# THE SEAWAY CURRENT

Newsletter of the Seaway Section of the Mathematical Association of America

#### **Spring 2017** Vol. 41, No. 1

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#### THE SEAWAY CURRENT

The Seaway Current is published twice per year by the Seaway Section of the Mathematical Association of America (MAA) for the benefit of its members. Its pages are open to all members of the MAA and, by invitation to others, for the exchange of information and opinion. Contributed announcements. articles, and editorials are welcome and should be sent to the editor.

Material may be submitted to the editor by e-mail. Opinions expressed in this newsletter are those of the editor or of individual contributors and do not necessarily represent the views of the MAA or of the Seaway Section.

#### Editor

Elizabeth Wilcox, Asst. Professor Department of Mathematics Oswego State University of NY tel. 315-312-6586 elizabeth.wilcox@oswego.edu

### SUNY Oswego will host the Spring 2017 meeting, March 31 - April 1, 2017.

SUNY Oswego's Mathematics Department fosters students The Department of Mathematics at SUNY Oswego is dedicated to quality teaching and close work with students, preparing students for teaching, graduate work or immediate employment in statistics and applied fields. (SUNY Oswego Math Department)

Thank you SUNY Oswego for hosting our meeting!

## **SPRING 2017: THE INVITED SPEAKERS**



## **Friday Banquet Speaker:**

Fred Rickey, U.S. Military Academy (Emeritus)

Title: How George Washington Learned to Be a Surveyor



Abstract: Most of us are aware that our first president was a surveyor in his younger days, but how did he learn that lucrative trade? Fortunately we can give an informed answer to this question as he compiled two notebooks cyphering books – as a teenager that show what he learned about geometry, decimal arithmetic, and surveying. Al-

though available for decades this material has never been carefully studied. We shall present a sampling of the arithmetic and geometry that Washington studied and then concentrate on how surveying was done in seventeenth century Virginia. We will describe what the surveyor did in the field and how the final plats were prepared. This illustrated presentation will appeal to a wide audience.

**Biography:** Fred Rickey is a historian of mathematics who began his mathematical life as a logician. After 43 years of teaching at Bowling Green State University and the United States Military Academy, he retired as he could not get any work done while working. Now, instead of grading calculus papers, Rickey devotes his time to research on the history of mathematics.

Rickey's paper "Isaac Newton, Man, Myth, and Mathematics" received the George Pólya Award for expository writing in mathematics. He received one of the first Haimo Awards from the MAA for distinguished university teaching. In 1994-1995, Rickey was Visiting Mathematician at the MAA Headquarters where he built the first gopher, a precursor of the web, for the MAA. Also that year Rickey wrote a successful NSF proposal for The Institute on the History of Mathematics and Its Use in Teaching (IHMT), which prepared several dozen college teachers to teach history of mathematics courses.

Needless to say, Fred Rickey delights in sharing his knowledge of the history of mathematics with all who are interested.

FALL MEETING: October 20 - 21, 2017 at SUNY Broome

#### Tara Holm, Cornell University

Title: Dance of the Astonished Topologist (or How I Left Squares and Hexes for Math)

#### Abstract:

Topology is often called "rubber sheet" geometry. I will give a friendly introduction to some geometric and algebraic techniques in topology, proving along the way that a topologist can turn her trousers inside out without taking them off. I will describe how covering spaces have been useful in my own work in symplectic geometry, and how they can make square dancing more challenging.

**Biography:** Tara Holm (Project NExT Sepia, 2006) teaches at Cornell University and conducts research in symplectic geometry, algebraic geometry and topology. She is also active in national discussions about undergraduate mathematics education, serving on the

board of the group Transforming Post-Secondary Education in Mathematics. Holm is the President/CEO of the corporation running the Budapest Semesters in Mathematics and is a Fellow of the AMS. Her favorite pie is lemon meringue.

#### Manuela Campanelli, RIT (Gehman Lecture)

Title: Numerical Relativity in the Gravitational Wave Observation Era

#### Abstract:

Not long ago, the advanced LIGO observatories detected gravitational coming from the coalescence of binary black holes that occurred more than a billion of years ago. Numerical relativity simulations of binary black holes played a crucial role in the calculations of the expected gravitational wave signal that was just observed. I will review briefly the history of numerical relativity simulation efforts to model these systems, with an emphasis on the role that it currently plays in the new field of gravitational wave astronomy. I will also present some exciting new results in the context of magnetohydrodynamical simulation indicating that supermassive binary black hole sources might be also detectable in the EM spectrum, in some not too distant future.

**Biography:** Dr. Manuela Campanelli is a professor of Mathematical Sciences, and Astrophysical Sciences and Technology of the Rochester Institute of Technology, and the

founding director of the Center for Computational Relativity and Gravitation. She is also a member of the LIGO scientific collaboration, which on September 14, 2015 made the most important physics discovery of the last half century on the first observation of gravitational waves from the collision of two black holes.

Campanelli has an extensive research experience on Einstein's theory of General Relativity, astrophysics of black holes and gravitational waves. She was the lead author of one of three landmark papers in the field of numerical general relativity chosen by the American Physical Society (APS) to celebrate 100 years of Einstein's General Relativity - the others were from Princeton University and NASA Goddard Space Center. In her 2005 paper, Campanelli and her co-authors solved the Einstein's equations for colliding black holes for the first time. LIGO's observations of gravitational waves on September 14, 2016 perfectly matched mathematical models of colliding black holes.

Campanelli has published numerous papers on groundbreaking numerical simulations of binary black hole space times, exploring physical effects such as "super kicks" and spin-driven orbital dynamics. For example, in 2007, she discovered that supermassive black holes can be ejected from most galaxies at speeds of up to 4000 km/s. Her more current research focuses on computer simulations of merging supermassive black holes, and on magnetohydrodynamics simulations of their accretion disk and jet dynamics, in connection with both gravitational-wave and electromagnetic observations. She discovered a number of relativistic effects that completely overturned the earlier understanding of these systems, and have the potential to create distinctive radiation features that may uniquely mark supermassive binary black holes in the relativistic regime.





Campanelli is the recipient of several awards and recognitions, such as the Marie Curie Fellowship (1998), the American Physical Society Fellowship (2009) and the RIT Trustee Award (2014). She was also the Chair of the APS Topical Group in Gravitation in 2013. More info can be found at Campanelli's website.

#### Brett Stevens, Carleton University

Title: Design Theory, Tournaments and Cryptography

#### Abstract:

A video game tournament is held with  $n^2$  participants playing n games over n rounds. In each round, each game is played by n people against each other simultaneously. No one plays the same game twice. We would like to find a tournament schedule that maximizes the number of pairs of people who compete directly and/or minimizes the number of pairs who play against each other more than once. We set up this optimization problem as a combinatorial design and construct solutions from geometry over a finite field and from non-linear functions over groups. In the solutions we see directly the trade-offs between the two different objectives and symmetry. Our final construction is related to s-boxes used to make cryptosystems resilient to linear and differential cryptanalysis.



