Department of Mathematics

May 23, 2022

UNDERGRADUATE MATH SEMINAR

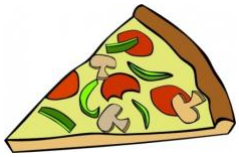
Professor Samuel Taylor

The next math seminar on the term will be

DATE: **THURSDAY, May 26**

Time & **12:30 –** Pizza lunch in **Bailey 204**

Location: **12:55 – 1:45** Seminar in **Bailey 207**



In this seminar, **Professor Samuel Taylor** from the Department of Mathematics at **Temple University** will present the following talk.

Title: Growth in Groups via Linear Algebra

Abstract: Finite groups are often studied using basic combinatorics and number theory, as in a first course in Abstract Algebra. For infinite groups, however, many of these techniques are unavailable. Since so many infinite groups play an important role in geometry and topology, different methods need to be developed for their study. In this talk, I'll introduce the *growth* of a group, which is perhaps the most basic notion of `size' when the group is infinite. As we shall see, for certain classes of groups, growth can be studied using properties of directed graphs and basic linear algebra. Our focus will be on some elementary (but important!) examples that require absolutely no previous background in group theory.

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 27 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.

TURN THE PAGE – THE NEWSLETTER CONTINUES

Pieces from Thesis – by Jack Andre

Jack *wrote his senior thesis this past winter under the supervision of Professor Jeff Hatley.*

When I look back on my writing experience, I recognize the amount of prior knowledge that I relied upon in order to understand and explain the complex mathematical concepts in my paper. In my expository thesis, I proved the primitive root theorem through a proof that consisted of number theory with a sprinkle of group theory. My biggest struggle was connecting these two areas of mathematics; however, it was definitely the most enjoyable part of my thesis. While completing a major, you learn group theory, number theory, linear algebra, abstract algebra, etc. but rarely see how they intertwine. The thesis experience connects the courses you have taken and you see how the theorems you learned and proved can be used to tackle complex ideas.

The primitive root theorem has many exciting applications, my favorite being its use in public-key cryptosystems. A cryptosystem is something that protects information when it is communicated across insecure channels. For instance, if you were to buy a product off Amazon, then your credit card information would need to be sent to Amazon for payment. However, hackers are trying to steal that information, so we developed cryptosystems to encode our information. The primitive root theorem allows us to find primitive roots which are vital in developing public keys.

If I had to give advice about thesis to underclassmen, I would pick a topic that you are truly passionate about. Researching and writing your thesis is hard, but it is so much easier and more enjoyable if you love what you are doing. Another piece of advice is to ask your advisor a ton of questions. My advisor always told me “there are no dumb questions.” Your advisor is there to help you and guide you, so ask them all the questions you can think of. My last piece of advice, which is applicable to anything, is to always do a little extra. Giving an extra 15% is not that hard, but it makes the world of difference.

Scenes from Steinmetz 2022

Pictured from this spring’s Steinmetz Symposium, clockwise starting from the right, we see **Adam Ginsberg, Zhebin Yin,** and **Xinchen Huang** giving presentations based on their math theses. **Jason D’Amico** also presented a poster (not pictured) based on his studies of gerrymandering. Congratulations on your hard work and fine presentations!