42nd Annual Meeting

Suncoast Region

Florida Section

Mathematical Association of America

Eckerd College

December 1, 2017

Program:

3:30pm – 4:00pm

BES 115 **Surveying for Math Teachers**

Alex Ambrioso - HCC, Katie Britt - UF

BES 116 **Mathematical Underpinnings of Bitcoin**

Anthony Cicanese, Richard Kelso, Joseph Little, Bryan Reagan -Saint Leo

BES 123 **Sharing the Code**

Brian Camp – Saint Leo

BES 124 **An Investigation of Learner-Generated Drawings in Linear Algebra Course**

Deniz Kardes Birinci, Mile Krajcevski - USF

ES 100 **The Unreasonable Popularity of Mathematics**

Greg McColm - USF

4:15pm – 4:45pm

BES 115 **Double-Occurrence Words and Word Graphs**

Brad Mostowski - USF

BES 116 **Tools for Modeling Financial Markets**

Ted Andresen – Honeywell Aerospace (ret)

BES 123 **Completing the Major: Oral Exams, Written Exams, or a Research Project?**

Jacci White, Monika Kiss, Kevin Murphy – Saint Leo

BES 124 **Topological Methods for Gene Correlation Analysis of RNA-seq Data Sets**

Kyle Houfek - USF

ES 100 **A Tour into Many-Valued Logic**

Daviel Leyva - USF

5:00pm – 5:30pm

BES 115 **Latent Storm Factors and their Indicators**

Joy D'Andrea - USFSM

BES 116 **Using MyMathLab for Online Remedial Math Course**

Bariaa Shatila - Flagler

BES 123 **Grades**

Rebecca Wooten, Dan Jelsovsky, Roxanne Back – Florida Southern

BES 124 **Flirtations between Knots and Primes: What is Arithmetic Topology?**

Matthew Cuffaro - USF

ES 100 **Log-concavity of Combinatorial Sequences**

Li Zhou – Polk State

5:40pm – 6:30pm

ES 100 **Invited Address**

Structural Aspects of Linguistic Theories: Embedding Grammars in Permutohedra

Nazarré Merchant - Eckerd

Linguists study mental grammars, functions from the subconcious representation of words to pronounced forms. Collections of grammars, as functions, exhibit patterns that represent linguistically interesting generalizations. Surprisingly, these grammars can be embedded in a permutohedron (permutoèdre), an (n-1)-dimensional polytope whose vertices are permutations of n objects. These grammars then can be viewed as connected regions of a permutohedron and linguistic generalizations can be interpreted geometrically.

General background

Prince, A. 2016. What is OT? ROA-1271, http://roa.rutgers.edu/article/view/1513.

References

Merchant, N. and A. Prince. 2016. The Mother of all Tableaux. ROA-1285, http://roa.rutgers.edu/article/view/1548.

Merchant, N. and J. Riggle. 2015. Erc Sets and Antimatroids. ROA-1158, http://roa.rutgers.edu/article/view/1226.

Guilbaud, G. Th. and Rosenstiehl, P. 1963. "*Analyse algébrique d'un scrutin*", Mathématiques et sciences humaines, 4: 9–33.

6:30pm – 8:30pm Conference Banquet – James Center

Abstracts

3:30pm – 4:00pm

Surveying for Math Teachers

Alex Ambrioso - HCC, Katie Britt - UF

In an effort to engage students in trigonometry by using real word problems I invited Katie Britt, UF Geomatics Program Specialist, to demonstrate modern surveying equipment, the Leica TRC 405 Total Station, to my trigonometry class. We took the students outside to gather distances, angles, and 3D points associated with buildings on my campus. Then we returned to the classroom to calculate distances and angles. We will present information on the equipment, the UF Geomatics program, and provide the audience with a list of problems that they can use in their own classes. Our presentation is intended for teachers of courses involving trigonometry, vectors, or conic sections.

