2017 ISMAA GENERAL SESSION ABSTRACTS

Olcay Akman, Illinois State University
Other authors: Mitchell Morris

You Say Soccer And I Say Football; Let's Not Call the Whole Thing Off

How is the Barcelona midfield linked geometrically? What's the similarity between an ant colony and Dutch Style Football? How are the mechanics of a Mexican Wave related with the singing of cicadas in an Australian valley? Soccer is indeed a game of numbers, patterns, and shapes. The last several decades transformed soccer to utilize mathematical modeling that renders itself as the applications of a host of biological systems. With this talk, we will shed light on individual plays, team strategies, and league performances from mathematics and statistics points of view.

This talk is appropriate for undergraduates, graduates, females, males, goal keepers, defenders, referees, coaches, handicapped, truck drivers, police officers, mascots, cooks, nurses, and professors, among others.

Angela Antonou (University of St. Francis), Rita Patel (College of DuPage)

Impact of the Southwest Chicago Math Teachers' Circle Workshop on the Disposition of Teachers

The Southwest Chicago Math Teachers' Circle is a recently formed math teachers' circle focused on providing opportunities for middle and high school mathematics teachers in the southwest Chicago suburbs to work with deep and interesting mathematical problems which may relate to the topics which they teach in their classroom. The authors have attempted to determine the impact of participation in this program on the teachers' dispositions toward mathematics, the teaching of mathematics, and their perception of the learning of mathematics. This talk will share some of the results gathered from the three day workshop held in August 2016.

This talk is appropriate for undergraduate students but is especially aimed at middle and high school mathematics teachers as well as teacher educators.

Abigail Bailey, Elgin Community College

On Noncommutative Piecewise Noetherian Rings

The definition of a piecewise Noetherian ring will be extended to the noncommutative case in this talk, and various properties of such rings revealed. In particular, it will be shown that a ring with Krull dimension is piecewise Noetherian, and certain fully bounded piecewise Noetherian rings have Gabriel dimension and exhibit the Gabrial correspondence between prime ideals and indecomposable injective modules.

Thomas Bengtson, Augustana College

Undergraduate Scholarship: The Beling Program at Augustana

The Earl Beling endowment at Augustana has supported undergraduate mathematics scholarship. The funds have been used to sponsor student travel to our section meetings, for example. We will discuss how the program has worked, including not only its limitations but also the advantages and opportunities it has provided.

Astrida Cirulis, Concordia University Chicago

IMTE (Illinois Mathematics Teacher Educators) Meeting

State requirements for teacher education programs have changed considerably in the last several years. We will discuss how institutions have changed existing programs and developed new programs to meet the new elementary and middle school level teacher education standards. Other topics related to teacher preparation are welcome as well. Please come ready to share thoughts and information about courses, programs, books, and EdTPA preparation.

This is for anyone interested in teacher education.

Steve Cohen, Roosevelt University

Teaching a PIC-Math Industrial Problems Class

PIC Math (Preparation for Industrial Careers in Mathematical Sciences) is an NSF funded, Mathematical Association of America program to raise math faculty awareness of non-academic career options for math majors, and to help students prepare for industrial careers. Participants in the program agree to teach a class where students work on a semester long project provided by an industrial contact. In the class, students need to figure out what the professional contact is asking of them, determine what mathematical tools they need (with help from the instructor) and develop a plan to solve the problem. As the instructor, I want the students to develop their own take on what is being asked of them and how they might go about solving it. They need structure and guidance, but also freedom and autonomy to make mistakes, and a sense of responsibility to the professional contact. I will share how I prepared to teach the class, and some of the ways I helped students to do their best work.

Timothy Comar, Benedictine University

Using Population Dynamics as a Theme to Introduce (Bio)calculus Students to Mathematical Biology

A two semester course sequence in biocalculus (calculus for the life sciences) is a great starting place for students in the life sciences to seriously begin applying mathematical and computational techniques to investigating biological problems and phenomena. This talk discusses a variety of active learning activities in the course sequence that lead students to develop the skills and understanding needed to be able to use mathematics to address biological problems. With a broad, underlying theme of population dynamics, the activities take the students from investigating the relationships of simple dynamical systems to data sets and exploring simple models to reading journal articles, working through computer laboratory projects, and eventually leading to the detailed study of a sophisticated model in a published journal article. Students with this preparation subsequently have completed successful research projects in mathematical biology as well as majors and research projects in related scientific disciplines.

