Goodsell Gazette

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Goodsell Gazette Changes

Notice anything different? The *Gazette* has changed its layout and delivery! However, we at the *Gazette* are still playing around with design and format, so if you have any feedback, do not hesitate to voice them!

NUMS 2014 is Here!

On Tuesday, October 7, several Carleton and St. Olaf students will present their summer mathematics or statistics research at the 2014 Northfield Undergraduate Mathematics Symposium. We'll be hosting this year's event here at Carleton, so all of the talks will be in CMC 209. Come find out about the mathematics and statistics your classmates did this past summer, and enjoy the lively conversation at dinner. Even if you can't stay for the whole event, you can still join the fun for a couple of talks. The schedule of events is below, followed by titles and abstracts for all of the talks.

Schedule of Events:

4:00 Uniquely Bipancyclic Graph
Zach Walsh, Carleton

4:30 A Mathematical Approach to Uncovering Regulatory Mechanisms in Calcium Homeostasis
Ben Liska, St. Olaf

5:00 Lasagna Dinner and Conversation

5:45 Chermak-Delgado Lattices of Metacyclic p-Groups
Kendra Johnson-Tesch and Brianne Power, St. Olaf

6:15 A Method for Combining Family-based Rare Variant Tests of Association
Kaitlyn Cook, Carleton

Abstracts:

Uniquely Bipancyclic Graphs
Zach Walsh, Carleton

A bipartite graph on n vertices, n even, is called uniquely bipancyclic (UBPC) if it contains precisely one cycle of length 2m for every $2 \leq m \leq n/2$. The concept of uniquely bipancyclic graphs was recently introduced by Dr. Walter Wallis of Northern Illinois University, who classified all UBPC graphs on at most 30 vertices. Namely, up to isomorphism, there is only one uniquely bipancyclic graph of order 4 and only one of order 8. There are precisely four uniquely bipancyclic graphs of order 14 and six of order 26. We used computer programs to show that if $32 \leq n \leq 56$, and $n \neq 44$, then there are no UBPC graphs of order n. We also found the six non-isomorphic UBPC graphs of order 44.

A Mathematical Approach to Uncovering Regulatory Mechanisms in Calcium Homeostasis
Ben Liska, St. Olaf

Calcium is a mineral essential to many systems of life. As such, the body regulates levels of calcium in the blood plasma very tightly through a process known as calcium homeostasis. The controlling mechanisms in this process include parathyroid hormone, calcitonin, vitamin D, and the mineral phosphate. Much research has been done on the biology of this system but it is not understood completely. Recently, work has been done to mathematically model this system, however, these models are very complex. In this talk, we will provide a simplified mathematical model of calcium homeostasis that still captures biologically relevant mechanisms. Using the modeling software COPASI (Hoops 2006), we will show numerical simulations and comparisons to experimental data. An analysis of the stability of our nonlinear model provides insights into our dynamical system. We will conclude by showing ways we can predict how various diseases can disturb calcium homeostasis and provide suggestions for further investigation that could lead to effective treatments.

Chermak-Delgado Lattices of Metacyclic p-Groups
Kendra Johnson-Tesch and Brianne Power, St. Olaf

The Chermak-Delgado measure of subgroup H in a finite group G is defined as $mG(H)=|H|\ |C\_G(H)|$. The subgroups with maximal Chermak-Delgado measure form a lattice of subgroups called the Chermak-Delgado lattice. This paper applies key properties of Chermak-Delgado lattices to split metacyclic p-groups. Moreover, we provide a complete Chermak-Delgado lattice for specific split metacyclic p-groups. Additionally, we describe a sublattice within the subgroup lattice of a split metacyclic p-group; we have reason to believe that this is a sublattice of the Chermak-Delgado lattice.

A Method for Combining Family-based Rare Variant Tests of Association
Kaitlyn Cook, Carleton

In statistical genetics, the current methods of detecting association between rare genetic variants and disease phenotypes often lack statistical power. To combat this lack of power, the use of pedigree data, in which rare variants are often more highly concentrated than in typical case-control data, has become increasingly popular. Methods for combining multiple gene-based tests of association into a single summary p-value are also a robust approach when little a priori knowledge is available about the underlying genetic disease model. However, to date, little consideration has been given to combining gene-based tests of association for the analysis of pedigree data. We propose a flexible framework for combining any number of family-based rare variant tests of association into a single summary statistic (p-value) and for assessing the significance of that statistic.

