

It has recently become apparent that Koszul duality can be extended beyond the class of Koszul algebras by equipping Ext algebras with a higher structure called an A_∞ structure. This new Ext A_∞ algebra becomes a kind of "A_∞ Koszul dual". A type of Koszul duality was also proposed by Positselskii for filtered algebras U with Koszul associated graded algebras. I will talk about how Positselskii's filtered Koszul duality and this new A_∞ Koszul duality can be used together to form a theory of Koszul duality for a large class of filtered algebras. I will also talk about how this broader duality can be harnessed to gain a new understanding of the homological algebra of filtered algebras.

Title: A Generalization of Group Automorphisms
Presenter: Long Nguyen
Affiliation: Brigham Young University
Abstract: A weak Cayley table isomorphism is a bijective map $f : G \to G$ satisfying two conditions: 1)If g and h are conjugate then $f(g)$ and $f(h)$ are conjugate. 2)For all g, h in G, $f(gh)$ is conjugate to $f(g)f(h)$. A weak Cayley table isomorphism is a generalization of an automorphism. Let $W(G)$ denote the group of all weak Cayley table isomorphisms. Any automorphism is an element of $W(G)$. The inverse map given by $I(x) = x^{-1}$ is also an element of $W(G)$. These are called trivial weak Cayley table isomorphisms. Given a group G, in general, there are a lot of nontrivial weak Cayley table isomorphisms. The research question that I worked on for my dissertation is "For what groups G does $W(G)$ consist of only trivial weak Cayley table isomorphisms?" This talk should be accessible to anyone having taken a first semester Abstract Algebra course.

Title: The Isbell-hull of a di-space
Presenter: Olivier Olela Otafudu
Affiliation: University of Cape Town
Abstract: In this talk, we discuss the concept of hyperconvexity that is appropriate to the category of T_0-quasi-metric spaces (called di-spaces in the following) and nonexpansive maps. Moreover, we provide an explicit construction of the corresponding hull (called Isbell-convex hull or, more briefly, Isbell-hull) of a di-space.

Title: Note on Positive Semidefinite Maximum Nullity and Positive Semidefinite Zero Forcing Number of Partial 2-Trees
Presenter: Jolie Roat
Affiliation: Iowa State University
Abstract: The maximum positive semidefinite nullity of a multigraph G is the largest possible nullity over all real positive semidefinite matrices whose (i, j)th edge (for $i \neq j$) is zero if i and j are not adjacent in G, is nonzero if $\{i, j\}$ is a single edge, and is any real number if $\{i, j\}$ is a multiple edge. The definition of the positive semidefinite zero forcing number for simple graphs is extended to multigraphs; as for simple graphs, this parameter bounds the maximum postive semidefinite nullity from above. The tree cover number $\mathrm{T}(G)$ is the minimum number of vertex disjoint induced simple trees that cover all the vertices of G. The result that $\mathrm{M}_+(G) = \mathrm{T}(G)$ for an outerplanar multigraph G is extended to show that $\mathrm{Z}_+(G) = \mathrm{M}_+(G) = \mathrm{T}(G)$ for a multigraph G of tree-width at most 2.

Title: Computing the Grothendieck group of a noncommutative curve
Presenter: Gautam Sisodia
Affiliation: University of Washington
Abstract: Let A be a free algebra on n generators modulo a single quadratic relation of maximal rank. Zhang shows that these are the connected-graded Gorenstein algebras of global dimension two. A noncommutative version of Beilinson's Theorem establishes a derived equivalence between the category of representations of the n-Kronecker quiver Q and the quotient category $\mathsf{qgr}A$ of the finitely-presented graded A-modules by the finite-dimensional ones. Noncommutative algebraic geometry then suggests studying the moduli space of Q as the noncommutative space with homogeneous coordinate ring A. We show that the Grothendieck group of $\mathsf{qgr}A$ is isomorphic as an ordered abelian group with order unit to the subgroup of the reals generated by the minimal positive pole of the Hilbert series of A.

Title: Hyperbolic structures on link complements
Presenter: Anastasiia Tsvietkova *
Affiliation: University of Tennessee
Abstract: Thurston demonstrated that every link in S^3 is a torus link, a satellite link or a hyperbolic link and these three categories are mutually exclusive. It also follows from work of Menasco that an alternating link represented by a prime diagram is either hyperbolic or a $(2, n)$–torus link.

A new method for computing the hyperbolic structure of the complement of a hyperbolic link, based on ideal polygons bounding the regions of a diagram of the link rather than decomposition of the complement into ideal tetrahedra, was suggested by M. Thistlethwaite. The method is applicable to all diagrams of hyperbolic links under a few mild restrictions. The talk will introduce the basics of the method. Some applications will be discussed, including a surprising rigidity property of certain tangles, a new numerical invariant for tangles, and formulas that allow one to calculate the exact hyperbolic volume, as well as complex volume, of 2–bridged links directly from the diagram.