Anthony DeLegge, Benedictine University

Other authors: Chand Bhanot

The Effect of Embellishment on Rumor Spreading

How a rumor spreads is quite interesting and can be modeled very similarly to the spread of an infectious disease. Namely, someone who knows the rumor and wants to spread it (spreader) does so to one who hasn't heard it yet (ignorant), and, eventually, the spreader tires of the rumor and then stops spreading it (removed). But, what is the effect if a second kind of spreader, an embellisher, comes along and not only spreads the rumor, but exaggerates it in such a way that more ignorants are likely to spread it (and potentially embellish it) themselves? How much longer can this make a rumor last? This talk concerns the set-up and analysis of a model for spreading a rumor with embellishment and a discussion of how powerful an effect embellishment can have on rumor spreading.

This talk would be appropriate for undergraduates. The math involved is largely at the undergraduate level, and it is the result of a research project with an undergraduate student.

Amanda Harsy, Lewis University

Other authors: Ahmad Mojiri, Rita Patel, Angela Antonou

Math Teachers' Circles: Inquiry-Oriented Activities Used to Investigate Rich Math Problems

Many K-12 math teachers are not ready to teach from a conceptual and inquiry-oriented perspective because they have an algorithmic understanding of mathematics. One solution is to create a math teacher circle (MTC), which provides conceptual and inquiry-based learning activities and builds professionalism among the teachers. With the support of grants from the American Institute of Mathematics (AIM), over 100 math teacher circles (MTCs) have been formed over the last decade. Each circle is a partnership among faculty members at colleges and universities along with local elementary, middle, and high school math teachers and provides a great way to collaborate with colleagues to investigate rich math problems. Regardless if you teach K-12 or future math teachers, participating in math teachers' circles provides ways to extend your love of learning math at a deeper level. In this session, several members of the newly created Southwest Chicago Math Teachers' Circle will discuss some of the activities used in their circle during their first year. We will then have the audience participate in a math teachers' circle demonstration.

This talk is appropriate for undergraduates.

Jon Johnson, Elmhurst College

Other authors: Sharon Robbert

The MAA - Programs and New Governance

The MAA has changed its Bylaws to include a new governance system with a Board of Directors and a Congress replacing the Board of Governors. Why did they do this? How does it change the MAA? We'll also share some information on the programs in the MAA.

Azar Khosravani, Columbia College Chicago

Some lesser known properties of the Fibonacci numbers

The Fibonacci numbers have been known and studied for centuries. These numbers are frequently exhibited in nature, and the Fibonacci sequence is known for its many elegant mathematical properties. In this presentation, we will look at some of the well-known properties of this sequence but will focus on properties related to the sequence’s digit distribution such as sum invariance and uniform distribution mod one.

Appropriate for undergraduates.

Nathan Krislock, Northern Illinois University

BiqCrunch: solving binary quadratic problems efficiently using semidefinite optimization

BiqCrunch is a branch-and-bound solver that uses semidefinite optimization to compute high-quality bounds to many difficult (in fact, NP-hard) combinatorial optimization problems that can be modeled as binary quadratic problems, such as MaxCut, Max-k-Cluster, Maximum-Independent-Set, the Exact Quadratic Knapsack Problem, and the Quadratic Assignment Problem. BiqCrunch does not use an interior-point method for computing its bounds. Instead, an eigenvalue solver and a quasi-Newton method are used to efficiently compute tight bounds. We will discuss our bounding procedure and give an update on the new features and performance enhancements of the latest version of BiqCrunch.

Most of my talk will be appropriate for undergraduates, especially if they have have some background in constrained optimization.

Michael McAsey, Bradley University

Other authors: Libin Mou

Tax Policy to Minimize the Gini Index

The Gini index is a simple measure of inequity in the distribution of income (or other attributes) in a society. The index is a number between 0 and 1 measuring the area in the unit square between the line y=x (perfect equity) and the Lorenz curve of the society. The Lorenz curve L(p) is the fraction of the total income that the holders of the lowest pth fraction of income possess. It is increasing and concave up. The goal is to find a tax scheme to minimize the Gini index by increasing the Lorenz curve. The re-distribution function q(x) of incomes normalized on [0,1] gives the after-tax income; it is required that q(x) satisfies q(0)=0 and for two given distinct numbers A and B with $0 < B <= A <= 1$, we want $B <= q'(x) <= A$. The optimal q is a piecewise linear function that allows lower incomes to be most preserved (q(x)=Ax for x small), higher incomes to be least preserved (i.e., q(x) has slope B for x large). The surprising result is that the optimal q(x) has only two "tax brackets" in the case that the income is considered to be a continuous random variable and has at most three brackets in the discrete case.

Appropriate for undergraduates.

Todd Oberg, Illinois College

Developing An Advanced Perspective Through Extended Problem Analysis

This talk aims to give a brief introduction to a technique called extended problem analysis for revisiting content from the secondary math curriculum but from an advanced perspective. In an extended problem analysis, a teacher candidate starts with a simple problem – typically coming from the high school mathematics curriculum – and is guided through an analysis of its solution(s) and its variant(s) to gain a deeper understanding of the problem itself, the underlying mathematics in the problem, and connections associated with that problem.

