Colloquium Announcement
Thursday, September 27

Julian Wolfson, from the University of Minnesota Biostatistics Department, will talk on September 27, at 4 pm in CMC 206.

Playing in Everyone’s Backyard: My Life (So Far) as a Biostatistician.

Legendary statistician John Tukey once said “The best thing about being a statistician is that you get to play in everyone's backyard.” This is particularly true for biostatisticians, as we divide our time between research into new statistical methods for designing and analyzing biomedical studies and collaborative projects on an amazing diversity of topics. In this talk, I will introduce the field of biostatistics through real-world problems encountered in collaborations with (among others) pediatricians, epidemiologists, urban planners, and HIV researchers. Some of these problems have inspired my own statistical methods research, and most remain only partially solved. At the end of the presentation, I will give a brief overview of the Masters and PhD programs in biostatistics at the University of Minnesota.

Math Across the Cannon

Rebecca Goldin, Professor of Mathematics at George Mason University and Director of Research STATS, will be giving a two-part talk next Monday, October 1, one at Carleton and one at St. Olaf. More details in next week’s Goodsell Gazette issue.

Volunteers Needed

Math Students, the Carleton Center for Community and Civic engagement needs you to volunteer! Here are several great opportunities:

1. Through the one-on-one volunteer tutoring program, Carleton students will be matched up with Northfield students by the ACT center, and you can meet with them for an hour a week, typically in the Carleton or Northfield library. We need Math and Science tutors! Fill out a profile on: http://apps.carleton.edu/campus/act/tutoring/students/. If you have any questions please direct them to Danny Ulman (ulmand) or Rachel Clark (clarkr).

2. We also need volunteers for after school homework help on Mondays, Tuesdays or Thursdays from 3-5pm with the TORCH program at Northfield High School. Email Danny Ulman (ulmand) or Teddy Gelderman (geldermt) to sign up, or if you have any questions.

New Faculty:
Professor Rafe Jones

Exciting News: As we go to press we have just learned that Professor Jones and his wife Michelle welcomed Victoria Anne Sharp-Jones into the world Saturday night. She is 20.25 inches and 7 lbs 11 oz. Congratulations!

Professor Jones went to Amherst College as an undergraduate, spent a year in Paris taking classes at the Ecole Normale Superieure, and went to Brown University for his PhD. This
term, he is teaching two sections of Calc II. Jones’ personal victories include running the Boston Marathon and completing an expert level Minesweeper board in 65 seconds. He also “really wants to visit Idaho”. He loves speaking French, is accepting tips on cross-country skiing down hills without crashing, and is also curious about Carleton’s obsession with a bust of Schiller, so feel free to parler francais, give skiing advice, and try to explain Schiller to him. Welcome to Carleton, Professor Jones!

Career Opportunities

Consulting: Undergraduate backgrounds in science, math, and economics are key skills for a consulting career. At the Career Center during third week (Sep 24-28) you can come talk one-on-one with Carleton alumni about their jobs as consultants! Visiting alumni: Jeanette Rebar ’01, Project Manager, Grassroots Solutions; Jeff Appelquist ’80, Founder and President, Blue Knight History Seminars LLC; Ben Barclay ’10, Management Consultant, Deloitte Consulting; and Lena Tjosvold ’09, Brand Strategy, The Futures Company. Sign up for appointments through the Tunnel or come to the Career Center.

National Security Agency (NSA) Summer Programs: The Office of Mathematics Research at the National Security Agency (NSA) offers two exceptional summer programs for mathematicians on problems involving mathematics, statistics, data analysis, cryptology, and communication technology. Competitive pay and travel compensation. The application deadline is October 15, for more information visit nsa.gov.

Job Opportunity with Epic: Epic develops “the best healthcare software in the world” and is looking to hire exceptional people from computer science, math, and hard science backgrounds to fill software developer, technical services analyst, interfacing engineer, and reporting engineer roles. Alumni will be on campus Thursday, September 27. Tabling in Sayles 11:00 am-2:00 pm, Information Session in Leighton 304, 6:00-7:00 pm. Contact alumni Carl Smith ’11 or Tanya Bui ’12 for more information.