**Biography:** Brett Stevens was educated at the University of Chicago, University College London and the University of Toronto. His M.Sc. was in mathematical biology and his

Ph.D. in mathematics, specifically combinatorics. Stevens did post-doctoral work at Simon Fraser University and IBM T.J. Watson Laboratories and is currently a professor in mathematics at Carleton University. Stevens is interested in combinatorics and the interaction of mathematics with other disciplines and culture.

### SPRING 2017: SPECIAL EVENTS

#### Project NExT Workshop - MathBook XML

**Led by:** Ben Atchison (Framingham State University) Friday, March 31, 2:00 - 5:00 130 Shineman Center

*Description:* This workshop will introduce participants to Mathbook XML (MBX). Participants will receive a general overview of the use of MBX to author and collaborate on textbook, article, and other educational resource projects, which can be easily converted to many outputs, including print, LaTeX-to-PDF, and HTML. Sufficient time will be provided for initial MBX authoring/conversion practice via SageMathCloud. By the end of the workshop, authors will be well on their way to establishing and working with MBX locally on their own operating system. An introduction to knowls, self-contained MBX enhancements, with examples (SageCells, WebWork, etc.) will also be given. Participants should bring their own laptop; no previous experience is necessary. Everyone is welcome to attend! Please send an email to Nate Reff (nreff@brockport.edu) if you plan on attending.

#### Math Trivia Contest

**Hosted by:** Blair Madore, SUNY Potsdam Friday night, following the banquet speaker Sheldon Ballroom

*Description*: All (students and faculty) are welcome to participate in round one of this mathematics trivia contest. The top scorers from round one will form teams and play a round of Jeopardy to determine the champions. There will be prizes!

Rubik's Cube Rewind Hosted by: Kenny Roffo, SUNY Oswego Saturday 11:10 - 11:40 Lanigan Hall

*Description*: Teams will be given a Rubik's cube which is several turns away from being solved. Each team will have the same scramble, and must figure out a solution to the puzzle in the given number of turns. This activity does not require knowledge of how to solve a Rubik's cube, and should be fun for everyone!

**If you're planning to participate, bring along your Rubik's cubes!** Each team will need 2-3 cubes – don't worry, we've got a plan to keep your cubes safe and identifiable.

#### Math Magic Show

Hosted by: Blair Madore, SUNY Potsdam Saturday 12:10 - 1:00 122 Shineman Center

*Description*: Come watch your colleagues and students share their favorite math-based magic tricks with the Section. Want to be the magician? Volunteer in advance or the day of the conference by contacting Dr. Blair Madore.

#### Celebrate Clarence Stephens, as he turns 100!

*Description:* After the closing keynote, there will be cake to celebrate Section member and inspiration Clarence Stephens, who turns 100 years old this July. Join the celebration!

#### IBL Workshop: Find your flavor

Hosted by: Ryan Gantner (St. John Fisher College), Yousuf George (Nazareth College), and Xiao Xiao (Utica College)
Saturday 4:45 - 7:30 pm
150 Shineman Center

*Description*: In this workshop we will discuss a spectrum of inquiry-based learning (IBL) techniques, including some of the nuts and bolts of running an IBL class. Various types of classroom styles will be explored. Whether you are curious about IBL, hoping to implement an IBL classroom, or have already begun using IBL techniques, this workshop is should provide activities and ideas to help broaden your teaching repertoire. Dinner will be included at no extra charge. In order to plan, pre-registration is requested by March 29. To register, send e-mail indicating intent to uny.ibl@gmail.com.

"... we call on institutions of higher education, mathematics departments and the mathematics faculty, public policy-makers, and funding agencies to invest time and resources to ensure that effective active learning is incorporated into post-secondary mathematics classrooms."
– Statement on Active Learning by the Conference Board of the Mathematical Sciences (July 15, 2016)

## Swimming in the Current with orcas

The other day I was reading a story to my daughter about a group of people who were on a whale-watching trip. The story was fiction but contained some not-so-subtle dialogue to try to inform its elementary school audience about orcas, their habits, and the people who study them. The characters in the story had just witnessed on orca breach – when an orca jumps nearly entirely out of the water to breathe and then slaps itself down onto the water again upon reentry. The characters (children, of course) were wondering out loud to a scientist why an orca would do such a thing. The scientist admitted that nobody really knows, but gave a few theories.



I became chair of the Seaway Section in April 2015 and had the fortune of inheriting a leadership position in a community which was mathematically vibrant, financially sound, and often a lot of fun. Charlie Ragozzine, Hossein Shahmohamad, Bob Rogers, and all of the chairs which came before — together with all of the other people who put in so much hard work — deserve the credit for bringing the section to where it is today. Yet even in times of success we must be cautious not to become too satisfied with ourselves and stop seeking improvement, refinement, and new life. If we keep swimming in the Current, we may have a hard time seeing the future.

One theory that scientists have for why orcas breach, according to the children's author I was reading (and verified by a quick internet search before writing this article), is that they may want to use the abrasion caused upon reentry to scrape off loose skin or tiny parasitic organisms that are connected to their bodies.

Over the last two years, we've made some changes to the way things work in the Seaway Section. A keynote address was moved to the end of the program. A micro-course was offered. Workshops of various sorts have become more commonplace. Credit cards will now be accepted for meeting payment. This meeting will have a split lunch. These little things are all ways to keep our "skin" fresh. Maybe not all of them are good ideas, but they are all worth trying.

Of course, the children in my daughter's story figured the orcas were just playing. The scientist surprised the kids by informing them that some scientists agree with that theory.

We've also had our share of playing in the past two years. Pub-style trivia, estimathon, Jeopardy, Rubik's cubes, math magic, mimes, hammer juggling, and a book in Farsi about recreational mathematics! I can't take credit for any of this, of course, but it sure is fun to look back at all of the things we can do when we take the time to jump out of the Current and breach the surface.

There are actually several other theories about why orcas breach, but my metaphor here is already being stretched pretty thin. My point is that if we always swim in the Current, we'll miss some of these valuable experiences.

Now take this one step further. This July the great Dr. Clarence Stephens turns 100 years old. We'll celebrate him and his accomplishments in Oswego this spring. He was able to jump out of the Current and look to the future. Certainly we cannot all do what he did, but is there something where we can jump out? In your research? In your classroom? In your department? Where can you breach the surface rather than swimming in the Current?

Thank you for helping me through my time as chair of the section. We'll all be in good hands as Jonathan Cox begins his term at the close of the Spring meeting. I wish him the best of luck.

Ryan Gantner, St. John Fisher College Seaway Section Chair

### NATIONAL MAA NEWS



Deanna Haunsperger (Carleton College) took office as the president of the MAA on February 1, 2017. Haunsperger has been a professor at Carleton College for more than 25 years and during that time, has been an active member of the MAA. From serving as co-editor of Math Horizons for 5 years to directing the long-time Summer Mathematics Program for Women at Carleton College, Haunsperger has made encouraging students to continue on in mathematical careers and with mathematical lives a priority. (*Photo credit: This photo was taken with permission from Deanna Haunsperger's Carleton College website*.)