Mathematics & Statistics Colloquium

On Tuesday, October 14, Associate Professor of Mathematics at Kenyon College, Bob Milnikel ('92), will be speaking at 4:00 p.m. in CMC 206.

An Old Construction and a New Twist
It's well known that an exact straightedge-and-compass construction of a regular n-gon is impossible for most values of n, but that didn't keep people from needing to construct such polygons in the days when straightedge and compass were the principal tools of drafting. Professor Milnikel will introduce a historical technique for approximating a regular n-gon that works (more or less) for any value of n. Finally, he will introduce a slight variation -- original as far as he knows -- that improves the construction's accuracy. The material is very accessible! The only mathematical background needed is a little high school algebra and trigonometry.

Math at the Cow

Hang out with fellow math/stats majors at the Cow every Wednesday at 8:30 p.m. If you're new to Math at the Cow, it's a great time to get to know your peers in a more casual setting. You do not need to be 21 to attend.

University of Minnesota Biostatistics Graduate Program Open House

On Friday, October 17, the School of Public Health at the University of Minnesota, Twin Cities will be having their 15th annual Open House for the Division of Biostatistics Graduate Program. The Open House will consist of presentations by faculty and alumni, followed by a faculty meet and greet in which admission and graduate program questions will be answered. If interested, RSVP by 4 p.m. on October 14. For more information, visit http://sph.umn.edu/biostatistics/.

Seven Rivers Undergraduate Research Symposium

Viterbo University's 12th Annual Seven Rivers Undergraduate Research Symposium will be held on Friday, November 14, in La Crosse, WI. This symposium showcases the research and creative works of over 200 undergraduate students from a variety of disciplines and institutions. The symposium will run from 10 a.m. to 4:30 p.m. and includes a keynote address, lunch, and presentations by students. There is no fee associated with participation, but all attendees and presenters must register. For details, visit http://www.viterbo.edu/sevenrivers/.

Nebraska Conference for Undergraduate Women in Mathematics

The 2015 Nebraska Conference for Undergraduate Women in Mathematics at the University of Nebraska-Lincoln Department of Mathematics will be held January 23-25 in Lincoln, Nebraska. This conference brings together outstanding undergraduate female mathematicians at all stages of their careers. Registration is now open online for both presenters and non-presenters. Registration fills up quickly so interested students should think about signing up early. If interested, register at: http://www.math.unl.edu/~ncuwm/ncuwm_registration/.

Job & Summer Opportunities

InstaEDU Online Tutor

Become an online tutor in your favorite subjects and teach whenever you're free! As an InstaEDU tutor, you set your own schedule, make $20/hour, and work from wherever is convenient for you. For more information, visit https://instaedu.com/become-a-tutor/.

New York Fed Research Analyst

The Federal Reserve Bank of New York is seeking talented seniors for their Research Analyst position in the Research and Statistics Group. For details, visit www.newyorkfed.org/careers/current_undergrad_openings.html.

National Security Agency Summer Program

The Mathematics Research Group at the National Security Agency (NSA) offers a summer program, Director's Summer Program (DSP), for undergraduate mathematics students. This program gathers two dozen exceptional students to collaborate with each other and with NSA mathematicians on problems critical to the intelligence gathering and information assurance missions of the agency. The deadline for applications is October 15. For more information, visit www.nsa.gov/careers/opportunities_4_u/students/undergraduate/dsp.shtml.

Problems of the Fortnight

Problem 3:
Is it possible to cover a 25x25 checkerboard with 2x2 squares and 3x3 squares so that none of the squares overlap? (Combinatorialists call this a tiling.)

Problem 4:
You are given 200 points in the plane, no three collinear. 100 of these points are designated as out-points and the other 100 are designated as in-points. Is it necessarily possible to build 100 straight thin pipes each connecting an out-point to an in-point so that each outpipe is connected to an in-pipe and vice versa?

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