This talk is one of the two hour-long talks sponsored by the ISMAA Teacher Preparation Committee. The talk is appropriate for undergraduates, though the target audience is faculty teaching mathematics education courses.

Jim Olsen, Western Illinois University

Other authors: Mary McMahon, North Central College

The New SAT

The SAT test from the College Board underwent a number of significant changes recently (they were put into effect in spring 2016). In this session we will look at the new SAT Math test, its makeup, format, and structure. In Illinois, the State of Illinois is now paying for high school juniors to take the SAT test (previously, they paid for the ACT). As a result, more college applicants applying to Illinois colleges and universities are using SAT scores in their applications. In this session we will raise some of the math placement issues surrounding use of the new SAT scores and share ideas. We may have more questions than answers at this point, so input will be welcome.

This talk will be of interest to those teaching teacher education courses, but is also of general interest and to those who are involved with math placement.

Stacey Rodman, Augustana College

Intentional Course Design

We want our students to read, experiment, question, communicate and other behaviors critical to success in mathematics. How a class is structured can have a huge impact on what the students spend their time doing. In this talk I will share several strategies that have been successful at motivating students to put their energy into more than just getting to an answer.

Douglas Shaw, University of Northern Iowa
Improv for Professors
Crucial teaching skills include being able to listen completely, react quickly, and to make bold choices. Many teachers who have had improv instruction discover that it transforms their teaching. Applied Improvisation has come into its own in the past several years, even being cited in medical journals. This experiential session will help you learn to teach "in the moment." The fact that it will also be Fun is an unavoidable byproduct of the work, and we apologize in advance. It is led by Professor Douglas Shaw, and builds on work he has done with the Applied Improvisation Network.
PRE-REGISTRATION REQUIRED: http://www.signupgenius.com/go/10c0b48aaa82ca4fe3-workshop

Vali Siadat
Area Inside a Circle: Intuitive and Rigorous Proofs
In this presentation I conduct a short review of the proofs of the area inside a circle. These include intuitive as well as rigorous analytic proofs. This discussion is important not just from mathematical point of view but also because pedagogically the calculus books still today use circular reasoning to prove the area inside a circle (also that of an ellipse) on this important historical topic, first illustrated by Archimedes. I offer an innovative approach, through introduction of a theorem, which will lead to proving the area inside a circle avoiding circular argumentation. I also present an intuitive proof along with other theorems which prove the area of a circle analytically.

Michael Sostarecz, Monmouth College
Analysis of Chaotic Motion
A chaotic system exhibits behavior that is sensitive to its initial conditions. Using a high-speed camera, chaotic motion is observed in various experimental setups. The behavior is analyzed from the image data to visualize the strange attractor and measure the correlation dimension. The talk is suitable for undergraduates.

Mathew Timm, Bradley University
Geometric Representations of Groups
Can you draw pictures that accurately capture algebraic structures? We will show how generalized Peterson graphs can be thought of as portraits of finite abelian groups.
The talk will be accessible to undergraduates.

Wilfredo Urbina-Romero, Roosevelt University
Other authors: Cuong Pham
An introduction to Markov Chains and application to credit ratings
We will provide a soft introduction of Markov chains using the simplest model with two states. Then we will consider a non-trivial application to credit ratings.
This talk is appropriate for undergraduates.

Aaron Zerhusen, Dominican University
Holomorphic Automorphisms in one dimension, several dimensions, and infinitely many dimensions
A holomorphic automorphism is a map from a region that is 1-1 and onto, is complex differentiable at every point, and has a complex differentiable inverse. We will give an overview of how the dimension of the space dramatically affects the complexity of the group of automorphisms, and will see some new results in infinite dimensional spaces.

Ellen Ziliak, Benedictine University
Other authors: Catherine Buell, Jennifer Schaefer, Aloysius Helminck, Vicky Klima, Carmen Wright
Orbit Decompositions of SL2(Fq)
Symmetric k-varieties are a generalization of real reductive symmetric spaces to general fields. The real reductive symmetric spaces, are the homogeneous spaces GR/HR, where GR is a reductive Lie group and HR is the fixed point group of an involution of GR. They play an important role in many areas, including Lie theory, number theory, differential geometry, harmonic analysis and physics. Orbit decompositions play a fundamental role in the study of symmetric k-varieties and their applications. In this talk I will discuss recent results on the classification of the orbit decompositions for SL2(Fq) and how this relates to our classification of the generalized symmetric spaces for SLn(Fq). While the theory is beyond what is typically covered in undergraduate courses, this problem has been worked on by a number of my undergraduate students, and most of the results come from theory that is developed in an undergraduate Linear Algebra course. This talk will be accessible to undergraduate students who have seen Linear Algebra.