The 100th Annual Meeting of the Illinois Section of the Mathematical Association of America

University of St. Francis, Joliet, IL
March 13-14, 2020

Speaker and Abstract List

Plenary Talks

Edward Kim, University of Wisconsin - La Crosse
Opening Plenary on Friday, March 13, 1:15 - 2:30
What does Minesweeper have to do with mathematical proofs?

I have a love-hate relationship with the game of Minesweeper. The game has had negative and positive influences on me as a mathematician. The game almost kept me from becoming a mathematician, yet simultaneously helped turn me into the mathematician I am today. Oddly enough (and amusingly enough), the game has had influences on how I think about proofs, both as a researcher and as a faculty member who regular teaches our foundations/bridges/proofs course.

Through understanding my students' struggles in abstract algebra and combining this with my own experiences when I was starting to become a mathematician, I desired to revisit the concepts of a foundations course from an intuitive lens. Removing esoteric descriptions of proof by cases gave way to Minesweeper. Reformatting syllogisms for visual clarity allowed students to quickly grapple with the task of proof.

In the most surprising twist, my student plunge into proving a type of theorem which never seems to appear in typical foundations courses, but are extremely typical of theorems they are expected to prove in abstract algebra and real analysis. Moreover, they thoroughly enjoy proving this type of theorem: more than once, I have had students make special requests that a theorem of this type is placed on an exam because they are so fun. Ask a question type that prepares them more thoroughly for algebra and analysis while simultaneously keeping them entertained? That's a win-win!

Arden Warner, Fermi National Accelerator Laboratory
Evening Plenary on Friday, March 13, 7:45-8:45
Discovery Mathematics - How mathematics is used in my world of Particle Accelerator Science and New Technology Development

How often have your math students asked the question "when will I ever need to use this in the real-world?" Modeling, or mimicking, the physical world often starts out by applying some basic principles in physics that uses mathematics as a tool to discovery. This presentation will describe some applications of mathematics applied to very understandable observations that lead to either discovery or invention. Some interesting video examples will be included.

Arden is a founding partner of Natural Science, LLC and the visionary behind the concept of using electromagnetic forces to remediate oil spills in our oceans and waterways. As Principal Scientist of Natural Science, LLC, Arden proved his concept in laboratory settings, envisioned the prototype, and assembled the team of investors, engineers, and scientists to build the companys first product, E-MOPTM Electromagnetic Oil Spill Remediation Technology.

Arden is also an Accelerator Physicist at Fermi National Accelerator Laboratory in Batavia, Illinois, working to advance the science of the Particle Accelerators used in particle physics. He is a frequently published author and public speaker on a range of scientific topics. Arden Completed his undergraduate studies at The City University of New York -City College and Columbia University in Physics and Electrical Engineering respectively before completing his Graduate work in Physics at Stony Brook University.

J. Alan Alewine, McKendree University
Morning Plenary on Saturday, March 14, 8:30-9:30
Something for Everyone

In the spirit of inclusivity, this presentation will appeal to students and instructors alike. Included is a teaching tidbit, an interesting proof of a well- known result, and musings on "being in the middle".

About the Author: Alan Alewine hails from South Carolina, where he attended Furman University as an undergraduate. He completed his graduate work in analysis at Vanderbilt University and has been a faculty member at McKendree University since 2002. He has also been an associate provost since 2014 and admits he loves the administrative work! He is wild about roller coasters, having visited 11 amusement parks in 2019. (Steel Vengeance is his favorite coaster.)

James Sellers, University of Minnesota Duluth
Closing Plenary on Saturday, March 14, 12:00-1:15
Revisiting What Euler and the Bernoullis Knew About Convergent Infinite Series

All too often in first-year calculus classes, conversations about infinite series stop with discussions about convergence or divergence. Such interactions are, unfortunately, not often illuminating or intriguing. Interestingly enough, Jacob and Johann Bernoulli and Leonhard Euler (and their contemporaries in the early 18th century) knew quite a bit about how to find the exact values of numerous families of convergent infinite series. In this talk, I will show two sets of exact results in this vein. The talk will be accessible to anyone interested in mathematics.

Panelist and PIC Math Biographies

The panel on Preparation for Industrial Careers in Mathematical Sciences is on Friday, March 13 from 3:50-4:45 in Library #G2.