Mathematical Underpinnings of Bitcoin

Anthony J. Cicanese, M.S. Richard S. Kelso, Ph.D., Joseph A. Little, J.D. Bryan B. Reagan, Ph.D. - Saint Leo

The mechanics of Bitcoin rely on some non-trivial mathematics. Each user has an account called a "wallet" which has an associated balance stored in a public ledger called the blockchain, which allows the user to remain anonymous. The blockchain is a decentralized, distributed database which acts as a ledger and tracks the chain of ownership each individual fraction of a bitcoin all the way back to the bitcoin's original creation. The use of public key cryptography allows third parties to confirm the wallet of each transaction's initiator, providing a form of non-repudiation. In order to process transactions, a process called Mining involves searching for values, which combined with transaction data, force a one-way hash function to produce output with certain mathematical characteristics. Since only a finite number of BitCoin numbers exit, this sets an absolute limit on the circulation. This poses some interesting economic, legal, and reputational risks for individuals using this technology.

Sharing the Code

Brian Camp – Saint Leo

Come see some coding in mathematics on the web! Specifically, we will look at some examples of code on the web for classes such as Calculus, Discrete Mathematics, and Probability. Different web site features will be explored including how to share the code easily with others.

An Investigation of Learner-Generated Drawings in Linear Algebra Course

Deniz Kardes Birinci, Mile Krajcevski - USF

In this presentation, we use so called *theory of abstraction* developed by Hershkowitz, Schwarz and Dreyfus, to analyze how undergraduate linear algebra students generate mathematical drawings. The theoretical model we use consists of three dynamically nested epistemic actions: constructing, recognizing, and building-with. The data of our qualitative research study was collected using a think aloud protocol on questions with a rich visual content. Our findings indicate that linear algebra students experienced difficulty in the actions of building-with and constructing new visual structures, although they were good at recognizing and interpreting mathematical drawings in a linear algebra context.

The Unreasonable Popularity of Mathematics

Greg McColm - USF

Mathematics is notoriously difficult, so much so that making mathematics accessible is a major desideratum of STEM pedagogy. Students struggling with mathematics are often motivated with pep talks about its utility - and its necessity. And yet, the ubiquity of highly regular patterns in art, the endurance of games based on patterns, the use of geometry and numerology by scientists, gnostics, alchemists, charlatans, and amateur enthusiasts - even by people who find it difficult - suggest that mathematics is attractive and / or credible to many people. We consider mathematical activity from an anthropological perspective, and what it means to bring mathematics to the people.

4:15pm – 4:45pm

Double-Occurrence Words and Word Graphs

Brad Mostowski - USF

Double-occurrence words (DOWs) are words where each symbol in the word appears twice. DOWs can be operated on by insertions and deletions of repeat (ww) and return (ww^R) patterns, in which case another DOW is formed. A word graph is a graph where the vertices are DOWs and the edges represent repeat or return pattern insertions. In this talk, we give several results showing how DOWs are related by pattern insertions and deletions. Then, we apply the results towards characterizing word graph structure. These findings can be applied to DNA rearrangement processes in ciliates.

Tools for Modeling Financial Markets

Ted Andresen - Honeywell Aerospace (ret)

This presentation will focus on downloading historical data and using Excel to view and analyze it. We will examine available tools, such as, the Rule of 72, long-term growth, the difference between volatility (VIX) and the standard deviation (SD), using open-close versus min-max sigma's and using moving averages versus Linear Least Squares fits. In addition we will examine correlations between European markets (DAX, FTSE 100, CAC 40) and the S&P 500 (SPY). Finally, I will show you how to create and run your own models. Attendees can obtain a copy of the Excel file from the presentation via thumb drives or email.

Completing the Major: Oral Exams, Written Exams, or a Research Project?

Jacci White, Monika Kiss, Kevin Murphy – Saint Leo

Capstone experiences can vary from research, service, or artistic projects, to oral or written exams. We will focus on advantages and disadvantages of written exams, oral exams, and projects. In addition, we will share a basic process for a senior capstone project, and assessment rubrics for exams.

Topological Methods for Gene Correlation Analysis of RNA-seq Data Sets

Kyle Houfek - USF

RNA-seq data provides gene expression rates at different time points of the cell processes. To each gene we associate a multi-dimensional vector, with an expression rate at a time point corresponding to a coordinate of the vector. Then a correlation between certain genes can be expressed by the distance between each pair of these vectors. We propose using topological methods with persistence homology to find clusters of genes which are correlated. These methods are applied to RNA-seq data for certain species of ciliates using three different distance functions for the vectors.

