Abstracts for MAA Seaway Meeting Alfred University

George Hart, Stony Brook University (Friday Banquet)



Title: Math is Cool!

Abstract:

Geometric sculptures, mathematical puzzles, insightful videos, hands-on workshop activities, and the Museum of Mathematics in NYC are all means to demonstrate that math is a living, creative, joyful subject—i.e., that Math is Cool! Hart will present and discuss a variety of these works from his creative output, and show you some giant mathematical artworks, 3D printed mathematical models, and original workshop projects. For examples of his work, see http://georgehart.com.

Biography:

George Hart is an applied mathematician and sculptor who demonstrates how mathematics is cool and creative in ways you might not have expected. Whether he is slicing a bagel into two linked halves or leading hundreds of participants in an intricate geometric sculpture barn raising, he always finds original ways to share the beauty of mathematical thinking. An interdepartmental research professor at Stony Brook University, he holds a B.S. in Mathematics and a Ph.D. in Electrical Engineering and Computer Science from MIT. Hart is an organizer of the annual Bridges Conference on mathematics and art and the editor for sculpture for the Journal of Mathematics and the Arts.

His research explores innovative ways to use computer technology in the design and fabrication of his artwork, which has been exhibited widely around the world. Hart co-founded the Museum of Mathematics in New York City and developed its initial set of hands-on exhibits. He also makes videos that show the fun and creative sides of mathematics. See http://georgehart.com for examples of his work.

Joel Foisy, SUNY Potsdam



Title: A Survey of Intrinsically Linked and Intrinsically Knotted Graphs

Abstract:

Take 6 points in space, and connect every possible pair of points by non-intersecting arcs. In the 1980s, Conway-Gordon and Sachs proved that no matter how the points are connected, two non-splittably linked loops will form. We say that the complete graph on six vertices is *intrinsically linked*. Conway and Gordon also proved that the complete graph on seven vertices is *intrinsically knotted*. Mathematicians have since attempted to classify all intrinsically linked and intrinsically knotted graphs. In the 1990s, Robertson, Seymour and Thomas classified the complete set of "minor-minimal" intrinsically linked graphs. Their proof is difficult, and intrinsically knotted graphs have been even more difficult to classify.

In this talk, we will survey some known results and open questions about intrinsically linked and intrinsically knotted graphs. There will be a lot of pictures.

Biography:

Joel Foisy was introduced to mathematics research while a student at Williams College, participating in the SMALL Geometry group under Frank Morgan. He went on to obtain his doctorate in mathematics in 1996, studying geometric topology at Duke University under John Harer. Since 1996, he has been teaching at SUNY Potsdam. For 16 summers, he has had the privilege of working with students in a summer REU program, held jointly by SUNY Potsdam and Clarkson University. Most of those summers have been spent studying intrinsically linked and knotted graphs.

Mark McKinzie, St. John Fisher College



Title: Euler and a modern evaluation of $1 + \frac{1}{4} + \frac{1}{9} + \cdots$

Abstract:

The story of Euler's original evaluation of $\zeta(2) = 1 + \frac{1}{4} + \frac{1}{9} + \cdots$ and subsequent rederivations is well known. Each derivation shows the familiar Euler genius for creative manipulation of series. In the modern classroom, it is tempting to attempt an evaluation of the series by more mundane means, by manipulating the power series $f(z) = \sum \frac{z^k}{k^2}$. One progresses without difficulty to find that $\zeta(2) = \int_0^1 -\frac{\ln(1-t)}{t} dt$. Evaluating this integral presents an obstacle, but success is possible if one is aware of some properties of the dilogarithm function $Li_2(z) = \int_0^z -\frac{\ln(1-t)}{t} dt$. Following this path, we will obtain another derivation of the value of the series. So far as I know, the earliest appearance in print of this particular method for evaluating the series is from c. 1980.

