Department of Mathematics

May 27, 2019

UNDERGRADUATE MATH SEMINAR

This week's seminar is the last seminar of this academic year. Please note that it will not be on its usual day, but will be on *Tuesday*.

DATE: Tuesday, May 28

Time & 12:30 pm – Refreshments in Bailey 204

Location: 1:00 pm – Seminar in Bailey 207

In this seminar, **Professor Andrea Pedeferri**, from the **Philosophy Department** at **Union College** will present the following talk.

Title: The Historical Roots of Gödel's Theorems

Abstract: At the beginning of "On formally undecidable propositions of Principia Mathematica and related systems" Gödel writes: "The development of mathematics toward greater precision has led [...] to the formalization of large tracts of it, so that one can prove any theorem using nothing but a few mechanical rules." In just few sentences Gödel summarizes a century of key developments in mathematics that made that period one of the most exciting and optimistic for the discipline. As Hilbert wrote in 1925 and in 1930 "we are all convinced that [...] in mathematics there is no ignorabimus", "We must know. We will know".

Then comes 1931. Gödel writes: "One might therefore conjecture that these axioms and rules of inference are sufficient to decide any mathematical question [...]. It will be shown below that this is not the case [...]. The precise analysis of this curious situation leads to surprising results concerning consistency proofs for formal systems." The impact of Gödel's results was immense.

In my talk I will follow the main developments of mathematics highlighted by Gödel in order to show how they are crucial to understand the impact and the reach of Gödel's theorems and to fully appreciate their dramatic but revolutionary nature.

Pieces from Theses, by Lijing (Christine) Wu

Christine's thesis was supervised by Professor Jue Wang

In winter term, I spent my time working on a thesis paper with Professor Jue Wang as my advisor. Since I am considering a career in actuarial science, I wanted to connect connected mathematics and actuarial work. My topic was Retirement Risks of China and America: Predictions and Preventions. This thesis introduced the history of the pension systems of both China and USA. The policies that influenced retirements are included, as well as the low-income and poverty and health insurance coverage in both countries. The method of risk prediction that is used in this paper is by using linear regression to build up the models of both China and USA. I also predicted the risk of some years and talked about various influences.

Before everything was started, I was very nervous because I had taken only one economics class. I was afraid that this would influence my understanding of some important contexts. At first, I had no idea about what I was going to do. However, I chose to meet with Professor Wang in fall term so that I could prepare something in advance. Professor Wang was so nice and she suggested I read articles about the topics that I may be interested in before making a decision on the topic. I read



Professor Andrea Pedeferri

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several papers about risk predictions, pension systems in different countries and future retirement strategies. They really helped a lot. After the topic had been chosen, I started to collect all the data I might use to set up the models in the thesis. I struggled in finding some of the data because you have to make sure that the data does not have too much correlation between each other. Once the models were made, we can learn more precisely about the retirement risk. By analyzing these outcomes, it helps to understand what parts of retirement risk play more important roles and what parts are insignificant. The mathematics I used in the was linear regression. It can be used to predict the risk in future years. The formula for linear regression is

 $Y = C_0 + C_1 * X_1 + C_2 * X_2 + C_3 * X_3 + \dots + C_n * X_n$

The variable Y in this formula is the longevity risk, $C_1, C_2, C_3, \dots, C_n$ are the coefficients, $X_1, X_2, X_3, \dots, X_n$ are the effects that may influence the risk. By analyzing the coefficients, we can know which parts are more important aspects that may have impacts on the risk.

During the process of writing thesis, I definitely learned a lot from Professor Wang. She taught me how to set up models by using Excel and answered all of my questions patiently. This thesis topic was a challenge for me but, during the term, I felt that I was achieving new knowledge instead of staying in the comfort zone to do things that are familiar to me. My advice is to always feel free to communicate with your adviser on any problems and as Francis Bacon says, 'A prudent question is one-half of wisdom.'

Seen at ReUnion 2019

Kicking off ReUnion weekend this past Friday, May 17, the math department hosted an informal gathering of alumni. About 15 - 20 former students, friends, and family from the Class of 1961 to the Class of 2018 stopped by to meet the faculty and to enjoy each other's company.







Problem of the Newsletter - May 27, 2019

Last week's problem: A solution to last week's problem is posted at the newsletter sites in Bailey Hall.

This week's problem: Here's another one from a recent national high school math competition – no googling!

Find, with proof, all pairs of positive integers (n, d) with the following property: for every integer S, there exists a unique non-decreasing sequence of n integers a_1, a_2, \ldots, a_n such that $a_1 + a_2 + \cdots + a_n = S$ and $a_n - a_1 = d$.

Professor Friedman (friedmap@union.edu) will accept solutions until noon on Thursday, May 30.