ABSTRACTS OF TALKS PRESENTED TO THE INDIANA SECTION OF THE MAA

1. INTRODUCTION

The Spring 2013 meeting of the Indiana Section of the Mathematical Association of America is at Indiana University East, March 22–23. The abstracts appearing here are based on text electronically submitted by the presenters. Contributed talks are listed in alphabetical order by presenter.

2. INVITED TALKS

Presenter: Aparna Higgins, University of Dayton
Project NExT — a professional development program of the MAA for new faculty

Project NExT is a year-long professional development program that is designed for new or recent Ph.D.s in the mathematical sciences. It addresses the full range of faculty responsibilities in teaching, research, and service. Although many of the sessions focus on the teaching and learning of undergraduate mathematics, others address the concerns of new faculty about balancing the many demands on them for teaching, maintaining scholarly activity, and giving service to the department, the institution, and the profession as a whole. The academic community asks quite a lot of our new colleagues, and Project NExT provides a supportive community for them as they launch their careers.

Presenter: Aparna Higgins
Sequences of polygons

At a mathematics meeting several years ago, two students who attended different schools and who did not know each other presented talks that were variations of the same problem. The student from the University of Dayton spoke of the result of alternately inscribing regular polygons and circles, while the other spoke of the result of alternately circumscribing regular polygons and circles. Recently, I heard a talk on other variants of this theme, and I found myself still intrigued by the questions. I am delighted when I see problems that are simple to state, yet have an element of surprise. I will use GeoGebra to help us explore some of these problems.

Presenter: Ivars Peterson, MAA Director of Publications and Communications
The Jungles of Randomness

From slot machines and amusement park rides to dice games and shuffled cards, chance and chaos pervade everyday life. Sorting through the various meanings of randomness and distinguishing between what we can and cannot know with certainty proves to be no simple matter. Inside information on how slot machines work, the perils of believing random number generators, and the questionable fairness of dice, tossed coins, and shuffled cards illustrate how tricky randomness can be.

Presenter: Ivars Peterson

Workshop: *Writing mathematics well*

The importance of communicating mathematics clearly and effectively is evident in the many ways in which mathematicians must write, whether to produce technical reports, expository articles, book reviews, essays, referee's reports, grant proposals, research papers, evaluations, or slides for oral presentations. With a focus on exposition, this workshop offers tips for improving writing skills, from grammar and usage to organization and manuscript or slide preparation. It also suggests how participants can contribute to the public understanding of mathematics.

3. INDIANA PROJECT NExT PANEL DISCUSSION

Panelists: Daniel Curtin, Northern Kentucky University; Colin McKinney, Wabash College; Jeff Oaks, University of Indianapolis; Danny Otero, Xavier University

Incorporating history across the math curriculum

We will discuss the history of mathematics within the context of incorporating historical content into a broad range of mathematics courses. The panelists are all active researchers in the history of mathematics, and teach within mathematics departments. Panelists will give brief introductions of their experiences, followed by an extended time of Q&A with the audience. The panel is open to all meeting participants.

4. STUDENT WORKSHOP

Presenter: Kristin Farwell, Grace College

Analysis of Games

Farkle is a dice-rolling, "press your luck" game involving six dice. A player may keep as many scoring dice as desired and re-roll all remaining dice. Scoring dice must be rolled and kept on each roll of the dice in order to not "farkle" on that turn and yield zero points. A player may stop rolling and collect points whenever is thought best to avoid "farkling." We are going to challenge the students to find the optimal strategy for playing Farkle by calculating the probabilities analytically.

5. CONTRIBUTED TALKS

Presenter: Paul Drube, Valparaiso University

Inverted classroom for multivariable calculus

The inverted classroom is a non-traditional course structure in which students are given "lecture notes" in advance so that they can complete Class Preparation Assignments (CPAs) before they come to class, freeing up actual class time for collaborative work and higher level conceptual learning. This semester, I have been implementing the inverted classroom structure for both of Valparaiso University's Calculus III sections. In this talk, I'll introduce the basic structure of my course, address the benefits and challenges of the inverted classroom technique, and share the results of recent student surveys.

Presenter: Ian Line, Grace College undergraduate student
Faculty Advisor: Kristin Farwell, Grace College
Risk averse Risk

In the board game Risk, ever wonder what your attack strategy should be in order to have a 90% confidence of success? Ever wonder how much is too much when attacking a country with 4 defenders? Ever needed to know when retreating was inevitable? This exhibit uses game theory and probabilities to study the Hasbro game Risk to find the success percent of certain situations, when withdrawing is most wise, and the expected values of remaining troops after a battle. This study has looked into a different version of Risk, causing different probabilities and possibly causing different strategy philosophies.

Presenter: Xuan Ma, Pi Math Center
How to get kids excited about math?

These days, much attention from educators, parents, and politicians has been focused on how to raise the students' test scores in mathematics. However, research on how to foster the students' positive attitude towards math remains quite lacking. This presentation traces a math enrichment program for middle schoolers during its two years of operation. Initially supported by the Mathematical Sciences Research Institute, the Math Circle of Indianapolis aims at getting the students excited about mathematics. By demonstrating examples of hands-on activities, mathematical games, and logical puzzles, this talk will showcase the students' ability to grasp abstract concepts, and their creativity in solving problems and even forming conjectures.