As Haunsperger prepared to step into the office, Francis Su (Harvey Mudd College) was preparing to leave the office of MAA president. Su (Harvey Mudd College) gave a farewell address at the Joint Mathematics Meetings in Atlanta, Georgia back in January 2017 that called for broadening the scope of who is encouraged to study mathematics. The talk, titled "Mathematics for Human Flourishing", received a standing ovation at the national conference. The full talk is available as a video on YouTube or for reading on Su's blog. Su made access to mathematics and the human side of mathematics a priority during his term as MAA president. Check out his series of MAA FOCUS columns on race and microaggression in the classroom (also available on Su's website). These articles have provided many faculty across the nation with "talking points" to start conversations about bias and issues of race and gender in mathematics classrooms. (*Photo credit: This photo was taken with permission from Francis Su's Harvey Mudd College website*.)



Jim Conklin, Seaway Section Governor / Representative to the National MAA Congress, points out that Francis Su also recently released an app, MathFeed, that keeps users updated on math in the news and allows users to access MAA journals from the app. You can check MathFeed out in the App Store.

During the Business Meeting on Saturday, April 1, elections for the Section Treasurer and Second Vice-Chair will take place. The nominations brought forth by the nominations committee, appointed by the Section Chair and consisting of Margaret Morrow (chair), Joe Straight, and Joe Petrillo, are as follows:

- Treasurer (3-year term): Gary Towsley, SUNY Geneseo
- Second Vice-Chair (2-year term): Steve Kilner, Monroe Community College

Additional nominations will be taken during the Business Meeting.

## SECTION NOTES - SPRING 2017

## A Breeze Blows in from Chicago: Greetings from Luise Kappe

Greetings from Chicago, Illinois! Last fall I moved from Binghamton, New York, to Chicago, where my adult sons live with their families. It was an exciting time of transition, with getting to know the Chicago streets mixed up with trips to Germany, Italy, and Atlanta, Georgia. I'm all settled in now, just returning from a trip to India to visit and collaborate with my last doctoral student, Viji Thomas.

Have you thought about coming to MathFest 2017? MathFest is July 26-29 and this year, it's in Chicago! I hope you decide to come and if so, be on the listen for news of a Seaway Section get-together during the conference.

Best wishes,

Luise Kappe Friend of the Seaway Section

## **SUNY Plattsburg:**

We are very pleased to have Rich Spindler join our faculty, starting last Fall. He previously taught at the University of Wisconsin - Eau Claire and at Bemidji State University. Having received his Ph.D. from

the University of Vermont, Rich is happy to return to the Northeast. His expertise is in applied mathematics (differential equations in particular) and in pedagogy (active learning, IBL, and gifted talented education).

The Mathematics Department at Plattsburgh State University, spearheaded by Greg Quenell, hosted its third annual Math Day on February 7, 2017. The department welcomed about eighty calculus and





pre-calculus students and their teachers, coming from half a dozen high schools in northeastern New York, to a day of math-related activities.

The MAA's American Mathematics Competition (AMC12) was the centerpiece of Math Day, and the students took up the challenge with enthusiasm. Before and after AMC12, the visitors had time to mingle, eat doughnuts, and play with an assortment of mathematical puzzles. Two faculty members presented talks, one before and one after lunch, and the day wound up with a lively round of mathematical Jeopardy!

Many of the area high-school mathematics teaches are Plattsburgh alumni, and for them, Math Day is a kind of homecoming. Their students enjoy a chance to spend a day on a college campus, meet math people from neighboring high schools, and try to come up with the most outrageous, if not the most correct, Jeopardy! questions. (Submitted by Sam Northshield and Margaret Morrow)

## **Greater Upstate NY IBL Consortium:**

Thanks to a \$2.5 million grant from the National Science Foundation, the Academy of Inquiry Based Learning (AIBL) out of California Polytechnic University is able to fund professional development opportunities related to inquiry-based learning (IBL) for collegiate mathematics instructors over the next several years. Part of this project involves offering intense 4-day summer workshops for those interested in developing or refining IBL techniques.

Last summer (2016) a workshop was offered at Cal Poly which was facilitated by an "Upstate NY team" consisting of Patrick Rault (then of SUNY Geneseo), Jane Cushman (Buffalo State College), Ryan Gantner (St. John Fisher College), Yousuf George (Nazareth College), and Xiao Xiao (Utica College). This summer (2017) and next (2018), the team will stay together to facilitate two more such 4-day workshops here in New York. This year's workshop will be July 18 – 21 at Nazareth College in Rochester. The team traveled to Phoenix in February to meet with the facilitators of the other two workshops for planning and development.

While this summer's workshop at Nazareth College is already filled to capacity, interested parties can contact any one of the facilitators to get their names on a regional mailing list and be informed right away when next year's registration opens up. You can also keep up with news from the Greater Upstate NY IBL Consortium at the consortium website. (Submitted by Ryan Gantner)

## **REPORTS & MINUTES SINCE FALL 2016**

#### 1. **ONE LAST GOVERNOR'S REPORT** – SPRING 2017 James Conklin, Seaway Section Governor

I would be remiss if I didn't start off the Governor's report by noting that there are no longer any Governors in the MAA. In the business meeting at the JMM meetings in Atlanta the updates to the Association Bylaws and Articles of Incorporation were approved and took effect Feb. 1, 2017.

The former Executive Committee is replaced by a Board of Directors and MAA sections will elect representatives to the new Congress, which will help advise the Board of Directors. As part of the transition, current Governors were appointed as Section Representatives to the Congress for the remainder of their term. Full details about the governance changes can be found at the MAA website.

At the JMM meeting in Atlanta, Francis Su gave his retiring presidential address, which can be viewed on YouTube (and which I highly recommend) and read online. Deanna Haunsperger is beginning her term as the new MAA President.

Also announced at the Atlanta meetings is the availability of the mobile app MathFeed, which compiles math related stories from the media.

Finances remain challenging at the national level, driven in part by reduced revenue from publications. There is optimism that the recent anticipated deficit will be much lower than first feared. There will not be any change in dues in 2018.

Everyone is encouraged to attend MathFest which will be held in Chicago this summer. Details are already available on the meeting website.

Respectfully submitted by Jim Conklin (Ithaca College), Seaway Section Representative to the MAA Congress

2. REPORT FROM THE CHAIR OF THE SECTION – SPRING 2017 Ryan Gantner, Section Chair

Our section is scheduled to undergo a review and revision of its bylaws in the next year. We will begin this process at the executive board meeting and extended executive board meeting this year (Spring 2017). As this will likely generate much conversation (and possible debate), the work will likely continue into the summer by committee. Proposals will then come back at the Fall 2017 meeting where we will work out issues in person and create a draft. If we need to bring any issues before the entire body at this time, we can do so at the business meeting in Fall 2017. A formal draft can be made after the meeting and sent to the MAA Committee on Sections. After possible back and forth with them, we will publish a version of the bylaws in the Current prior to the Spring 2018 meeting and vote on final approval by both the executive board and the membership (at the business meeting) at that time. If the motion to accept the revised bylaws fails in Spring 2018, we get one more chance during Fall 2018 to produce accepted bylaws so that they can be approved at JMM 2019 by the MAA.