Free Practice Test Opportunity: On Saturday, September 29, you can take a free practice test (GRE, GMAT, LSAT, MCAT, DAT, OAT, or PCAT) from anywhere with internet access during Kaplan’s Free Practice Test Event. Space is limited, so if interested pre-register at bit.ly/carletonfallpt.

Apply To Be an Environment America Fellow: Environment America is hiring recent college graduates with the passion, commitment, and talent to stand up to polluters, organize public support, and fight for our environmental values. They are also hiring interns for winter break and spring term for non-seniors. Priority application deadline is Thursday, September 27. Apply at jobs.environmentamerica.org or contact Michelle Hesterberg ’11, mhesterberg@environmentamerica.org.

Northfield Undergraduate Mathematics Symposium

The Northfield Undergraduate Mathematics Symposium is next Tuesday, September 25, in CMC 206. Schedule as follows:

3:35 pm: Hannah Burson, St. Olaf
Explorations into the Lawn Mowing Problem: Specific Cases and General Trends

The general Lawn Mowing Problem has been determined to be an NP-complete problem through comparison with the Traveling Salesperson Problem. With applications to robotic routers and computer chips, the Lawn Mowing Problem has been studied in its own right with particular attention to special case algorithms. In this talk,
we provide a theoretical approach to understanding the general Lawn Mowing Problem by comparing lawn mowings to unique three dimensional paths. We then determine complete, and occasionally surprising, solutions to specific instances of the Lawn Mowing Problem.

4:00 pm: Adam Zweber, Carleton

Invariants of an Incidence Matrix Related to Rota's Basis Conjecture

Suppose you are given $n$ bases of an $n$-dimensional vector space. Additionally suppose that each basis is assigned a particular color: say the first basis is red, the second blue, etc. Then Rota's Basis Conjecture asserts that one can always repartition the multiset union of these bases into $n$ “rainbow bases”--that is, each new basis will contain exactly one vector of each color.

This innocent-looking conjecture has been open for over twenty years. In this talk we discuss the eigenvalues and Smith normal form of a particular matrix of ones and zeros which may be useful in solving this problem.

4:25 pm: Josh Wilson, St. Olaf

Linkless Embeddings of Permutation Graphs

Let $G$ be a graph on $n$ vertices, and let $\alpha$ be a permutation of the vertices of $G$. We define the $\alpha$-permutation graph of $G$ to be the graph formed by taking two copies of $G$ and joining a vertex $v$ of the first copy of $G$ to the vertex $\alpha(v)$ of the second copy of $G.$

On a rather different note, a linkless embedding of a graph is an embedding of the graph in $\mathbb{R}^3$ that has no interesting links, where by interesting links we mean two circles that you can't separate from each other. In this talk we'll explore some of the intersection between permutation graphs and graphs with linkless embeddings.

4:50 pm: Daoji Huang, Carleton

Understanding Spaces of Phylogenetic Trees

A classical problem in computational biology is the construction of a phylogenetic tree from a sequence alignment of $n$ species. The work by Billera, Holmes, and Vogtmann (2001) provides a construction of a space $T_n$ of such metric trees, which is shown to have a CAT(0)-structure, enabling the computation of geodesics and centroids. Due to its conical structure, the essential combinatorial characteristics are encoded in its cross section $L_n,$ which is a simplicial complex. We describe $L_n$ in the language of associahedron and permutohedron, which are famous classical polytopes that encapsulate algebraic information.

An alternate phylogenetic tree space introduced by Kim (2000), known as the "space of phylogenetic oranges", is a more general tree space that captures forests rather than trees. Moulton and Steel (2004) proved that the space is a contractible CW-complex that admits a regular cell decomposition. We study the connection between these two important tree spaces by decomposing a quotient map into discrete folds and continuous collapses.