A Tour into Many-Valued Logic

Daviel Leyva – USF

Some would claim that all we do, as mathematicians, rests on the somewhat firm foundation that logic (and set theory) provides. For over 2000 years the prescription passed down to us via Aristotle, the founder of formal logic, has reigned as the supreme law of the land; however, like most human prescriptions, it is not absolute and has its own limitations. In this talk, I would like to motivate the need for an expansion of classical logic to many-valued logical systems – in particular, those of C.S. Peirce, J. Łukasiewicz, D.A. Bochvar, and S.C. Kleene – as well as their dependence on interpretation and how they compare with classical logic.

5:00pm – 5:30pm

Latent Storm Factors and their Indicators

Joy D'Andrea - USFSM

The concept of exploratory factor analysis (EFA) was used in this study to determine the latent storm factors of hurricanes in the Atlantic Basin (1992-2014), that explain variance and measure the correlation that exist between their respective storm indicators. In this study, the latent variables are the meteorological measures such as the month, the location of a storm, wind speed

and pressure. There were two levels of the EFA process where the factors and their factor indicators were measured. In this talk, we present the findings of this study and show the valuable model(s) that arose from the process.

Using MyMathLab for Online Remedial Math Course

Bariaa Shatila - Flagler

Previous studies have shown that MyMathLab is a valuable online learning tool for college students. As part of the college curriculum, students are required to take math courses. However, some students need to take remedial math courses before they can take their college math courses. This study will show why the majority of the students who took Intermediate Algebra online using MyMathLab were well prepared when they took College Algebra in the following semester.

Grades

Rebecca Wooten, Dan Jelsovsky, and Roxanne Back - Florida Southern

We all assign grades: grades on assignments, grades on tests, grades in courses. But what are they really measuring? If a student's course grade is a 96%, what does it mean? Of what does the student have 96%? We will address these questions and the philosophy of grades in this presentation.

Flirtations between Knots and Primes: What is Arithmetic Topology?

Matthew Cuffaro - USF

This talk introduces the hotly-developing rapport between arithmetic and knot theory, and aims to communicate the underpinning concept of the *Galois correspondence*, a relationship between fundamental groups and symmetry on coverings.

Log-concavity of Combinatorial Sequences

Li Zhou – Polk State

Abstract: A sequence of real numbers (a_i) is log-concave if $a_i^2 \geq a_{i-1}a_{i+1}$ for all i. Log-concave sequences occur throughout combinatorics, algebraic geometry, and convex geometry. In this talk, we present a solution to a recent MONTHLY problem proposed by Donald Knuth: For fixed $s \leq t$, prove that the sequence $a_n = \binom{n}{s} + \cdots + \binom{n}{t}$ is log-concave for $n \geq 1$. We also talk about the recent solution of the long-standing Rota Conjecture: The coefficients of the chromatic polynomial for any graph are log- concave. This talk is accessible to pre-calculus students.

Titles at a Glance

	BES 115	BES 116	BES 123	BES 124	ES 100
3:30 – 4:00	Surveying for Math Teachers	Mathematical Underpinnings of Bitcoin	Sharing the Code	An Investigation of Learner-Generated Drawings in Linear Algebra	The Unreasonable Popularity of Mathematics
4:15 – 4:45	Double-Occurrence Words and Word Graphs	Tools for Modeling Financial Markets	Completing the Major: Oral Exams, Written Exams, or a Research Project?	Topological Methods for Gene Correlation Analysis of RNA-seq Data Sets	A Tour of Many-Valued Logic
5:00 – 5:30	Latent Storm Factors and their Indicators	Using MyMathLab for Online Remedial Math Course	Grades	Flirtations between Knots and Primes: What is Arithmetic Topology?	Log-concavity of Combinatorial Sequences

5:40 – 6:30	Invited Address - Structural Aspects of Linguistic Theories: Embedding Grammars in Permutohedra – ES 100

BES 115	BES 116	BES 123
		BES 124

Registration and MAA Book Sales	ES 100