Aimee Eichelberger
Quality Method Specialist at Case New Holland

Eichelberger is a native of Joliet, IL (graduated from Joliet Central HS in 2005) and graduated with a BA in Mathematics (Actuarial Science) in 2009 from University of St. Francis (USF). She went on to get her Masters in Applied Statistics from Illinois State University in 2011 many of the skills (not just math) she learned at USF helped her in graduate school and on the job. For the last four years she's worked for CNH Industrial in Burr Ridge, IL as a Warranty Reporting Analyst for large scale agricultural and construction equipment. She analyzes the monthly and quarterly warranty spending trends for equipment parts and determine the number of part failures and their costs. She also teach statistics classes geared toward engineers and business personnel so they can learn how to make more sense of their products performance. She also moved into the Reporting & KPIs role for the Global CE segment at work, instead of warranty reporting for AG and CE for North America only.

Adrienne Harrell
Actuary

Harrell graduated from Taylor University with a B.S. in Mathematics in 2010. She interned in Chicago with Marsh & McLennan Companies in their Financial Risk department as a junior in college and then started full-time as an analyst after graduation. In 2012 she moved into actuarial work as a consultant at Oliver Wyman. She is working towards becoming a fellow of the Casualty Actuarial Society. She currently lives in Westmont, Illinois with her husband and two daughters Grace and Cora.

Bailey Minogue
Supervisor of Variable Compensation for Addison Group

Addison Group is a nationwide staffing firm. Minogue's role includes managing a team that calculates all commissions, bonuses, and create reporting for the executives of the company.

Patrick Wallenberg
Real Estate Assistant Manager

Wallenberg assists with managing 5 apartment building (over 20 units), performs accounting functions and activities using both Quicken and Excel, and reviews lease agreements and determines future tenants. He researches real estate values to determine appropriate pricing for rents. Other duties include managing cash flow of rental receipts electronically using Tenant Cloud Software and remodeling and refurbishing apartment units.

Mason Williams
Optometrist

Dr. Mason Williams is a passionate primary care Optometrist who enjoys seeing patients of all ages. He takes great pride in listening to patients to provide comprehensive eye-care that best meets their visual needs. His special interests include RGP/scleral contact lens fittings and the treatment and management of ocular disease. After obtaining his B.S. in Mathematics from Benedictine University in Lisle, IL he went on to earn his Doctor of Optometry from Southern College of Optometry (SCO) in Memphis, TN. He completed extern rotations at Eye Specialist Associates in Memphis, TN and the James A. Lovell Federal Health Care Center in Greatlakes, IL. During his rotations, he received extensive training to best help patients with a variety of their eye-care needs including pediatrics, geriatrics, cataract surgery co-management, Pre-LASIK consultations, ocular disease, as well as strabismus and amblyopia. While at SCO, Dr. Williams served as president of the Illinois State club and was a member of the Beta Sigma Kappa International Honor society. Dr. Williams is a member of the American Optometric Association and the South Carolina Optometric Physicians Association. Originally from the Chicago suburbs, Dr. Williams and his wife (Heather) have enjoyed living in multiple parts of the U.S. In his spare time, he enjoys spending time with their 2 dogs, traveling, and eating out.

The PIC math session is on Saturday, March 14 from 9:50-10:45 in Library #G3.

Haley Yaple
Carthage College

Dr. Haley Yaple is an Associate Professor of Mathematics at Carthage College, in Kenosha, Wisconsin. As an applied mathematician at a liberal arts school, she teaches mathematical techniques for the physical sciences in courses such as Differential Equations and Multivariable Calculus. Her research with undergraduate students spans a variety of areas, including applied dynamical systems, network science, and mathematical modeling.

Dr. Yaple earned a Ph.D. in applied mathematics from Northwestern University, where her thesis research included two main projects: modeling religious shift in societies and analyzing the dynamics of ferromagnetism. Believe it or not, she says, these two topics can be modeled using the same basic differential equation! Dr. Yaple earned a B.S. in mathematics and B.S. in mechanical engineering from Trinity College, a small liberal arts college in Hartford, Conn. Outside of her academic activities, she is active in music and dance, collects antique math books and ephemera, and spends most of her free time during the winter months participating in the sport of curling.

