Department of Mathematics

May 9, 2022

~~UNDERGRADUATE MATH SEMINAR~~ Steinmetz Symposium!

In deference to the annual Steinmetz Symposium, **Friday, May 13**, there will not be a separate math seminar this week. Instead, we encourage you to attend the talks and to read the posters prepared by students in the math department (as well as many others!).

Session I Measurements and modeling in the physical sciences, ISEC 120

- 9:20 **Adam Ginsberg** Using Mathematical Functions to Express Harmonic Progression

Session II Cancer – Covid – HIV – Quantitative studies of serious disease, ISEC 120

- 10:50 **Xinchen Huang** Survival Analysis in Patients with Hepatocellular Carcinoma by Different Demographic and Tumor Characteristics
- 11:10 **Zhebin Yin** Diagnosing and Categorizing Lung Cancer Using Deep Learning
- 11:30 **Zekai Hu** Building Computational Models to Predict Survival Rate of Heart Failure Patients with COVID-19

Session III Poster Session – Wold Atrium

- 12:30 **Jason D'Amico** A Medial Axis-Based Compactness Measure Versus the Eye Test for Detecting Gerrymandering

HRUMC – A Wonderful Experience, by Professor Louisa Catalano

On Saturday April 30, a group of Union students and mathematics professors traveled to Siena College for the 28th Hudson River Undergraduate Mathematics Conference. The day featured over 60 talks from a variety of areas of mathematics such as Abstract Algebra, Applied Mathematics, Combinatorics, and Number Theory, including two talks from Union's own **Zhebin Yin** and **Professor Jeff Hatley**.

In addition to the Union talks, some of the fan-favorite topics included talks on origami, mathematical magic tricks, the evolution of zombies, and a statistical tour of the Barbie cinematic universe. The attendees also enjoyed a keynote address from Emeritus Professor Frank Morgan of Williams College, who talked about the best ways to tile the Euclidean and hyperbolic planes with various polygons.

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Pieces from Thesis – by Laura Vinton

***Laura** wrote her senior thesis this past fall and winter terms, supervised by Professor Roger Hoerl.*

During the fall and winter terms I completed my senior thesis with Professor Hoerl. I studied models that involved both mixture and process variables. A mixture variable is interesting because all the components must sum to 1. This results in difficulty when modeling a data set when these mixture terms interact with the process variables. Throughout the fall term, I studied literature regarding these types of variables and what models have been run with data sets of this form. The literature revealed that the best model is a fully linearized model. However, this type of model can get quite large very quickly, so part of my goal was to determine what other smaller models can compete with the fully linearized model. Using 4 data sets, I compared 4 other models to the fully linearized model. This revealed the 2 nonlinear models to seem to be the best alternatives. However, when modeling it is important to ensure that your model is not overfitting the data. To check this, you must have data that your model hasn't seen that it can try to predict. In order to do this, I fractionated the data sets systematically as indicated in the literature. This revealed that one of the two nonlinear models had major overfitting issues. Finally, I tried fractionating the data sets in a new way, using bootstrapping. Bootstrapping is random sampling with replacement. Using this method, I created a fraction of each data set proportional to the original data set that was used to create the model and let any remaining points serve as the hold out set used to evaluate prediction. In the end one conclusion I made was that one of the nonlinear models appeared to be the best alternative to the fully linearized model.

I found that writing a senior thesis to be such a rewarding experience. I had never worked on one project or topic for such a long period of time and in such a deep manner in my academic career. I really enjoyed being able to delve deeper into something I am interested in. Going into a senior thesis is definitely intimidating, but as soon as I started working with Professor Hoerl the intimidation became excitement. I found myself looking forward to our weekly check-ins regarding my progress, and excited about what I was going to be doing the next week. I would definitely recommend the experience to anyone, just make sure you are studying something you are excited about.

Fall Term Preregistration: Advising, Waitlisting this Week

The "waitlisting" process is this week, May 9 – May 13. For the fall term, only the following math courses are waitlist courses: Math 105, 110, 113, and Math 115H.

Courses beyond calculus: This fall, the Math Department will be offering several interesting courses beyond the calculus sequences that are suitable for math majors and minors.

- **Math 199** is the department's "bridge course," intended to help students make the transition from computationally oriented courses to more theoretical proof-writing courses. This is a **required** course for all math majors and minors that is *usually* taken after Math 115.
- **Math 219 – Discrete Mathematics**. In this course, topics studied may include graph theory, partially ordered sets, the Four-Color Theorem, and more. As a 200-level course, Math 219 is appropriate for students coming from Math 199, as well as more advanced students.
- **Math 235** – **Number Theory**. This course studies properties of the integers including divisibility, prime numbers, congruences, special number theoretic functions, and quadratic reciprocity. This is another good choice for students coming from Math 199, as well as more advanced students. Note that students generally may not take both Math 221 and Math 235 (Number Theory) – choose wisely!
- **Math 336 – Real Variable Theory.** is a core course that is **required** for math majors. In this course, you will learn some of the theoretical underpinnings of the calculus of functions whose domain lies within the set of *real* numbers.