Our section is now committed to accepting credit card payment for its meetings. This happened in Oswego through the local organizer and the SUNY Oswego Auxiliary Services but can happen in the future though our section's new PayPal account.

Thank you to everyone who has supported me over the last five years as I have been program chair, chair elect, and chair of the section. I couldn't have done anything without the enormous amount of help that I have received along the way. Jonathan Cox will be an even better leader than I have been and I look forward to his vision and wish him the best of luck.

Respectfully submitted by Ryan Gantner (St. John Fisher College), Seaway Section Chair

3. TREASURER'S REPORT – SPRING 2017 Gary Towsley, Seaway Section Treasurer

Balance as of 9/15/2016		\$14,836.79
Fall Meeting at RIT		
Meeting Receipts	\$6,173.00	
Meeting Expenses	\$5,604.06	
Net		\$568.94
Speaker Expenses, Honoraria		\$759.00
Subvention		\$1237
Book Sale		\$19.63
Book Sale (Sent to MAA)		\$78.00
Balance as of 3/1/2017		\$15,825.36

### 4. The Executive Committee Meeting – October 21, 2016

Present: Ryan Gantner (Chair), Jonathan Cox (1<sup>st</sup> Vice-Chair), Steve Kilmer (2<sup>nd</sup> Vice-Chair), Gary Raduns (Secretary), Jim Conklin (Governor), Gary Towsley (Treasurer), Jeff Johannes (at-large), Tim Chartier (MAA visitor).

The meeting was called to order at 4:30 pm.

Minutes: Clarify the intention in notes on the Randolph Lecture by replacing "reiterate desire" with "discuss the possibility of" in reference to a shorter presentation followed by a discussion period for the Randolph Lecture.

With this change, the minutes were approved.

Governor Jim Conklin provided a written report and highlighted:

- Vote to be taken at the upcoming Joint Mathematics Meetings to revise the Governance structure of the Association
- Budget deficit of the Association with Publications having a significant impact
- Promoting Department Membership
- Elimination of the Association's Liaison Program

Section Secretary Gary Raduns gave a brief report of highlights from the Section Officer's Meeting at MathFest. The officers had some discussion around the elimination of the Association's Liaison Program – including that Sections may continue their own programs. The officers also had discussions encouraging taking advantage of SIGMAAs in planning section programs.

Treasurer Gary Towsley provided a written report and highlights that the March balance was \$15145, current balance is \$16093. The balance has held steady (down only \$20) over a two-year period.

First Vice-Chair Jonathan Cox provided a written report highlighting speakers for this meeting Tim Chartier (MAA Visitor), Bruce Pittman (banquet speaker), Cristina Gomez (Randolph Lecture), and Patrick Rault. At last report, registration for this meeting stood at 192.

Chair Ryan Gantner asked for response on two items: Section sponsorship for a Project NExT

Fellow – this action is not supported by the Section; the role of the Public Information Officer and perhaps expanding the role to build a social media presence for the Section. Ryan will ask for volunteers for Public Information Officer at the Business Meeting.

Jeff Johannes reports that the current plan is to have a closing keynote speaker for the next two meetings (Spring 2017 and Fall 2017).

Jim Conklin will keep notes at the Business Meeting given Gary Raduns' planned absence for the morning.

Chair Elect suggests posting photos from past meetings to the Section web page.

Old Business:

- Supporting host institutions: The Executive Committee discussed, but took no action, on the question of whether to provide financial support for host institutions.
- There was little further discussion on the visioning session and survey from the Spring 2016 meeting. There was brief discussion supportive of continuing a closing keynote address when local arrangements permit.

New Business:

- Seaway Distinguished Lecturer Committee: The Section will form a committee to recommend the structure and financial commitment of the section to a Seaway Distinguished Lecturer program.
- Standardized meeting registration process: The Executive Committee discussed online and onsite credit card payment options.

The meeting moved into Extended Executive Committee at 5:15.

Respectfully submitted by Gary L. Raduns, Jr. (Roberts Wesleyan College), Seaway Section Secretary

#### 5. The Extended Executive Committee Meeting – October 21, 2016

The meeting moved into Extended Executive Committee at 5:15 with Elizabeth Wilcox, Anurag Agarwal, and Nathan Reff joining the meeting.

Minutes: Regarding the Randolph Lecture, edit the minutes to read "discuss possibility of ..." rather than "reiterate desire for ..." Otherwise, the minutes were accepted.

The Extended Executive Committee received a review of the Extended Executive Committee meeting. This included discussion surrounding attendance at the closing plenary session. The group agreed to continue monitoring and seeking ways to encourage staying through the closing talk.

Student Program Committee reports the highest fall meeting student presentation count in five years. This observation led to some discussion regarding grouping student presenters by school or shuffling schools.

There was no report from the Randolph Lecture Committee.

The Gehman Lecture Committee reports Manuela Campanelli of RIT will be the Gehman Lecturer for the Spring 2017 Section Meeting.

Educational Policies Committee – no report.

Clarence Stephens Distinguished Teaching Award Committee reminds us that nominations are due February 1 and nomination forms are available on the Section web page.

Nominating Committee – no report.

Liaison Coordinator Jeff Johannes reports that the Section will continue its Liaison Program and continue to seek liaisons (and updated liaisons) from more schools.

Seaway Current Editor – no report.

Seaway NExT: This meeting features a discussion session with topics voted on by participants.

Webmaster (Anurag) reports:

- Files are updated
- The Seaway Current is current
- Adding student activities
- Requests an update from Seaway NExT, photos of new Section officers, and photos from past meetings (a suggestion that photographs may be a task for the Public Information Officer).

The Chair would like to be sure highlights of our Section Meeting are submitted to the MAA Focus. Submit suggestions for meeting highlights to Ryan.

The meeting adjourned at 6 pm.

Respectfully submitted by Gary L. Raduns, Jr. (Roberts Wesleyan College), Seaway Section Secretary

6. THE BUSINESS MEETING – October 22, 2016

Agenda and minutes from Spring 2016 approved without objection.

Reports from officers:

Chair (Gantner) – Called for volunteers (and passed around sign up sheets) asking for interest in serving on/as:

- Public Information Officer for Seaway section (especially looking for people to expand our presence on social media)
- Distinguished Lecturer Committee

Governor (Conklin) announced:

• Passage of change in bylaws and governance at the national level and urged interested members to read details in upcoming issue of FOCUS. The final decision contingent on the outcome of a vote in January at the JMM meetings

• Budgetary concerns at national level, where the 2017 deficit may rise to \$1 million. The Association is currently pursuing a partnership for publications with the goal of reducing financial pressures arising from books and journals.

Secretary: no report

Treasurer (Towsley): Announced balance of approximately \$16,000 and noted that this has been stable even after the expenses of the anniversary meeting at Colgate.

First Vice Chair (Miller): Announced speakers for March 31/April 1, 2017 meeting in Oswego – Fred Rickey (banquet speaker), Manuela Campanelli (Gehman Lecture), Brett Stevens, Tara Holm.