Contributed Talks

M. Vali Siadat, Richard J. Daley College
Friday, March 13, 2:40-3:05
Omar Khayyam- Geometric Algebra and Cubic Equations

Omar Khayyam was born on May 18, 1048, in Nishapur, a city in Northeast Iran and died on December 4, 1131. While Khayyam is widely known in the western world as a poet, he also made significant contributions to the world of mathematics. His most well-known mathematics publication is called, Treatise on Demonstration of Problems of Algebra, which was completed in 1070. Within this text, Khayyam presents a geometric method for finding solutions to cubic equations using geometric constructions such that he would identify the intersection of hyperbolas, parabolas, circles, and semicircles. In this respect we may regard Khayyam as a pioneer in connecting algebra with geometry, well before the French mathematician Rene Descartes (1596-1650) was credited with inventing analytical geometry. In this talk I will present some of the contributions of Khayyam to science and mathematics and his methods for solving the cubic equations.

Bir Kafle[1], Anitha Srinivasan[2], and Alain Togbe[1]
[1]Purdue University Northwest, IN; [2]Saint Louis University, Madrid, Spain
Friday, March 13, 2:40-3:05
Markoff Equation with Pell Components

The Diophantine equation

$$x^2 + y^2 + z^2 = 3xyz \tag{1}$$

was first considered by A. Markoff in 1879, and is now known as the Markoff equation. A triple (a, b, c) of positive integers with $a \leq b \leq c$ is called a Markoff triple if it satisfies equation 1. The first few such triples are

$$(1,1,1),\ (1,1,2),\ (1,2,5),\ (1,5,13),\ (2,5,29), (1,13,34),\ (1,34,89),\ (2,29,169), \cdots$$

A Markoff number is a positive integer arising as a component of a Markoff triple. So, the first few Markoff numbers are

$$1,\ 2,\ 5,\ 13,\ 29,\ 34,\ 89,\ 169,\ 194,\ 233,\ 433,\ 610,\ 985,\ 1325, \ldots$$

The Markoff conjecture (first stated by G. Frobenius, little more than 100 years ago) states that any Markoff number c appears uniquely as the maximal element of a Markoff triple. While the conjecture still puzzles us, many interesting connections between Markoff numbers and other well known sequences of numbers have been discovered.

In this talk, we discuss about the triples of Pell numbers $(P_i,\ P_j,\ P_n) = (x,\ y,\ z)$ satisfying the Markoff equation 1. The Pell sequence $(P_n)_{n\geq 0}$ is defined by the binary recurrence

$$P_{n+1} = 2P_n + P_{n-1},$$

with the initial terms $P_0 = 0,\ P_1 = 1$.

This is a joint work with Anitha Srinivasan and Alain Togbé.

Rachel Rupnow, Northern Illinois University
Friday, March 13, 2:40-3:05
Language for Mathematical Concepts: Does Context Matter?

Group isomorphism and homomorphism are topics central to abstract algebra, yet research on instructors ways of understanding these concepts is limited. Based on interviews and classroom video, this talk examines the language used to discuss isomorphism and homomorphism. Two types of results are presented. First, language used for group isomorphism and homomorphism are identified and classified into four main categories. Second, how the instructors used language from those four categories in the interview and instruction settings are compared and contrasted.

Paul Buldak*, Lewis University
Friday, March 13, 2:40-2:52
Modeling Fan Graphs in Self-Assembling DNA Using Graph Theory and Linear Algebra

Motivated by the recent advancements in nanotechnology and the discovery of new laboratory techniques using the Watson-Crick complementary properties of DNA strands, formal graph theory has recently become useful in the study of self-assembling DNA complexes. Construction methods based on graph theory have resulted in significantly increased efficiency. We present the results of applying graph theoretical and linear algebra techniques for constructing fan graphs.

Raman Aliakseyeu*, Natalie Oliven*, Ethan Thieme*, Benedictine University
Friday, March 13, 2:40-2:52
Description and Count of the Extended Symmetric Space of $SO(3, p)$

Our goal is to investigate Special Orthogonal group of 3 by 3 matrices modulo p, denoted $SO(3, p)$. Such matrices can be used in a multitude of fields, such as physics, chemistry and computer science. We began by generalizing the notion of symmetry as it pertains to matrices. For this investigation, we will use an inner automorphism of order two which is defined as $\theta(X) = MXM^{-1}$. For a specific involution matrix M, we provide a count and description of the elements of the Extended Symmetric Space of 3 by 3 matrices defined as $\mathbf{R} = \{X \in SO(3, p) \mid \theta(X) = X^{-1}\}$.