Curiously, the necessary properties of the dilogarithm were first discovered by Euler himself. His initial work on the dilog function predates his evaluation of $\sum 1/n^2$, appearing in a 1730 paper where he estimates the value of the series to six decimal places. The critical identity for this new derivation was published by Euler in a 1779 paper. In that paper, Euler might easily have then evaluated $\zeta(2)$, but instead he takes its value to be a well-known result. Did Euler realize that his methods provided yet another way to compute $\sum 1/n^2$? Could he have failed to notice? (This talk is based on joint work with Dan Kalman at American University.)

Biography:

Mark McKinzie earned his Ph.D. in mathematics from the University of Wisconsin in 2000. His dissertation, on the early history of power series, kindled a fascination with the mathematical work of Edmond Halley and Leonhard Euler, and the history of mathematics more generally. He was an Instructor in the Mathematics Department at Monroe Community College from 1999 to 2004, and is currently an Associate Professor at St. John Fisher College in the Department of Mathematical and Computing Sciences. Mark co-authored two papers which were recognized by the MAA with writing awards, the Carl B. Allendoerfer Award (2002), and the Paul R. Halmos - Lester R. Ford Award (2013).

Carol Schumacher, Kenyon College (Randolph Lecture)



Title: What is the Definition of Definition? and Other Mathematical Cultural Conundrums

Abstract:

Helping our students think like mathematicians should be at the center of every class we teach. The particular topic will affect which parts of thinking mathematically we might address, but the goal of every math class should be to turn out students who can bring mathematical reasoning to bear in the context of the material taught in the course. In order to help our students think like mathematicians, we teachers must think deeply about what is going on in our students' heads. But this also takes an unusual amount of self-reflection. We need to understand how we think about things. Unfortunately, thinking mathematically is often something that comes naturally to people who eventually go on to get Ph.D.'s in mathematics. Thus we have no idea how we learned to think this way, and we are often not even aware of how much is really going on in our own heads when we attack a mathematical question. I can attest to the fact that this was certainly true of me. As I have become more self-aware, I believe my teaching has improved tremendously. In addition to trying to illustrate some of the insights acquired over many years, the talk will be filled with illustrative examples of activities that can be used in different courses to help students engage the mathematical ideas of the course as mathematicians do every day.

Biography:

Carol Schumacher is Professor of Mathematics at Kenyon College in Gambier, OH. She received a BA in Mathematics from Hendrix College in 1982 and a Ph.D. in Mathematics from The University of Texas at Austin in 1989. She joined the Kenyon faculty in the fall of 1988. Carol loves teaching and is the winner of Kenyon's Trustee Teaching Award. She is very interested in inquiry-based learning (IBL) and is the author of two texts written to support an inquiry-based approach: Chapter Zero—Fundamental Notions of Abstract Mathematics, 2E and Closer and Closer—Introducing Real Analysis. Carol just completed her third term as chair of the mathematics department at Kenyon and is one of a team of MAA members working on the 2015 CUPM Curriculum Guide to Majors in the Mathematical Sciences.

Saturday Afternoon Special Sessions

Inquiry-Based Learning Contributed Talk Session

Contact and moderator: Patrick Rault, SUNY Geneseo; rault@geneseo.edu

1:30-1:42 **Phong Le**, Niagara University *A Beginners guide to IBL from a Beginner*

I learned about IBL many years ago from friends and colleagues. I had witnessed the impressive levels of independence and curiosity that it can foster. Yet it took me many years to finally take the plunge. In this talk I'll describe my fears, hesitations and the reality of teaching IBL for the first time. Special focus will be paid to the challenges of transitioning from a lecture style class to a more student-centered approach.

1:45-1:57 Xiao Xiao, Utica College

IBL in Upper-Level Courses

In this talk, I will share my amateur experiences of using IBL in two courses: Introduction to Proof and Introduction to Abstract Algebra. These will include but not limited to, writing my own notes, color felt-tip pens, presentation management, electronic feedback and weekly journals.

2-2:25pm Jonathan Cox, State University of New York at Fredonia Two different approaches to rapid implementation of IBL

Although my first "official" IBL course will be in Spring 2015, I am incorporating IBL activities and philosophy to the greatest extent possible in this semester's Calculus I and History of Mathematics courses. I will briefly present the arguments that compelled me to implement inquiry-based learning immediately. Then I will describe how I am employing IBL in each course. While there are similar themes in the implementations, there are also significant differences, particularly in the time and effort involved in the conversion. I will also share some of the struggles I am facing in adapting to this new way of teaching.