Reports from committees:

- Student Program Committee (Brown/Wilcox) Reported successful student program from Friday night including the Esmimathon and 22 student presentations scheduled for Saturday.
- Randolph Lecture (Madore) Thanked this year's speaker, Christina Gomez, and asked for feedback on a possible future format of short talk followed by interactive session.
- Gehman Lecture (Maceli) Announced next meeting's Gehman Lecturer Manuela Campanelli and issued call for ideas for future speakers.
- Educational Policies Committee (Cushman) Nothing to report
- Distinguished Teaching Award Committee (Leary) Called for nominations; people were directed to Seaway website for the appropriate nomination materials.
- Nominations Committee (Morrow) Nothing to report
- Liaison Coordinator (Johannes) Emphasized that the Seaway Section will maintain its liaison program at the section level, but that the program is not being continued at the national level. Asked for help in identifying liaisons at institutions where we do not currently have liaisons.
- Seaway Current Editor (Wilcox) Also emphasized that liaisons were important and the section level for supplying information from the schools for the Seaway Current.
- Seaway NEXT/PFF (Reff) Recommended the (Saturday 11:10) NEXT Workshop session, *Re-Energizing your career at all stages*.
- Webmaster (Agarwal) Nothing to report

Old business: nothing to report

New business: nothing to report

Meeting adjourned with no objection.

Notes as recorded by James Conklin (Ithaca College), (then) Seaway Section Governor

## Spring 2017 - Contributed Talk Schedule

#### **150 Shineman Center**

**Teachers' Masters Capstone Projects in Secondary and College Mathematics** Session Organizer, Keary Howard, SUNY Fredonia

- 1:10-1:35 Danielle Czerwinski, SUNY Fredonia, Feared Fractions and Dreaded Decimals: A Study of College Students' Preferences Between Fractions and Decimals.
- 1:40-2:05 Jacob Brostrom, SUNY Fredonia, The Effectiveness of Teaching Constructions Using Straightedge and Compass Versus Using Technology
- 2:10-2:35 Nicole Sottilaro, SUNY Fredonia, Sig Figs and Scientific Notation Confusion: Misunderstandings in Significant Figures and Scientific Notation
- 2:40-2:55 Elyssa Adams, SUNY Fredonia, *The Efficacy of Video-Based Learning in the Common Core* Algebra Classroom.

#### **170 Shineman Center**

- 1:10-1:35 Chad Mangum, Niagara University, New Realization of Twisted Toroidal Lie Algebras
- 1:40-2:05 Sam Northshield, SUNY Plattsburgh, Small Denominators and Their Corresponding Numerators
- 2:10-2:35 Christopher Baltus, SUNY Oswego, Central Collineations: Straightedge Constructions and Matrix Algebra
- 2:40-2:55 Hossein Behforooz, Utica College, Linear Algebra Properties of Magic Squares

#### **172 Shineman Center**

- 1:10-1:35 **Yozo Mikata,** Bechtel Corporation, *1D Phononic Metamaterials: Infinitely Periodic and Finitely Periodic Materials*
- 1:40-2:05 Gordan Craig, Université Laval and Mérici College, The Unsteady Invisible Hand
- 2:10-2:35 Amanda Mangum, Niagara University, Comparing Clustering Algorithms on Porcine Atherosclerotic Data
- 2:40-2:55 James Parkus, RIT, Trajectories around Lagrange Points in the Restricted Three-Body Problem

#### **174 Shineman Center**

- 1:10-1:35 Joseph Kolacinski, SUNY Elmira, A Mathematical Comparison of Open and Closed Primaries through Fairness Criteria
- 1:40-2:05 Darren Narayan, RIT, Research with Undergraduates: Towards a Characterization of Graphs with Distinct Betweenness Centralities
- 2:10-2:35 Olympia Nicodemia, SUNY Geneseo, Calculus: Closing the Equity Gap
- 2:40-2:55 James Marengo, RIT, A Geometric View of an Interesting Probability Distribution

## Student Talk Schedule

#### Room 1:

1:10-1:35 **Hui Dan,** University at Buffalo, SUNY, A Comparison of Three Fractional Derivatives in Finite Difference Approximations to Fractional Differential Equations 1:40-2:05 **Sean Lyons**, Le Moyne College, Exploring NHL Team Styles and What Determines Success

2:10-2:35 **Michael McDermott, Brendan O'Braitis, and Thomas Maurer,** SUNY Oneonta, *A History of the Mathematics Department at SUNY Oneonta* 2:40-3:05 **Erin Nannen,** Ithaca College, *Mathematical Symmetry in Poe's Work* 

#### Room 2:

1:10-1:25 **Michelle Persaud,** SUNY Fredonia, *Discovering Parallels Between Euclidean Constructions and Origami Constructions* 

1:25-1:40 Emily Hedison, Hamilton College, Extensions of Rock-Paper-Scissors

1:40-1:55 Rachel Schank, SUNY Fredonia, Mathematical Group Theory and Triadic Harmony

1:55-2:10 Luke Ciminelli, Niagara University, Markov Chain Methods to Produce a Walking Bassline in Jazz Music

2:10-2:25 **Brandon Payne**, Elmira College, *The Similarities of Open and Closed Primaries Through Fairness Criteria* 

2:25-2:40 **Phoebe Cai**, Hobart and William Smith Colleges, *Constructing the Species Tree from the Gene Tree* 

2:40-2:55 Jesse Maltese, Hobart and William Smith Colleges, *Species Tree Estimation Under the Coalescent Model* 

#### Room 3:

1:10-1:25 Gordon Bogardus, Hamilton College, *Baseball, Percentages, and Regression* 1:25-1:40 Jenna Zomback, SUNY Geneseo, *Colored Unlinking* 

1:40-1:55 Mark Curiel and Jacqueline Kane, Hobart and William Smith Colleges, Analysis of Phylogenetic Trees Used in Quantitative Trait Mapping

1:55-2:10 Hector Miranda, RIT, Domain of Possible Configurations for Planar 3 Body Problem 2:10-2:25 Ashley Case, SUNY Brockport, Extending the Applicability of the Lagrange Multipliers Method

2:25-2:40 **Michelle Piwonski**, SUNY Brockport, *The Probability that a Cubic Equation has Only Real Roots - The Special Cases* 

#### Room 4:

1:10-1:25 **Shoshanna Longo and Hunter Collin**, RIT, Comparison Study of Adomian's Decomposition Method and Homotopy Perturbation Method for the Non-Linear Differential Equations

1:25-1:40 **Sterling Campbell**, Alfred University, *Discrete Morse Theory for Medial Subdivision* 1:40-1:55 **John Steiner**, SUNY Brockport, *Approximation of Fractals* 

1:55-2:10 Emmerson Zhaime, Hamilton College, Using Cronbach's Alpha to Assess the Reliability of Alcohol Survey Questions

2:10-2:25 **Binh Nguyen**, Hamilton College, *What is the Hidden Markov Model? And How Does it Help Advance Our Understanding of Biology?* 

2:25-2:40 Dakota Morano, Niagara University, Predictions and Outcomes in the MLB

#### 1. Christopher Baltus, SUNY Oswego

#### Central Collineations: Straightedge Constructions and Matrix Algebra

A classroom topic that ties synthetic geometry with matrix algebra. A collineation is a 1-to-1 mapping of the projective plane onto itself that respects collinearity. If there is a line of fixed points, it's a Central Collineation. Interesting constructions are by straightedge and a device for drawing parallels. Multiplication by nonsingular 3-by-3 matrices produce the collineations in homogeneous coordinates.