Brendan Miller*[1], Isaac Brown*[2], Tyler Russell*[3], Christina Graves[3]
[1]University of St. Francis, [2]Washington State University, [3]University of Texas at Tyler
Friday, March 13, 2:55-3:07
Most Reliable Two-Terminal Graphs with Node Failures

A two-terminal graph is an undirected graph with two specified target vertices. If each vertex of such a graph fails independently with the same fixed probability (and edges are perfectly reliable), the two-terminal node reliability is the probability that the target vertices are in the same connected component in the induced subgraph of all operational nodes. A two-terminal graph is uniformly most reliable if its node reliability polynomial is greater than or equal to that of all other two-terminal graphs with the same fixed number of vertices, n, and edges, m. We show that there is always a uniformly most reliable two-terminal graph. Furthermore, when the distance between the target vertices is restricted to be at least three, we completely classify which values of n and m produce a uniformly most reliable graph and which do not.

Fernando Elesterio*, Benedictine University
Friday, March 13, 2:55-3:07
Algebraic Approaches to the N-Queens Constraint Satisfaction Problem

Constraint Satisfaction Problems (CSPs) is a common field of problems in computer science classes. One of the most famous being the N-Queens problem: given an $N \times N$ chessboard, find all possible positions of N queens such that none are threatened. This CSP is commonly approached using algorithmic graph traversal with various enhancements to speed up the search for solutions.

This research explores a group-theoretic enhancement to solving N-queens, exploiting symmetries to quicken the solution search, and detecting earlier possible dead-ends.

Paul Bialek, Trinity International University
Friday, March 13, 3:10-3:35
What Can I Do with a Math Major? Five Basic Career Fields for Math Majors

If someone asks you, "What can I do with a Mathematics major?" what do you say? We will talk about the five basic career fields for Mathematics majors, so that you will know the answer to this question.

Brooke Randazzo(+), Northern Illinois University
Friday, March 13, 3:10-3:35
Integral Representations of Finite Groups

Representation theory is a powerful tool that can be used to study algebraic groups. A representation of a group is a homomorphism sending group elements to invertible matrices with entries in a particular field, with the idea that groups of matrices are easier to understand than generic groups. While classical representation theory looks at matrices over the complex numbers, we can also consider matrices with entries in other fields. This then opens the door to studying integral representation theory, which turns out out to be more difficult than looking at representations over a field, but can provide additional insight. In particular, given a fixed prime p, we can consider the set of rational numbers with denominator not divisible p, which turns out to be a ring. Examining representations over this ring in combination with subgroups of size p^n will be discussed.

Aaron Zerhusen, Dominican University
Friday, March 13, 3:10-3:35
One Example of Social Justice In a Statistics Class: Bill Jenkins and the Tuskegee Experiment

The long-running Tuskegee Study is infamous in the history of medicine in the United States as an example of unethical practice and racism. In this talk, we will look at an overview of the study, and focus on one of the sole voices to speak out against it, a young statistician named Bill Jenkins. The eventual outcry against this and other experiments helped lead to the modern institutional review board. We will then discuss how I used his story within a introduction to statistics classroom. Content note: this talk will discuss race and racism in recent US history, as well as sexually transmitted diseases.

Patrick Ward*, Illinois Wesleyan University
Friday, March 13, 3:10-3:22
On multidecompositions of complete direct graph into directed graph pairs of orders 3 and 4

A directed graph is a way to encode information about directional relationships among objects. The complete directed graph on n objects is the directed graph with arrows pointing in both directions for each pair of objects. In this project we are interested in decomposing complete directed graphs into pairs of smaller directed graph pairs. A directed graph pair is two directed graphs that together form a smaller complete directed graph. In particular, we find the spectra of all of the 28 graphs pairs (D, H) where either (A) D has three vertices, or (B) D has four vertices, at most four arcs, and is bipartite.

Joshua Krawczyk*, Benedictine University
Friday, March 13, 3:10-3:22
A Dual Approach to Graph Coloring: Nowhere-Zero k-flows

In graph theory, graph coloring is a scheme of labeling vertices, edges, or faces of a graph in such a way that no color is adjacent or connected to itself. This problem can be used in applications such as scheduling and bandwidth allocation. These problems can generally be modeled as planar graphs: any graph which can be drawn in a plane in such a way that its edges only intersect at their endpoints. The coloring problem is of particular interest for planar graphs, because it is known that every planar graph is 4-colorable. The task itself of finding the coloring is computationally expensive, however, and it is therefore interesting to consider using nowhere-zero k-flows to find the coloring of a graph G. We will discuss the process of creating $G*$, the dual of a graph G, and the nowhere-zero k-flow, a map from the directed edges of a graph to an additive abelian group, and its inherent tie to the coloring problem.

