~~UNDERGRADUATE MATH SEMINAR~~ Steinmetz Symposium!

In deference to the annual Steinmetz Symposium, **Friday, May 12**, there will not be a separate math seminar this week. Instead, we encourage you to attend the many math talks that will be given at Steinmetz.

Session 2 Mathematics I, ISEC 118

- **10:50**, **Lichuan Xiong,** Puzzles and Games with Linear Algebra: *Many puzzles and games can be better understood via linear algebraic tools. In this talk, I'll briefly introduce two examples, Magic Squares, and the game Lights Out. I'll show how some interesting properties of Magic Squares could be understood via linear algebra, and how linear algebra can help us to find a systematic way to win Lights Out.*
- **11:10**, **Michael Nyikos**, Exploring the Art of Computer Graphics: *Computer Graphics is the field that studies the creation and manipulation of pictures with the aid of computers. This field focuses on the manipulation of three-dimensional objects in a two dimensional plane. This talk provides an introduction into how linear algebra is utilized in this field. I will show how linear transformations can be used to move and stretch images in a plane, and how basic matrix arithmetic can be used to blend and edit images.*
- **11:30**, **Shizhe Li**, Bipartite Intrinsically Knotted Graphs with 21 Edges: *A graph is intrinsically knotted if there exists a knotted cycle in every spatial embedding of the graph. Using the restoring method, Kim, Mattman, and Oh construct a complete listing of intrinsically knotted bipartite graphs with 22 edges. In this study, we adapt their strategy to show the Heawood graph is the only intrinsically knotted bipartite graph with 21 edges.*
- **11:50, Quoc (Jordan) An,** Some Different Ways to Prove the Irrationality of $\sqrt{2}$: *In this talk, we will explore the different ways to prove the irrationality of the square root of 2. First, we will consider the classical proof that is often shown in a math classroom. Then, we will consider several other proofs of the same result. For each of these other proofs, we will investigate the extent to which they generalize to prove the irrationality of $\sqrt{3}$, $\sqrt{p}$ (p is a prime), $\sqrt[n]{p}$, and more.*

Session 4 Mathematics 2 and Theoretical Physics, ISEC 118

- **1:50, Daniel Tyebkhan**, Elliptic Curves for Prime Factorization of Integers: *Elliptic curves are abelian groups known for their many applications ranging from the cryptographic standards underlying much of the modern internet, to number theory where they play a central role in Andrew Wiles' proof of Fermat's Last Theorem. In this talk, we introduce the basic theory of elliptic curves, beginning with the Weierstrass equation and a a brief overview of projective space, followed by a discussion of their group law. We then shift to the realm of factoring and describe how and why Lenstra's Algorithm works by leveraging elliptic curves to illuminate prime factors of composite integers. We conclude with some discussion of our own implementation of Lenstra's Algorithm.*
- **2:10, Mayah Teplitskiy**, Polynomials in $F_p[X]$ Which Commute Under Composition*: Let F be a finite field and let f be a linear polynomial in $F[X]$. We investigate the number of polynomials of degree d which commute with f under composition. In so doing, we rediscover a result of Park, but with a conceptually simpler proof.*
- **2:30, Aidan McAuliffe**, Isoperimetric Inequality: *We will provide an explanation and proof of the Isoperimetric Inequality of simple closed curves in the plane. We will show that among all simple closed curves bounding a given area, the curve with the shortest length is a circle. Likewise, among all simple closed curves of a given length, the curve that bounds the greatest area is a circle.*
- **3:10, Julian Zapata-Hall**, Big Data: Development of Fouling Strategy for College Basketball: *To foul or to not foul? Experts frequently disagree on when a foul must or must not be committed within college basketball. However, it is clear that this strategic decision is critical, since it frequently heavily impacts the outcomes of games and even entire seasons. I compared different fouling strategies and their performance over time, using 13 seasons of actual NCAA Division 1 men's basketball games in order to find a comprehensive fouling strategy that optimizes a team's chances of winning.*

TURN THE PAGE – THE NEWSLETTER CONTINUES

Pieces from Thesis – by Julian Zapata-Hall

Julian *wrote his senior thesis this past winter term, supervised by Professor Roger Hoerl.*

Last winter term I wrote my senior thesis with the help of my advisor Prof. Roger Hoerl. Within my thesis I presented a set of strategies for college basketball that improve a team's chances of winning in the late stages of basketball games. The process was very rewarding for me since I am passionate about both basketball and math. Applying math and statistics to improve sports strategy has always been a dream of mine. I am deeply thankful with Prof. Hoerl for giving me the opportunity to research a topic that really interests me. Throughout the process I got to interact and meet with many college basketball coaches around the country and discuss their opinions on late game basketball strategy. Additionally, I met with many sports statisticians and had great conversations regarding my project. This was not only incredibly insightful, but it also put me in position to provide actionable advances to college basketball strategy.

For future seniors, I strongly suggest that you take the time necessary to find a project that interests you. This may be the last time you have the opportunity to research a topic you are truly passionate about. If you can, reach out to professors beforehand with a topic of interest and you may be able to work on that topic for your senior thesis. I found that having a topic I enjoyed made the work much more fun. At times I found myself wishing I had more time for my project. A good thesis paper can also be a good way to create connections or immerse yourself deeper into your field of interest. Your senior project may be a responsibility, but it is also a great opportunity you may not have again. I would recommend you take the time necessary to choose a topic that will make the experience as enjoyable and rewarding as possible. Good Luck, Julian.

Fall Term Job Opportunities: Calculus Help Center Tutor; Math Coach for MTH 105

CALCULUS HELP CENTER TUTOR

The Math Department is now accepting applications for vacant **Calculus Help Center (CHC) tutoring positions**. Tutors in the fall work in the CHC one fixed night per week, Sunday through Thursday, from 7:30-10:00pm.

Qualifications: Calculus through Math 115 with grades of no less than A-. Preference will be given to students who

- have also completed Math 117 (with a grade ≥ A-),
- are declared math majors,
- are considering becoming a math teacher or pursuing graduate work in mathematics, and
- have other tutoring experience (not necessary, though).

To apply for a position, send an email to Professor Paul Friedman (friedmap@union.edu) expressing your interest, listing your mathematical background, including coursework (term, professor, and grade) and tutoring experience (if any), and discussing why you think you would be a good tutor.

Application deadline: Friday, May 26 at NOON

MATH COACH for MATH 105

Math Coaches will attend and work with a section of MTH 105 in the fall to assist students with their understanding of course content.

For more information and to apply, use the QR code below. If you have questions, contact **Lesly Clay** at clayl@union.edu.

Don't Forget! Fall Term Pre-Approval Deadline is Wednesday, May 10