5:20 pm: Pizza Dinner and Conversation

6:00 pm: Ben Perez, St. Olaf

Betti Tables of Line Arrangements

A line arrangement is simply a collection of intersecting lines in projective space. These are degenerate curves that exhibit somewhat more diverse behavior than their smooth counterparts. Despite their complex structure, however, they are easy to think about in that they can be modeled as graphs.

In algebraic geometry, curves are thought of as ideals (or systems of equations, if you like). A Betti table is a systematic way to keep track of the relations between the generators of a curves defining ideal. These are often difficult to compute by hand, and there are few theorems that allow one to go easily between ideals and Betti tables.

My talk will examine how certain properties of graphs can tell us something about the curves they represent. Furthermore, I will give equa-
tions that allow us to go directly from graphs of low genus to Betti tables, rather than getting caught up in some rather nasty homological algebra.

6:25 pm: Ben Strasser, Carleton
A Characterization of the Prime Graphs of Solvable Groups

For any finite group $G$, the prime graph of $G$ is the graph whose vertices are the prime divisors of $|G|$, in which primes $p$ and $q$ are adjacent whenever $G$ has an element of order $pq$. For example, the prime graph of a finite cyclic group is the complete graph on the set of prime divisors of its order. In this talk we characterize the prime graphs of solvable groups, and we discuss some consequences of our characterization.

6:50 pm: Ashley Earls, St. Olaf
Labeled Oriented Intervals That Are Not Diagrammatically Reducible

A virtual knot, from a graph theoretic point of view, is an arbitrary (not necessarily planar) 4-regular graph. Each long virtual knot corresponds to a labeled oriented interval (LOI) whose edges encode 4-sided tiles which match the crossings of the knot. A spherical diagram is a tessellation of the surface of a sphere with these tiles and their mirror images. A spherical diagram is called reduced if no tile is adjacent to its mirror image. If a LOI has no reduced spherical diagram, it is called diagrammatically reducible (DR). In this project, we looked for similarities among LOIs which are non-DR.

7:15 pm: Christophe Dethier, Carleton
T-segment Graphs and Variations

A T-segment representation is a way of representing the key information contained in a graph using line segments intersecting in the plane. A T-segment graph is a graph which can be represented in this way. This presentation will focus on results involving T-segment graphs, as well as their variations and generalizations. It will also include a few of the most important open questions about these graphs, along with some possible methods of proof.

PROBLEMS OF THE WEEK

1. Let $a$ and $b$ be positive constants with $b > 1$. Given that $x + y = 2a$ and all values of $x$ between 0 and $2a$ are equally likely, find the probability that $xy > \frac{(b^2-1)a^2}{b^2}$.

2. How many real numbers $x$ satisfy the equation $\left\lfloor \frac{x}{2} \right\rfloor + \left\lfloor \frac{x}{3} \right\rfloor + \left\lfloor \frac{x}{5} \right\rfloor = x$? (Note: Here $\lfloor y \rfloor$ is the greatest integer less than or equal to $y$. For example, $\lfloor \pi \rfloor = 3$ and $\lfloor -1.3 \rfloor = -2$.)

The first of last week's problems generated quite a few responses. I received correct solutions from Jordan Cahn, Adam Locroix, Emily Pollard, Matthew Rathkey, and Ben Strasser. Congratulations! Alas, as of press time, I have yet to receive any correct solutions to the second problem. You may still get credit for a correct solution to that problem if I receive it before I post my own solution. When multiple correct solutions are received, as was the case here, a prize winner is chosen at random. Ben Strasser won the lottery and should stop by CMC 217 to collect a prize from the BBOP (Big Box of Prizes). You can earn a chance to visit the BBOP by correctly solving one or both of the above problems. As always, to be mentioned in next week's Gazette, you have until Tuesday night to turn in a solution.

- Gail Nelson