Eric Redmon*, Lewis University
Friday, March 13, 3:25-3:37
Optimal Tilings of Self-Assembling Bipartite Graphs

Motivated by the recent advancements in nanotechnology and the discovery of new laboratory techniques using the Watson-Crick complementary properties of DNA strands, formal graph theory has recently become useful in the study of self-assembling DNA complexes. Construction methods based on graph theory have resulted in significantly increased efficiency. In this paper, we present the results of applying graph theoretical and linear algebra techniques for constructing crossed-prism, book, and stacked-book graphs. In particular, we explore various design strategies for these graph families in three sets of laboratory constraints.

Enrique Treviño and Mikita Zhylinski*, Lake Forest College
Friday, March 13, 3:50-4:15
Happy numbers on fractional base number systems

Let n be a positive integer and $S_2(n)$ be the sum of the squares of its decimal digits. When there exists a positive integer k such that the k-th iterate of S_2 on n is 1, i.e., $S_2^k(n) = 1$, then n is called a happy number. The notion of happy numbers has been generalized to different bases, different powers and even negative bases. In this article we consider generalizations to fractional number bases. Let $S_{e,\frac{p}{q}}(n)$ be the sum of the e-th powers of the digits of n base p/q. Let k be the smallest

nonnegative integer for which there exists a positive integer $m > k$ satisfying $S^k_{e,\frac{p}{q}}(n) = S^m_{e,\frac{p}{q}}(n)$. We prove that such a k, called the height of n, exists for all n, and that, if $q = 2$ or $e = 1$, then k can be arbitrarily large.

Ugur Odabasi[1], Peter Adams[2], Katie Battista*[1], Ryan Bunge[1], William Duncan[1], Saad El-Zanati[1], Colleen Hehr[1], and Tracer Mills[1]
[1]Illinois State University, [2]The University of Queensland
Friday, March 13, 3:50-4:15
On Decomposing the Complete Multigraph into Connected CubicBipartite Multigraphs of Order 8

Let λKv denote the λ-fold complete multigraph on v vertices and let G be a connected cubic bipartite multigraph on 8 vertices. We find necessary and sufficient conditions on λ and v so that there exists a G-decomposition of λKv.

Sarah Bockting-Conrad, DePaul University
Friday, March 13, 3:50-4:15
Adopting Student-Created Norms in Active-Learning Classrooms

A crucial element in creating a successful active-learning classroom is establishing an environment in which students feel respected, comfortable sharing their ideas, and at ease working with others. In a typical course, we as faculty might outline our classroom expectations on the first day. In this talk, I will discuss an alternative approach in which students work collaboratively to create their own classroom norms. I will discuss motivation for this approach and methods for implementation, as well as observed positive outcomes such as fostering student engagement and creating a more inclusive classroom.

Aidan Mullins-Pearson(+) and Horia I Petrache, Indiana University-Purdue University Indianapolis
Friday, March 13, 4:20-4:45
Evolution of Power Sets Under a Deletion-Regeneration Algorithm

Regeneration is an interesting class of phenomena found in both living and non-living systems. We present a regeneration model that is based on set operations within power sets and relies on the property that power sets are closed under set operations. A power set $P(S)$ is defined as the set of all subsets of S. We present an algorithm that starts with a given power set $P(S)$ and at each step either deletes a set from the power set or combines two remaining sets to attempt to "regenerate" a previously deleted set. By varying deletion and regeneration rates, we can explore a parameter space in which the time evolution of the initial power set is such that the set will either decay completely or reach a metastable state. We will show and discuss results as a function of the number of elements in S and the ratio of deletion and regeneration rates.

Gregory Galperin, Eastern Illinois University
Friday, March 13, 4:20-4:45
Hot Air Balloon Flight in Lobachevsky Space

Having risen in the Lobachevsky space H^3 to a great height above the Lobachevsky plane H^2, we will see this plane as a disc D on our retina. Considering the retina as a small piece of a horosphere centered at an infinite point Sigma, the projection of the disc D on the retina from this point can be proven to be the standard Euclidean Beltrami-Caley-Klein model of hyperbolic plane H^2 in a unit disc.

