Goodsell Gazette

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Individual Comps Presentations

The following individual comps presentations will take place on Tuesday, February 24 from 3:30 p.m. in CMC 206.

Title: *p*-adic Analysis Compared with Real
Student: Suheng Cheng
Time: 3:30
Abstract: Just like the field of real numbers, the field of p-adic numbers can be constructed from the rational numbers as its completion with respect to a norm. This norm depends on the prime number *p* and this completion yields a normed field. The algebraic and structural properties will be subsequently carried out. I will also compare the topology of the field of real numbers and the field of p-adic numbers, and introduce some convergence properties of sequences and series in p-adic numbers.

Title: Projective Planes, Moore Graphs, and Steiner System
Student: Zach Walsh
Time: 4:00
Abstract:The number six has a remarkable combinatorial property that helps us in the construction of several different mathematical objects. This talk will describe this property, and then use it to construct the projective plane of order 4, the 5-(12,6,1) design, and the Moore graph of diameter 2 and valency 7. Before this can happen, basic concepts from graph theory and design theory will be introduced.

Title: The Unsolvability of the Word Problem
Student: Larkin Flodin
Time: 4:30
Abstract: Have you ever been working on a problem that seemed so hard, you weren't sure if it was even possible to solve? A similar situation was taking place 100 years ago with several problems in abstract algebra, until the development of computability theory gave us methods for showing that some problems actually are too hard to solve. In my talk, I'll examine some fascinating connections between algebra and computability theory that allow us to prove certain problems unsolvable, like the problem of deciding whether two differently-written elements of a group are the same.

Group Comps Gala

The following group comps presentations will take place on Thursday, February 26 from 3:30 p.m. in Olin 141. Dinner will be served after the presentations.

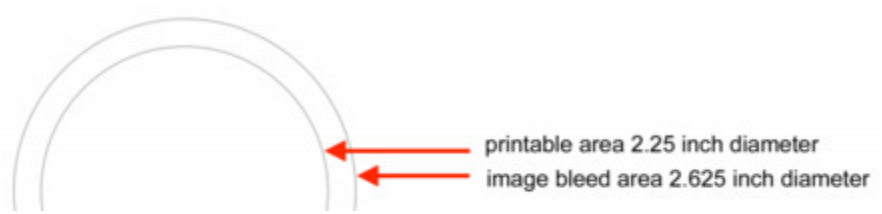
Title: Spatial Economics through a Mathematical Lens: City Structure and the Breakdown of General Equilibrium
Students: Preston Carlisle, Matt Godfrey, Will Salon, Wenth Wang
Time: 3:30
Abstract: In this presentation we present contemporary theories of economic geography in their mathematical forms. Specifically, we discuss the agglomeration and dispersion forces that determine city structure and human organization as well as the breakdown of general equilibrium in a spatial economy. We begin with an introduction of basic economic concepts like supply and demand and increasing return to scale. Subsequently, we discuss why traditional general equilibrium theories fail in the context of a spatial economy. We then present some major contemporary economic theories that take geographic factors into consideration and discuss their implications. Real-world examples of these theories are analyzed critically and include the organization of rice farms in Japan, social stratification of cities, and city shapes in India.