Question: Which matrices produce central collineations?

#### 2. Hossein Behforooz, Utica College

#### Linear Algebra Properties of Magic Squares

First of all, this talk is especially suitable and understandable for undergraduate students. We know that every magic square is a very especial square matrix and in this talk, we will present some interesting linear algebra properties of these magic square matrices. There are some published materials and short articles or notes related to this subject but they are not very complete papers with all details in one place. Since the time of the lecture is short, I will state the theorems without proofs or I will make the proofs as simple as possible. Some entertainment properties of magic square will be followed if time permits. Yes, MATH is FUN. Remember that we have Magic Squares for thousands of years, way before new born entertainment with Sudoku Squares.

#### 3. Gordon Craig, Université Laval and Mérici College

#### The Unsteady Invisible Hand

The concept of general equilibrium (namely, that supply equals demand for all goods) is fundamental to economic theory. In the 1950s Arrow and Debreu used fixed-point theory to show that, under certain hypotheses, such an equilibrium exists. Unfortunately, their theorem did not address the issue of the stability of the equilibrium. In this talk, I will present several simple examples due to Scarf showing that in general, the Arrow-Debreu equilibrium is unstable. The talk will assume no prior knowledge of economics, and will be accessible to anyone who has completed an ordinary differential equations course.

#### 4. Joseph Kolacinski, SUNY Elmira

#### A Mathematical Comparison of Open and Closed Primaries through Fairness Criteria

This talk will explores the differences between open, closed, and semi-closed primary elections, both from theoretical standpoint. We define five of the most fundamental "fairness criteria," a set of desirable characteristics "fair" election systems should satisfy. Using these definitions, we determine that by allowing voters to choose which primary election in which to vote, open primaries satisfy four out of the five fairness criteria while closed primaries do not: anonymity, neutrality, majority, and Pareto. We also determined that closed primaries satisfy monotonicity while open primaries do not. We use these results to argue that open primaries are superior to closed primaries in selecting candidates that represent the interests of the greatest number of citizens.

5. Amanda Mangum, Niagara University (Work done in collaboration with Dr. Mansoor Haider, North Carolina State University)

#### Comparing Clustering Algorithms on Porcine Atherosclerotic Data

Atherosclerosis is a cardiovascular disease in which plaque accumulates along the wall of an artery, altering blood flow and increasing the risk for heart attack or stroke. Acoustic Radiation Force Impulse (ARFI) is an ultrasound imaging technique in which acoustic waves are focused at a point, causing displacement of the tissue that is then tracked over time to measure elastic and viscoelastic material properties from the imaging data. We investigate the application of data clustering algorithms, K-Means, Self-Organizing Maps (SOMs), and Relational SOMS to ARFI imaging for early detection and characterization of atherosclerotic plaques.

In this context, we hope to cluster images based on similar patterns in the data set. Based on the dimension, size and scope of image patterns considered in this work, the clustering configuration used for each clustering algorithm considered was a 3x3 lattice of nine neurons. We will discuss metrics, including the topographic product, used to compare the performance of the three algorithms as well as comparing different clusterings using the same algorithm.

#### 6. Chad Mangum, Niagara University

#### New Realization of Twisted Toroidal Lie Algebras

The representation theory of Lie algebras is a vibrant field of research and has been significant in various areas of mathematics and physics for several decades. In this talk, we will discuss a recent advance in part of this theory, namely twisted (2-)toroidal (Lie) algebras, which we view as universal central extensions of twisted multi-loop algebras. The usual loop algebra realization generalizes the familiar realization of affine Kac-Moody algebras. We will discuss a new realization of these algebras given by generators and relations, based on a similar realization by Moody, Rao, and Yokonuma in the untwisted case. This has the advantage of being more amenable than the loop algebra realization to studying the representation theory. This is joint work with Dr. Kailash Misra and Dr. Naihuan Jing.

#### 7. James Marengo, RIT

#### A Geometric View of an Interesting Probability Distribution

In this talk an n-dimensional geometric derivation will be presented for the probability distribution of the sum of n independent random variables, each of which is uniformly distributed on the interval (0,1). The derivation makes use of the inclusion-exclusion principle and should be accessible to anyone who has had a first course in probability.

#### 8. Yozo Mikata, Bechtel Corporation

#### 1D Phononic Metamaterials: Infinitely Periodic and Finitely Periodic Materials

Metamaterials have been studied extensively since Pendry and Holden (1999), and Smith et al. (2000) have succeeded in creating an electromagnetic composite material (photonic metamaterial) with negative permeability and negative permittivity in certain frequency range (double negative materials). But the original concept goes back to a theoretical paper by Veselago in 1967. In this talk, binary and ternary 1D phononic metamaterials will be discussed in relation to local resonance. Particular attention will be focused on the effect of the geometrical parameters of the material periodicity on the dispersion characteristics of SH waves. Both infinitely layered material and finitely layered material will be considered. For infinitely periodic materials, dispersion relations will be obtained, and for finitely periodic materials, transmission coefficients will be discussed.

#### 9. Darren Narayan, RIT

#### Research with Undergraduates: Towards a Characterization of Graphs with Distinct Betweenness Centralities

The betweenness centrality of a vertex v is the ratio of the number of shortest paths between two other vertices u and w which contain v to the total number of shortest paths between u and w. We consider the problem of characterizing all graphs with distinct betweenness centralities. We begin by solving the problem for all graphs with less than or equal to seven vertices. Next, we investigate graph properties such as density and minimality. Finally, we determine sufficient conditions for graphs with distinct betweenness centralities to be extended to infinite families of graphs of the same type. This is joint work with Ruth Lopez, California State University at Long Beach, and Jacob Worrell, Indiana University.

#### 10. Olympia Nicodemia, SUNY Geneseo

#### Calculus: Closing the Equity Gap

I have spent the last year serving students from mathematically disadvantaged backgrounds in precalculus and calculus 1. I will briefly summarize some of the observations and questions prompted by this experience with the objective of establishing a continuing discussion of such matters within the Seaway Section.

#### 11. Sam Northshield, SUNY Plattsburgh

#### Small Denominators and Their Corresponding Numerators

For two random numbers from the unit interval, there is a unique rational number of lowest denominator between them We study several aspects of the distribution of this random rational number R. Baney, Beslin, and DeAngelis first discovered the distribution of D, the denominator of R; a contribution I make is to prove that the expected value of D is 4. In this talk, I will also discuss the distribution the numerator of R, and make some connections with open problems in number theory.

