Department of Mathematics

April 22, 2024

UNDERGRADUATE MATH SEMINAR

The next math seminar on the term will be

DATE: **THURSDAY, April 25**

Time & **12:30 –** Refreshments in **Bailey 204**

Location: **12:50 – 1:45** Seminar in **Bailey 207**

In this seminar, **Professor Kathryn Hess** from the École Polytechnique Fédérale de Lausanne (EPFL) in Switzerland the Union College math department will present the following talk.

Professor Kathryn Hess
Photo Credit, EPFL

Title: Of Mice and Men

Abstract: (With apologies to John Steinbeck...) Neurons from mouse brains and from human brains exhibit striking differences in shape when observed under a microscope. Since the precise shape of neurons plays an important role in their function, it is natural to ask to what extent to which these differences in neuronal shape play a role in the obvious behavioral differences between mice and humans.

In this talk I'll explain how topology - the mathematics of shape - can be applied to quantifying and characterizing the differences in shape between mouse and human neurons, as well the impact of these differences in neuronal shape on the complexity of the networks they form. No previous knowledge of topology or neuroscience will be assumed.

This talk is based on collaborations led by Lida Kanari of the Blue Brain Project.

Pieces from Thesis – by Lucas Kania

Lucas** wrote his senior thesis this past winter term, supervised by **Professor Paul Friedman.

This winter term, I delved into the intricacies of irrational numbers in my senior thesis. Unlike typical coursework, my thesis was an expository journey, building on proof techniques learned in earlier courses like Math 199, such as proof by contradiction and proof by mathematical induction.

My experience writing this thesis was transformative, pushing me to delve into theoretical frameworks beyond the standard curriculum. My thesis centered on a novel representation of real numbers, extending the foundational proof techniques to more complex theorems, while also proving the irrationality of famous mathematical constants along the way, such as $\sqrt{2}$, $\sqrt{3}$, and e. This venture into advanced mathematical reasoning was not only about establishing proofs but also about communicating these intricate ideas in a comprehensible manner.

One of the most intriguing aspects was proving a critical theorem that allowed for the representation of any real number through a specific summation form. This theorem provided a structured method for representing numbers beyond traditional base-10 decimal system. The proof itself was a meticulous process that involved detailed calculations and logical deductions, reinforcing the mathematical rigor required at this level of study.

For those embarking on a mathematical thesis, I recommend selecting a topic that sparks genuine curiosity. This passion will be your guide through the rigorous research and intricate proof processes. Engaging deeply with your advisor and leveraging their expertise can profoundly enhance your understanding and presentation of the material.

Reflecting on this experience, the thesis was more than an academic requirement; it was a pivotal growth phase in my mathematical journey, providing me a profound appreciation for the discipline's depth and intricacies.