Presenter: Markus Pomper, Indiana University East
MSC 2010: 97D40
True or False? Teaching proofs in an online class

Online courses have become the medium of choice for students who cannot otherwise attend in a traditional classroom setting. Online distance education allows students to take courses in the convenience of their home or office, at their leisure, free of the distractions of campus life, without commute, while at the same time being provided with almost instantaneous access to the instructor and an abundance of online resources.

A critical observer would rightfully suspect that the lack of face-to-face interaction in an online class can be a significant detriment to learning. In this presentation we will discuss how online collaboration in discussion forums and wikis can be used to teach undergraduate students how to create proofs, and how to evaluate proofs critically.

We will describe the structure and design of several online upper-division Mathematics courses: Bridge to Abstract Math, Real Analysis, Modern Algebra, and Topology. The focus of the presentation will be how to create a sense of community, in which students learn how to evaluate the validity of a statement, provide a proof or a counterexample, or find the flaw in a sequence of statements that pretend to prove a theorem.

Presenter: Andy Rich, Manchester University

Volumes of higher dimensional balls and spheres

To find the volumes of higher dimensional balls and spheres, we find two recurrence relations which allow us to climb the dimension ladder in steps of two. We obtain two sequences depending on the parity of the dimension. The final results are expressed succinctly using τ and double factorials.

Presenters: Neil Sabine and Markus Pomper, Indiana University East

MSC 2010: 97B40

A math degree online — The administrative perspective

The presentation will showcase how Indiana University East has successfully implemented an online degree completion program in Mathematics. Our discussion will focus on the administrative aspects of the program, including the design of the program, scheduling, faculty workload considerations, recruitment of students, advising and retention.

Presenter: Morteza Seddighin, Indiana University East

Matrix forms of the Greub-Reinboldt Inequality

The classic Greub-Reinboldt inequality states: let $x = (x_1, x_2, \ldots, x_n)$ and $y = (y_1, y_2, \ldots, y_n)$ be two real n-tuples, and suppose that m_1, M_1, m_2, M_2 are constants such that $m_1 \leq x_i \leq M_1$ and $m_2 \leq y_i \leq M_2$; then for $w_i > 0$ we have

$$\left(\sum_{i=1}^{n} w_i x_i^2\right)\left(\sum_{i=1}^{n} w_i y_i^2\right) \leq \frac{(M_1 M_2 + m_1 m_2)^2}{4 m_1 m_2 M_1 M_2} \leq \left(\sum_{i=1}^{n} w_i x_i y_i\right)^2.$$

We will discuss extensions of this inequality to matrices.

Presenter: Caroline Shapcott, Indiana University South Bend

New bijections from n-color compositions

A composition of ν is a sequence of positive integers that sum to ν. Combinatorial bijections are given from n-color compositions of ν, for which a part of size n can take on n colors, to compositions of $2\nu - 1$ having only parts of size 1 or 2, compositions of 2ν having only odd parts, and compositions of $2\nu + 1$ having no parts of size 1. These bijections are revealing in and of themselves; however, they also reveal a sought-after bijection between compositions of ν into parts congruent to $a \pmod b$ and compositions of $\nu + b - a$ into parts congruent to $b \pmod a$ with each part greater than $b - a$.

Presenter: Derek Thompson, Indiana University - Purdue University Indianapolis graduate student, and Instructor at Trine University

Calculus and video games

Video games are now a huge part of American culture, and are ripe with examples for calculus. In this talk, I will describe video game projects for Calculus I students involving tangent lines, linear approximation, optimization problems, and related rates. I will focus on the iOS capabilities of the iPad and iPhone and how to use them with PC/Mac software packages Reflector and Geogebra to create your own examples for your students. My examples include modern games like Angry Birds as well as classics such as Final Fantasy.

Presenter: James Valles, Jr., Saint Mary-of-the-Woods College
MSC 2010: 97D99
A partial understanding of fractions among pre-service teachers
This talk will discuss data collected from a writing assignment given to pre-service teachers in a math content course. The students were asked to examine the expression $12 \div \frac{3}{4}$ algebraically, to create a verbal representation of the expression, and to develop a physical model of the expression using manipulatives.

Presenter: Michael Xue, Vroom Laboratory for Advanced Computing
Solving maximization/minimization problems by elementary means
This presentation illustrates a systematic approach in which maximization/minimization problems can be solved without calculus. First, we will demonstrate how problems can be cast in certain forms so that the extreme values can be obtained immediately. Next, we will apply AM-GM inequality and its corollaries to solve problems that appear to be solvable only by calculus. The non-calculus approach makes a range of very interesting problems available to a wider audience, and at a much earlier stage of their studies in mathematics and other sciences.

Presenter: Young Hwan You, Indiana University East
Course design and technologies for online upper level math classes
With the rapid development of internet and computer-related technologies, the educational area has broadened to a cyber-world beyond the traditional classrooms. With this fast technological development, teaching online has played a very important role in educating non-traditional students as well as traditional students. Teaching online is greatly different from teaching a face-to-face class. Online teaching requires different communication, tools, techniques, and assessment. In this talk, I would like to present the experience of teaching upper level math classes online. First, I will share the course design for online upper level classes such as Differential Equations or Mathematical Modeling. Second, I will introduce the use of technologies such as "Adobe Connect" and Indiana University's course management system "Oncourse" in support of these classes. Furthermore, I will explain how these tools were used to facilitate "Student to Student" and "Instructor to Student" communication. In particular, I will show how "Individual Discussion Forum" and "Group Discussion Forum" can create a productive learning environment. I will talk about how collaborative assignments, such as group projects, can be assessed.