2:30-2:55 Likin C. Simon Romero, Alfred University Active learning in a large Multivariable Calculus class

During the last academic year, I used a flipped classroom model in my Multivariable Calculus classes. The classes were about 40 students each and focused on non-Mathematics majors. The class activities were based on the ones used by Ron Taylor in Berry College. The class was part of the Learning Assistant Program. Two learning assistants were assigned to the class to act as facilitators. In this talk, we will discuss our experiences as well as the benefits of the use of learning assistants.

3-3:25 Nicole Juersivich, Nazareth College Teaching Calculus I Using a Modified Moore Method

For the first time, I am using a modified Moore method to teach Calculus I to 35 mixed majors. My main goals are for students to develop a solution and supporting argument, communicate that solution and argument orally and in writing, and to defend or adjust their argument as necessary. Therefore, the majority of our class time is spent on student presentations. In this session, I will present the materials I used, our class structure, the assignments and evaluation procedures, preparation, pitfalls, successes, and student comments.

3:30-4 **Padraig McLoughlin**, Kutztown University of Pennsylvania Gaining More From the Moore Method

R.L. Moore, H. S. Wall, and H.J. Ettlinger established a center of learning based on the philosophy of education we now call "the Moore Method." I studied (at Emory University, Auburn University, and Georgia State University) under mathematicians who were students of the three and employed the method. The method was so instrumental in my intellectual development that I found myself naturally tending to teach using a modified Moore method and opining such is most helpful in guiding students' intellectual development.

In this talk we shall discuss the Moore pedagogy, how we adapted it for use in freshman-level through graduate-level courses (with special attention being paid to Probability and Statistics). We will discuss some successes, failure, trials, and tribulations. We will highlight some of the differences between the Moore Method and our modified Moore method, and moreover compare and contrast other forms of Inquiry-Based Learning (IBL) to our modified Moore method. Finally we will accent how and why I opine this method helps students intellectually stretch, mature, and prosper. Upstate New York Inquiry Based Learning (UNYIBL) Consortium

Seaway NExT Discussion

Teaching Statistics

1:30-2:25 Hosted by Matt Koetz, Nazareth College

Workshop on Leadership in the Mathematical Sciences

Faculty Recruitment

Faculty workload: teaching, scholarship and service

2:30-3:25 Organized by Mihail Barbosu, RIT

Saturday afternoon Contributed talks

1. Joseph Brennen, Binghamton University

Flipped Calculus at Binghamton SUNY

At Binghamton, Calculus 1 is taught to over 1,000 students each fall in sections of about 30-40 students, with graduate student instructors teaching most sections. Though fortunate to be in small classrooms rather than lecture halls, the satisfaction and performance of students in this course has often been poor. We had hoped to improve student success by changing how we teach and not by lowering our standards. In the fall of 2013 the Binghamton University Department of Mathematical Sciences undertook an experiment in flipped teaching with Calculus 1 in which we compared a flipped model to our traditional lecture model. Overall, our quantitative analysis found moderate benefits to flipping over traditional methods for all groups studied. In fall 2014, all sections of Calculus 1 at Binghamton will run under the flipped model. This is joint work with Laura Anderson.

2. Joaquin Carbonara, and Dave Ettestad, Buffalo State

How a Mancala like game (the Cups and Stones problem) can be described as a discrete version of the fractal called Sierpinski triangle

In 1992 Barry Cipra posed the Cups and Stones problem that consists of setting up a circular arrangement of cups with one stone in each, and then moving the stones based on a transition rule. The original question posed was to find the number of configurations for any given number of cups. In the process of answering that question, the authors discovered a surprising link between this counting problem and the fractal called Sierpinski triangle. This presentation will outline the techniques used and results obtained in solving the Cups and Stones problem.