J. Christopher Tweddle, Governors State University
Friday, March 13, 4:20-4:45
Legislative and IAI updates

In this presentation I will provide an overview of some of the legislative initiatives that impact higher education broadly and mathematics in particular, such as the PWR Act (transitional math courses), SJR 22/STAR Act (transferability) and SJR 41 (placement). I will also highlight some of the recent revisions to the IAI General Education Common Core mathematics courses. There will be time for questions and discussion.

Haley Yaple
Saturday, March 14, 9:50-10:45
PIC Math: A Course with an Industrial Component

PIC Math: Students become mathematical consultants in a real-world research class

As part of a national program called PIC Math ("Preparing for Industrial Careers in Math), faculty facilitate student research with a local company as part of a semester-long research course. Students gain experience in messy, open-ended problem solving and gain professional skills that will position them well for future careers in mathematics. After running such a course last year, I am eager to continue working with local partners as a regular part of my research and teaching. In this talk, I will share my experiences and provide information on how to get started, whether as part of the official PIC Math program or independently.

Todd D. Oberg, Illinois College
Saturday, March 14, 9:50-10:45
Teacher Licensure Updates

Between the state legislature and ISBE there have been several changes in licensure rules and regulations in the past year. This session will present a summary of the relevant changes in initial licensure and endorsements requirements as pertains to teacher education and math.

Lihang Liu(+), Roosevelt University
Saturday, March 14, 9:50-10:15
Combinatorics and Multiple ways to solve Math Problem

I will present a math problem, and use Combinatorics to attack this problem in different perspectives and find the hidden connections with different math area.

Miles Mena*, Lewis University
Saturday, March 14, 10:05-10:17
Graph Theoretical Design Strategies for Modeling Self Assembling DNA Complexes

Self-assembly is a term used to describe the process of a collection of components combining to form an organized structure without external direction. The unique properties of double-stranded DNA molecules make DNA a valuable structural material with which to form nanostructures, and the field of DNA nantechnology is largely based on this premise. By modeling complexes with discrete graphs, efficient self-assembly of nanostructures becomes a mathematical puzzle which can be solved using undergraduate graph theory and linear algebra. In this poster, we present our results of applying graph theoretical and linear algebra techniques to constructing a variety of graphs including tadpole, lollipop, bow-tie, kite, moth, cricket, and more.

Marshall Whittlesey, California State University San Marcos
Saturday, March 14, 10:20-10:45
Proving theorems in spherical geometry using the quaternions

It is well known that the complex numbers can be used to do transformation geometry in the plane. In particular, rotation by angle θ about the origin is accomplished via multiplication by the complex number $e^{i\theta} = \cos(\theta) + i\sin(\theta)$. It is less well known that the quaternion algebra (consisting of expressions of the form $a + bi + cj + dk$ with $i^2 = j^2 = k^2 = -1$) can be used to do similar transformations in three dimensional space. In this talk we show how to use quaternions to prove significant theorems in spherical geometry. These methods are featured in the speaker's new book with CRC Press *Spherical Geometry and its Applications*, which the author hopes will be attractive for use in topics courses in geometry.

April Tran* and Jonathan Reaban*, Augustana College
Saturday, March 14, 10:20-10:32
Pursuit Curve with constant accelerations

Pursuit Curves are curves traced by a predator that is always moving in a direction that is tangent to the prey. We derive and solve a pursuit curve differential equation where both the prey and the predator have constant-magnitude accelerations. Additionally, we conclude that it reduces to the Bouguer model with constant velocities.

Tuan Truong, Augustana College
Saturday, March 14, 10:35-10:47
Partition Numbers: A Generating Function Approach

This presentation includes a brief introduction to generating functions and how they apply to counting partitions of natural numbers. A partition of n is an unordered collection of positive integers, such that the sum of all the elements in the collection equals n. In a sense, it is the way to write n as a sum of smaller positive integers. In the presentation, we will review some known results: combinatorial numbers with negative degree, Eulers pentagonal number theorem, and derive a recursive formula for $p(n)$.