Title: 2-Selmer Groups of Elliptic Curves Associated with Cunningham Numbers
Presenter: Jaime Weigandt
Affiliation: Purdue University
Abstract: The factorization properties of integers of the form $b^n \pm 1$ are the subject of a great deal theoretical and computational effort. This work is motivated by its relevance to ancient problems concerning perfect numbers and the construction of regular polygons as well as its use as a testing ground for modern factorization algorithms and primality tests.

In this talk, I'll illustrate a connection between some of these questions and the study of rational points on elliptic curves, another subject of immense theoretical and computational efforts with equally ancient origins.

** Invited Faculty Speaker
* Distinguished Graduate Scholar

Poster Presentation Abstracts

Title: Conic Sections Containing Rational Distance Sets of Three Points
Presenter: Jonathan Blair
Affiliation: Purdue University
Abstract: Euler showed that there are infinitely many rational points on the unit circle having pairwise rational distances. Campbell showed that the parabola and Goins and Mugo showed that the hyperbola each contain a rational distance set of at least four points. In this project we seek to generalize these results to an arbitrary conic section.

Title: Distance to uncontrollability with Hermitian matrices
Presenter: Eugene Cody
Affiliation: University of Kansas
Abstract: Controllability is a concept that plays a fundamental role in systems and control. If a system, (A, b), where A is a square matrix and b is a column vector, is controllable, how large a perturbation is necessary so that the resulting system is uncontrollable? This can algebraically be expressed by the distance to uncontrollability, which is a minimization problem over the complex field.

We consider the distance problem with a special case when the matrix A is Hermitian. In this case, the system (A, b) is reduced the pair (Λ, z), where Λ is a real diagonal matrix. By using the real diagonal matrix structure we prove that when A is Hermitian, the search field for the minimization problem of the distance to uncontrollability is reduced to the real field. We observe the behavior of the secular equation and study the relationship between Λ and z to determine the minimizer using a combination of two methods.

Title: Propagation Time for Zero Forcing of a Graph
Presenter: My Huynh
Affiliation: Arizona State University
Abstract: Zero forcing (also called graph infection) on a simple, undirected graph G is based on the color change rule: if each vertex of G is colored either white or black and vertex v is a black vertex with only one white neighbor u then v forces u to become black. A minimum zero forcing set if a set of black vertices of minimum cardinality that can color the entire graph black using the color change rule. The propagation time of a graph G is the minimum amount of time that it takes to force all the vertices of G black using a minimum zero forcing set and performing independent forces simultaneously. The study of propagation times of graphs is related to the study of control quantum systems. Examples that demonstrate various features of the propagation time of a graph are introduced and results on graphs having extreme propagation times are presented.

Title: Competitive Color Graphing
Presenter: Blanche Ngo Mahop
Affiliation: Howard University
Abstract: Imagine your best friend is getting married to your ex. Its probably safe to say you are no longer best friends anymore. Your best friend decides to invite you to the wedding and asks for your help. Your job is to place everyone around the table in a girl/boy order. Since you are upset that your best friend is marrying your ex you dont do your job affectively so you may accidentally place two girls or guys by each other. In fact, Competitive Color Graphing is a way of coloring the vertices of a graph such that no two adjacent vertices share the same color; this is called a vertex coloring. Similarly, an edge coloring assigns a color to each edge so that no two adjacent edges share the same color, and a face coloring of a planar graph assigns a color to each face or region so that no two faces that share a boundary have the same color.

Title: The Effect of Graph Operations on the Positive Semidefinite Zero Forcing Number
Presenter: Arianne Ross
Affiliation: Iowa State University
Abstract: The positive semidefinite zero forcing number $Z+(G)$ of a graph G was introduced by Barioli et.al. The effect of various graph operations on positive semidefinite zero forcing number and connections with other graph parameters are studied.

Title: Exploring Dessins d'Enfants
Presenter: Anika Rounds
Affiliation: Purdue University
Abstract: Suppose there are three cottages, and each needs to be connected to the gas, water, and electric companies. Using a third dimension or sending any of the connections through another company or cottage are disallowed. Is there a way to make all nine connections without any of the lines crossing each other? To answer such a question, we explore the properties of planar graphs. It is natural to generalize to graphs which can be embedded into Riemann surfaces, such as the sphere and the torus. In this talk, we discuss how to draw such graphs using Grothendieck's concept of a Dessin d'Enfant. This is based on joint research with Edray Goins through the Zoltners Summer Undergraduate Research Fellowship.

Title: 2-Isomorphism Theorem for Hypergraphs
Presenter: Eric Taylor
Affiliation: California State University, San Bernardino
Abstract: Whitney's 2-isomomorphism theorem characterizes when two graphs have isomorphic cycle matroids. This paper will generalize Whitney's theorem to hypergraphs.