3. Nikolai A. Krylov, Siena College

A congruence property of irreducible Laguerre polynomials in two variables

In this talk we present a version of irreducible Laguerre polynomials in two variables and show that these polynomials satisfy a congruence property, which is similar to the one obtained by Carlitz for the classical Laguerre polynomials in one variable.

4. Jonathan Lopez, Niagara University

An Introduction to Lie Algebras Using 2×2 Matrices

A Lie algebra is a vector space over a field that is equipped with a special "bracket" operation. We describe some of the basic properties that Lie algebras must satisfy, and present several examples involving 2×2 matrices. These techniques can be generalized to higher dimensions, and the resulting Lie algebras can be used to obtain topological information about the underlying group.

5. Carl Lutzer, RIT

A constructivist's approach to introducing the Laplace Transform in a first course in differential equations

Among all topics in the lower-division mathematics curriculum, the Laplace Transform is one of the most difficult to motivate conceptually, and to explain in a way that students find meaningful. This talk focusses on a way of introducing the transform as proceeding naturally from simple ideas about probability. By using this presentation, students find the Laplace transform meaningful rather than magical (in our experience), and accept it as a reasonable tool that is within their intellectual grasp. In brief, Riemann sums are used to approximate the expected net change in a function, assuming that it quantifies a process that can terminate at random. We assume only a basic understanding of probability.

6. James Marengo, RIT

Another Look at the Sums of Euler

In this talk, I will evaluate an integral that provides a rigorous argument behind the evaluation of Zeta(2) after explaining Euler's approach for this series. I will also talk about how Euler evaluated Zeta(2n) for other small values of n. This talk will be accessible to undergraduate math students.

7. Peter Mercer, Buffalo State College

Cauchy's Mean Value Theorem Meets the Logarithmic Mean.

We show how several results involving the Arithmetic, Geometric, and Logarithmic Means can be obtained in a simple and unified way, using Cauchy's Mean Value Theorem.

8. Olympia Nicodemi, SUNY Geneseo

A Non-Historian's Fun with Leibniz

When reading Leibniz for the first time this summer, I realized how much it was like learning Calculus for the first time. I faced the same hurdles as our students. I would like to share the experience with other non-historians. Historians are welcome to come and set my story straight.

9. John Peter, Utica College

Spaces with Two Basepoints

The suspension of a topological space is an important construction in homotopy theory. We will address the extent to which a given topological space is equivalent to the unreduced suspension of another topological space. The unreduced suspension of a space comes naturally equipped with two basepoints (the "north and south poles") and, in nice enough cases, is equivalent to the reduced suspension of the same space (which has a single basepoint). We will show, however, that under certain conditions, forming the reduced suspension is not always necessary. This provides a solution to what we call the "Unreduced Desuspension Problem".

10. Gabriel Prajitura, SUNY Brockport

The Sendov Conjecture

The Sendov Conjecture is based on Gauss - Lucas Theorem which, in turn, is a complex variable form of Rolle's Theorem from real analysis. Rolle's Theorem and Gauss - Lucas theorem discuss the position of the zeros of the derivative with respect to the zeros of the function. The Sendov Conjecture is about how far the zeros of the derivative of a polynomial can be from the zeros of the polynomial. After no progress in the last 15 years interesting new developments came this year.

11. Ruhan Zhao, SUNY Brockport

Korenblum's Maximum Principle for the Bloch space

Let $D = \{z \in C : |z| < 1\}$ be the unit disk in the complex plane. For an analytic function f on D, we say that f is in the Bloch space B, if $\sup_{z \in D} |f'(z)| (1 - |z|^2) < \infty$. It is well-known that B is a Banach space with the norm $||f||_B = |f(0)| + \sup_{z \in D} |f'(z)| (1 - |z|^2)$. In this talk we investigate the following problem: Given two analytic functions f, g in the Bloch space B that satisfy $|f(z)| \le |g(z)|$ for all $z \in D$, is it true that $||f||_B \le ||g||_B$? We study this problem for polynomials and show that, while the answer to this question is negative for certain pairs of polynomials, we do have certain cases that the answer if f and g are complex quadratics with f(0) = g(0) = 0. This is a joint work with Liangying Jiang and Gabriel T. Prajitura.