Sarah Bockting-Conrad[1], Aliza Steurer[2], Elizabeth DeWitt[3], Matthew Lee[4]
[1]DePaul University, [2]Dominican University, [3]Trinity Christian College, [4]University of Illinois - Chicago
Saturday, March 14, 10:55-11:50
An Introduction to Inquiry Based Learning

Inquiry Based Learning (IBL) is an active learning approach that helps students self-discover critical ideas and connections between them. In the broadest sense, the Academy of Inquiry Based Learning describes IBL as activities that (1) facilitate collaboration between peers and (2) encourage a deep engagement in rich mathematical activities. In our session we will give a brief introduction to IBL, give you an opportunity to experience this for yourself through an activity, and discuss some common "teacher moves" in an IBL classroom. The activity should be accessible to all. Thus, we welcome any conference participant to take part.

This session is brought to you by the new and growing regional IBL community: Chicagoland IBL.

Peter Andrews, Eastern Illinois University
Saturday, March 14, 10:55-11:20
A Simple Complex Proof of Morley's Theorem

Morley's Theorem states that for any triangle in the plane, the triangle formed by the intersections of adjacent angle trisectors is equilateral – that is each of its angles is $2\pi/3$! We present a proof of this result viewing the points of Euclidean plane as complex numbers. This proof is a variation on one given by Alain Connes in 2002.

Angela Antonou[1] and Brittany Stephenson[2]
[1]University of St. Francis, [2]Lewis University
Saturday, March 14, 10:55-11:20
Continued Fractions: A Math Teachers' Circle Activity

Math Teachers' Circles are a form of professional development for middle and high school mathematics teachers that puts teachers in the role of students as they attempt to solve open-ended inquiry-based mathematics problems. In this talk, we present a Math Teachers' Circle activity that we developed (using known results) to explore the world of continued fractions. The activity involves a surprising visual representation of these fractions and includes some interesting patterns as well (including interesting continued fraction representations involving π).

Ella Barker*, Roosevelt University
Saturday, March 14, 10:55-11:07
Data Analysis of Microplants and Over 100 Community Scientists

Roosevelt students are working with the Field Museum to compile and organize their measurements of microplants. From these measurements, the Field Museum wants to classify plants to see how the climate is changing. They also want to see if community scientists are able to measure these microplants with the same accuracy as experts and if there are quality differences between different age groups (children, teens, and adults). Using Excel and PowerShell, we can map the measurements over the photos taken, make sure that the measurements are at a $\pi/2$ angle and convert time zone differences.

Frida Linan*, University of Illinois at Chicago
Saturday, March 14, 11:10-11:22
Goldreich-Goldwasser-Halevi Method

During my reading project we discovered a handful of ways to encrypt words. I will be presenting on the Goldreich-Goldwasser-Halevi (GGH) method, which involves lattices. The shortest vector problem is what used to make the GGH method safe. Lattices and the shortest vector problem will be introduced during this presentation. People with basic knowledge of matrices and vectors will find this presentation accessible.

Donald A. Sokol, emeritus
Saturday, March 14, 11:25-11:50
Plimpton 322: Rosetta Stone - A Summary

There is an ancient Babylonian clay tablet in the museum at New York's Columbia University. It is identified as Plimpton 322, and it contains information associated with the equation a-squared + b-squared = c-squared, which is also know as the Pythagorean Theorem (P.T.). During the past two years, three papers addressing the contents of the tablet and their mathematical implications have been given at various AMS meetings: Atlanta (2017), San Diego (2018), and UM-Ann Arbor (2018). The first paper dealt with the contents of the tablet and an algorithm used to generate the data the tablet contains; the second paper addresses features of the P.T. not contained in the tablet due to the prevailing attitude towards the use of square roots and negative numbers in mathematics. The third paper focused on the algorithm discussed in the first paper and the ability to transform elliptic and parabolic waveforms into integer right triangles, making it a possible candidate for the interface of quantum and quotidian (classical) mechanics. This then is a summary of those issues.

Kiah Wah Ong, Illinois Institute of Technology
Saturday, March 14, 11:25-11:50
Applying Superposition Principle in Solving System of Linear Differential Equations

Most students first encountered generalized eigenvectors in their first course in differential equations. Generalized eigenvectors are used to solve system of linear first-order differential equations with a defective matrix. However, most textbooks at this level do not provide enough insight into why the method works. Instead of discussing Jordan canonical form, an alternative approach will be presented in this talk utilizing mainly the concept of linear dependency and superposition principle.