#### 12. James Parkus, RIT

#### Trajectories around Lagrange Points in the Restricted Three-Body Problem

In this paper we will present trajectories of a spacecraft moving in the gravitational field, considering the restricted three-body problem. We will study closed orbits around Lagrange points using Matlab.

#### Student Talk Abstracts

#### Gordon Bogardus, Hamilton College

Baseball, Percentages, and Regression

Abstract: Baseballers love percentages and statisticians love regression, but the two don't always play nice. One problem is that percentages ignore the sample size, but sample size is crucial in determining the uncertainty inherent in the percentages. Ordinary least squares regression treats each percentage equally regardless of the sample size used to determine the percentage, and therefore ignores the uncertainty associated with each data point. In reality, percentages resulting from a large sample should be given greater weight than percentages from a small sample because the larger sample has less variability associated with it. An approach that allows sample size to be taken into consideration is weighted least squares regression, with weights chosen to be the sample standard deviations. My talk will start with an introduction to weighted least squares regression, explain why weighting by the sample standard deviation is appropriate, and illustrate the technique with examples from the 2016 Major League Baseball season.

#### Pheobe Cai, Hobart and William Smith Colleges

Constructing the Species Tree from the Gene Tree

Abstract: Constructing gene trees from DNA data and then building the species tree from the gene trees is traditionally how species trees are estimated. The traditional way of estimate species trees from gene tree are either too slow or not accurate. We introduced a quartet based species tree structure algorithm, which is more efficient and statistically consistent assuming evolution occurs under the coalescent model.

#### Sterling Campbell, Alfred University

Discrete Morse Theory for Medial Subdivision

Abstract: Let F represent a discrete Morse function on a simplicial complex L. If we subdivide L using medial subdivision, will F be conserved? Is there a bijection between the critical simplexes? Do the internal and external paths remain non-cyclic? We will answer these questions by presenting a method of construction that maintains the properties of the discrete Morse function when a simplicial complex is subdivided. This talk is on research completed during the SAM REU 2016 at Sam Houston State University under Dr. Brian Loft.

#### Ashley Case, SUNY Brockport

Extending the Applicability of the Lagrange Multipliers Method

Abstract: We will discuss how to use Lagrange Multipliers in the case of constraints given by inequalities.

#### Luke Ciminelli, Niagara University

Markov Chain Methods to Produce a Walking Bassline in Jazz Music

Abstract: Improvisation is essential to jazz music, and modeling aspects of improvisation has long been an interesting question in mathematics. Most of the literature on this topic focuses on analyzing or producing jazz solos, but there is another improvised element of jazz music that has garnered less attention: walking basslines. This talk will discuss the use of a probabilistic method (Markov chains) to produce a walking bassline. This is joint work with Dr. Chad Mangum.

#### Mark Curiel and Jacqueline Kane, Hobart and William Smith Colleges

Analysis of Phylogenetic Trees Used in Quantitative Trait Mapping

Abstract: Determining the specific genes that cause genetic diseases and traits is a difficult process. Phylogenetic trees are used to inform statistical tests about the association between a particular trait and a single gene or multiple genes. Many genes among different species are identical. Thus, to associate a disease with a particular gene, genes that differ from others become essential. Genes where this event occurs are called SNPs (Single Nucleotide Polymorphism). Certain genetic factors may be discovered by looking into phylogenetic trees that correspond to the evolution of nucleotides. However, constructing accurate trees is challenging since there is limited local data, but a very large number of genes under consideration. We examine the accuracy of the tree reconstruction for each SNP data. Our goal is to determine any weakness in this current approach that would lead to a better algorithm for building local trees. We analyze models of these phylogenetic trees to establish their accuracy to real evolutional data. Improved construction of local trees would dramatically improve our ability to identify SNPs, which may be the cause of a particular disease or trait.

#### Hui Duan, University at Buffalo, SUNY

A Comparison of Three Fractional Derivatives in Finite Difference Approximations to Fractional Differential Equations

Abstract: In recent years, a number of numerical methods for solving fractional differential equations has been proposed. In this talk, we compare three different types of fractional derivatives, namely Riemann-Liouville, Caputo and Grünwald-Letnikov fractional derivatives and their low order finite difference approximations. In particular, a numerical study for the errors and oscillations by the three different fractional derivatives and a comparison of their performances will be presented. Numerical results illustrate that the Caputo and Grünwald-Letnikov derivatives will be yield better approximations than the Riemann-Liouville derivative. For the implusive fractional differential equation, we found and will present that the finite difference solution with the Riemann-Liouville derivative is oscillatory if the fractional order is small.

#### Emily Hedison, Hamilton College

Extensions of Rock-Paper-Scissors

Abstract: The classic game Rock-Paper-Scissors is an example of a balanced tournament of three "weapons" in which each weapon beats exactly one other weapon and loses to exactly one other weapon. But what happens when we consider balanced tournaments of more than 3 weapons? Through the use of automorphism and permutation groups, recent work by Marc Chamberland and Eugene Herman have shown it is possible to determine the number of distinct, isomorphic and non-isomorphic balanced tournaments for larger number extensions of rock-paper-scissors. Further, we look at the use of Borromean rings to visually describe this phenomenon.

#### Shoshanna Longo and Hunter Collin, RIT

Comparison study of Adomian's Decomposition Method and Homotopy Perturbation Method for the Non-Linear Differential Equations

Abstract: In this work, we compare the series solution obtained from the Adomian's Decomposition Method with the Homotopy Perturbation Method for the linear and non-linear differential equations originated from the engineering discipline. We are in the process of implementing the Picard's method in order to gage the efficiency and accuracy of both semi-analytical techniques. It is expected that the speed to convergence for the Adomian's Decomposition Method can be improved by appropriate modification into the standard algorithm.

#### Sean Lyons, Le Moyne College

Exploring NHL Team Styles and What Determines Success

Abstract: I examine the effect of play style on how a team performs in the NHL. To classify team styles, I used general linear models, linear regressions, and principal components to create mathematical models that were able to classify a team's style. Using the results of the classification models, I found that a team's style does not strongly affect a team's success.

#### Jesse Maltese, Hobart and William Smith Colleges

Species Tree Estimation Under the Coalescent Model

Abstract: Traditionally, gene trees created from DNA sequence data are used to estimate species trees. Under the coalescent model, we construct species trees with branch lengths directly from the DNA data itself, bypassing the step involving gene trees. We then estimate distances on the species tree between two taxa and use these distances to build species trees. Contradicting common intuition, we find that the distance between two taxa on a species tree could depend on more than the two taxa themselves.

#### Michael McDermott, Brendan O'Braitis, and Thomas Maurer, SUNY Oneonta

A History of the Mathematics Department at SUNY Oneonta

Abstract: As part of a class project, we have produced a small documentary about the history of the mathematics department at SUNY Oneonta. The documentary consists of interviews conducted with four current mathematics professors within the department. The interviews were concentrated on the integration of new technologies and new courses to the department, as well as instructional methods that are found to be the easiest and most beneficial for the students at a collegiate level math class. The professors being interviewed are indicative of the changes over the years since they graduated from graduate school and were hired as professors. Reforms in the educational system and developments in educational technology that have impacted classrooms around the country are discussed in the film. This short film provides insight into the path of progress of educating the future mathematicians of today and tomorrow.