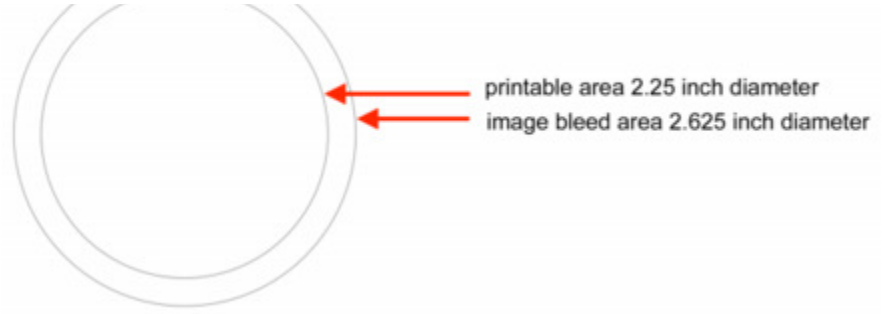
Title: Matching to Produce Causal Estimates in Non-experimental Settings
Students: Kaitlyn Cook, Tom Grodzicki, Harrison Reeder, Ji Min Yoo
Time: 4:30
Abstract: In perhaps every field, the most fundamental and most urgent research questions often take the following forms: "what is the relationship between X and Y? In particular, does X cause Y?" Given the importance of this type of research to identifying, understanding and solving humanity's problems great and small, statisticians and other practitioners have developed an entire discipline of causal inference devoted to uncovering and improving research methods that enable investigators to measure the size and significance of causal relationships between phenomena. In this paper, we reflect upon and extend the development of causal inference techniques in a variety of contexts: randomized experiments, observational studies, and even retrospective studies. We use a dataset capturing the effect of a job training program on unemployment in order to evaluate the performances of causal inference techniques in each of these types of study design, and also propose a novel approach to retrospective causal inference called the REC Score. We find that matching using the propensity score method in the prospective setting offers a marked improvement over non-matching approaches, and comes very close to recovering the experimental estimate; we further see promise in the REC Score matching analysis, whichbests all other retrospective analyses even though it does not perform as well as prospective approaches.

Title: Measuring Sets in Fractional Dimensions
Students: Jordy Cammarota, John Lee, Nami Sumida, Kan Wang
Time: 5:30
Abstract: Fractal sets, such as the Cantor set and the Sierpinski triangle, exhibit irregular properties. For example, the Cantor set is uncountable; however, it has length zero. This would suggest that the Cantor set is neither 0 nor 1-dimensional. Rather, it exists somewhere in between. In order to explore this concept, we will introduce another way to measure the Cantor set by examining the idea of fractional dimension. Along the way, we will show how the iterative construction of the Cantor set gives it the self-similarity property. We will exploit this property to explore the dimensions of other fractal sets.

Design the Math or Math/Stats Major Button

The Alumni Relations department is planning the Major Declaration Celebration and as part of that celebration, they'd like to give out buttons for the various majors. If you have an idea for a button design for either the Mathematics Major or the Mathematics/Statistics major, consider submitting it for consideration! The design must fit within the specific dimensions below. Please submit your ideas to Laura Chihara by the end of the term.





Job & Summer Opportunities

The Consumer Financial Protection Bureau (CFPB)
The CFPB's Office of Research (OR) is currently seeking Research Assistant candidates. Successful candidates will have a proven track record of academic excellence in one of the following areas: economics, mathematics, statistics, or computer science. Experience in R, SAS, or Stata programming as well as Excel, is also key. The application deadline is February 20. For more information, visit http://www.consumerfinance.gov/jobs/location.

U.S. Department of Homeland Security Domestic Nuclear Detection Office Summer Internship
The U.S. Department of Homeland Security (DHS) Domestic Nuclear Detection Office (DNDO) Summer Internship Program is a 10-week research program that provides opportunities for undergraduate and graduate students to participate in projects focused on helping DNDO meet its mission of "implementing domestic nuclear detection efforts for a managed and coordinated response to radiological and nuclear threats, as well as integration of federal nuclear forensics programs." Undergraduate students receive a stipend of $600 per week plus travel expenses. Areas of research include: engineering, earth and geosciences, computer science, mathematics, physics, chemistry, biological / life sciences, environmental science, and more.Â For details, visit https://www.zintellect.com/Posting/details/824.

Problems of the Fortnight

Problem 7:
A polynomial *p(x)* with integer coefficients takes the value 5 at five distinct integers. Prove that *p(x)Â* does not take the value 8 at any integer.

Problem 8:
In a finite sequence of real numbers the sum of any seven consecutive terms is negative and the sum of any eleven consecutive terms is positive. Determine the maximum number of terms in the sequence.

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