#### Hector Miranda, RIT

Domain of Possible Configurations for Planar 3 Body Problem

Abstract: This work focuses on the planar three body problem (P3BP): consider 3 points in a plane  $M_1$ ,  $M_2$ ,  $M_3$  with masses  $m_1$ ,  $m_2$ ,  $m_3$ , moving under the mutual Newtonian attraction. To study this motion we use Jacobi's coordinates  $(r_1, r_2, \phi_1, \phi_2)$  given by:

- $r_1 = \text{distance between } M_1 \text{ and } M_2$
- $r_2$  = distance between the center of mass  $G_{12}$  (of masses  $m_1$  and  $m_2$ ) and  $M_3$
- $\phi_1$  = angle between  $M_1M_2$  and the x-axis
- $\phi_2$  = angle between  $G_{12}M_3$  and the x-axis.

In these coordinates we write the moment of inertia I, the kinetic energy T, the force function U and the angular momentum c. We consider the following inequality, recently published, on the domain of configurations of the P3BP:

$$2I(U+h) - c^2 \ge \mu_1 \mu_2 r_1^2 r_2^2 \dot{\phi}$$

where  $\mu_1$ ,  $\mu_2$  depend on  $m_1$ ,  $m_2$ ,  $m_3$  and  $\phi = \phi_2 - \phi_1$ .

We study the case when this inequality becomes an equality and we explore regions of possible motion for different values of the total energy, h = T + U, (h > 0, h = 0, h < 0). Moreover we use Mathematica to describe some qualitative features of the problem.

#### Dakota Morano, Niagara University

Predictions and Outcomes in the MLB

Abstract: Predicting baseball statistics, mainly hits, runs, and wins, is the main purpose of this study. The research used R-stat, Sports Illustrated, and Baseball Reference to determine how many hits a team will get in a season and what their win percentage will be based on the total hits in that season and hits in each game. The results from this study had some large error but were able to predict some win percentages accurately. Team's total runs scored versus total hits was brought into consideration if the study is repeated to create a better model.

#### Erin Nannen, Ithaca College

Mathematical Symmetry in Poe's Work

Abstract: Symmetry is an interesting mathematical concept for many reasons, particularly its unique ability to present itself throughout different realms. Different forms of symmetry can be found within nature, such as the symmetry of a snowflake or the petals of a flower or the spirals on a pine cone. Symmetry can be observed in the Fibonacci spiral which is used as a measure of proportionality and human beauty. Thus, it is no surprise that symmetry can be found in literature as well. Symmetrical objects are seen as a standard of beauty and thus for an author to employ symmetry throughout his or her work is no surprise. Some authors, however, are explicit in their use of such instruments of beauty, as evidence by their collections of work and even their statements about composition. Edgar Allan Poe is one notable author who uses different types of symmetry to impose a greater meaning on his literature.

#### Binh Nguyen, Hamilton College

What is the Hidden Markov Model? And How Does it Help Advance Our Understanding of Biology?

Abstract: The Hidden Markov Model is a probabilistic model underlying the development of pattern-seeking applications, such as speech recognition. It is also gaining ground in the application to biological problems, such as the construction of genetic linkage maps, differentiation between coding and non-coding regions of DNA, and scoring sequence alignments. This talk will discuss the basic concepts behind the Hidden Markov Model, and how it is used in a particular example of multiple sequence alignments. In this particular application, a training set is first created by the assembly of a group of sequences that are known to be structurally or functional related. Second, the model size (i.e.: the number of acceptable states), preliminary probability value of each state transition, and preliminary probability value of each outcome given a particular state, are determined. Third, "training" of the model is performed by optimizing these probabilities so that a random output from the model is most likely a member of the original training set. Finally, this trained model is used to align test sequences to examine whether the structure underlying the training set is also present in these test sequences. The Hidden Markov Model provides a robust foundation to analysis studies concerning evolutionary relationship between different sequences.

#### Brandon Payne, Elmira College

The Similarities of Open and Closed Primaries through Fairness Criteria

Abstract: This talk explores the theoretical and practical similarities between open and closed primary elections using "fairness criteria." We discovered that both election systems satisfied unanimity and near-decisiveness, were neither imposed nor dictatorships, and neither system satisfied the Condorcet and Independence of Irrelevant Alternatives criteria. We discuss the proofs of a selection of these results and their implications.

#### Michelle Persaud, SUNY Fredonia

Discovering Parallels Between Euclidean Constructions and Origami Constructions

Abstract: What can we construct using origami? This is similar to the question "What can we construct using a straight edge and compass?" Euclid made the first attempt to axiomatize compass and straight edge constructions approximately 2500 years ago in his series of works, <u>The Elements</u>. 19th Century mathematicians used algebra to provide a framework for determining what is and is not constructible. Recently, mathematicians have used an isomorphic axiomatic and algebraic approach to determine what is foldable using origami. The goal of this presentation is to demonstrate how origami constructions can be axiomatized, and to determine what restrictions someone would face when creating an origami construction.

#### Michelle Piwonski, SUNY Brockport

The Probability that a Cubic Equation has Only Real Roots - The Special Cases

Abstract: I will look at the probability that a cubic equation with one coefficient equal to 0 has all roots real.

#### Rachel Schank, SUNY Fredonia

Mathematical Group Theory and Triadic Harmony

Abstract: Mathematical Group Theory allows us to talk about the cyclic structure of musical harmony by performing group actions on musical chords, which we limit to the major and minor triads. We will discuss two different group actions on the set of triads. In the end, when we embed them both in a larger group, we see how they are related.

#### John Steiner, SUNY Brockport

Approximation of Fractals

Abstract: I will look discuss the approximate construction of fractals with an irrational self similarity factor.

#### Emmerson Zhaime, Hamilton College

Using Cronbach's Alpha to Assess the Reliability of Alcohol Survey Questions

Abstract: Cronbach's alpha is is a measure used to assess the reliability, or internal consistency, of a set of scale or test items. It is most commonly used when you have multiple questions in a survey/questionnaire where the responses are on a Likert-type scale (such as Strongly Disagree to Strongly Agree), and you wish to determine if the responses are internally consistent. It is used in survey research in fields ranging from psychological research to medical studies, and may not be well known in the general statistics community. My study focuses on using Cronbach's alpha to explore the reliability of a set of questions asked of Hamilton College students in an Alcohol Survey Questionnaire administered to NESCAC schools in 2015.

#### Jenna Zomback, SUNY Geneseo

#### Colored Unlinking

Abstract: In links with two components there are three different types of crossings: self crossings in the first component, self crossings in the second component, and crossings between components. Previous work by Peter Kohn has mostly not made this distinction between the different types of crossings. In this talk we examine the minimum number of crossing changes needed to unlink without changing the crossings between components. For this, we restrict our attention to unlinking two component links with linking number zero and both components unknotted. After observing how to unlink linking number zero links, we move on to changing links of nonzero linking number to designated base links.