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Get Ready for Math Across the Cannon, happening on Thursday, April 28th!

University of Washington mathematician Sara Billey will soon be visiting Carleton and St. Olaf for Math Across the Cannon! Dr. Billey does amazing research in algebraic combinatorics, is a recipient of the prestigious Presidential Early Career Award, and holds the official title of "the most famous Sara in math".

She will give two talks on Thursday, April 28th. The first talk, "Trees, Tanglegrams and Tangled Chains" will be at St. Olaf at 3:30 p.m. in Regents Hall 410 and is intended for a mathematical audience. The second talk, "Computer Assisted Proofs: coming soon to a theorem near you!" will be at Carleton's Weitz Cinema at 7:00 p.m. and is intended for a general audience. Receptions will precede the St. Olaf talk and follow the Carleton talk.

Abstract, "Trees, Tanglegrams and Tangled Chains": Tanglegrams are a special class of graphs appearing in applications concerning cospeciation and coevolution in biology and computer science. They are formed by identifying the leaves of two rooted binary trees. We give an explicit formula to count the number of distinct binary rooted tanglegrams with n matched vertices, along with a simple asymptotic formula and an algorithm for choosing a tanglegram uniformly at random. The enumeration formula is then extended to count the number of tangled chains of binary trees of any length. This includes a new formula for the number of binary trees with n leaves. We also give a conjecture for the expected number of cherries in a large randomly chosed binary tree and an extension of this conjecture to other types of trees. This talk is based on recent joint work with Metjaz Konvalinka and Frederick (Erick) Matsen IV posted at http://arxiv.org/abs/1507.0496.

Abstract, "Computer Assisted Proofs: coming soon to a theorem near you!": Computers allow us to compute a million digits of pi, the delivery routes for UPS drivers all over the country each day, and optimal ways to invest in the stock market. Usually the ways computers are used is to calculate numbers or manipulate data. However, there is a growing field at the intersection of mathematics and computer science where computers are being used to help prove theorems. Some famous theorems with computer assisted proofs still have no known traditional proof like the 4 Color Theorem and the proof of Kepler's conjecture. We will discuss examples of theorems with traditional proofs and computer assisted proofs, survey some history of computer assisted proofs, and describe how computer assisted proofs and formal verification systems are helping companies like Amazon and Boeing to improve their products. This talk should be accessible to everyone and does not assume any advanced mathematics background.

Juniors: Upcoming Math & Math/Stats Comps Topics Are Here!

Juniors: curious about what kinds of comps topics will be offered next year? Attend the announcement of next

year's comps topics for the Math & Math/Stats Department on Tuesday, April 26 from 3:30 until 5:00 p.m. in CMC 206! It will be your best opportunity to hear details of the various comps projects: professors will introduce their topics to you! The entire department looks forward to seeing you there!

If you find yourself unable to attend, all majors will be contacted via email on Wednesday, April 27 with information about each topic as well as how to express your preferences.

Math in Cinema: *The Man Who Knew Infinity*
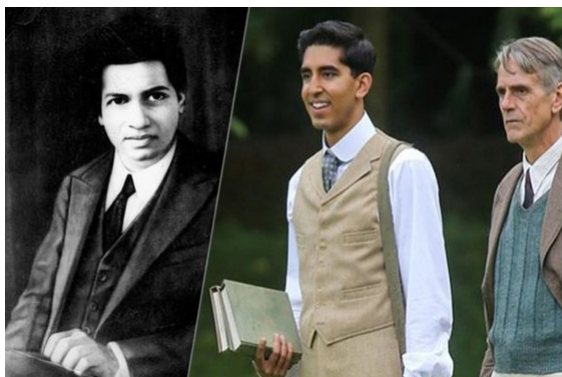
Left, a photo of Srinivasa Ramanujan. Right, Ramanujan as played by Dev Patel and G.H. Hardy as played by Jeremy Irons inÃ,Â *The Man Who Knew Infinity.*

Good Will Hunting, A Beautiful Mind, and *The Theory of Everything* are all excellent movies in which math plays a central role. Alas, such movies can be few and far between. But fear not! Keep your eyes out for *The Man Who Knew Infinity,* a biographical drama whose narrative centers around the life and accomplishments of Srinivasa Ramanujan, an Indian mathematician who made immense contributions to the study of analysis, number theory, infinite series, and continued fractions. What makes his life all the more remarkable is that for much of his life, Ramanujan had no formal mathematical training!

The film has already been released internationally, but the U.S. theatrical release will happen on April 29th! (And if you're *really* interested in Ramanujan, there's also a film that was released in 2014 as a collaboration between Indian and British cinema titled simply *Ramanujan* that views Ramanujan's life through a different (although similar) lens.)

Work Opportunites in the Math & Stats Department

Are you looking for a job to fill your work-study hours next year? The Mathematics & Statistics Department is looking for course graders, lab assistants, someone to edit the Gazette, and an office assistant. Applications are due by April 22 and can be found at https://apps.carleton.edu/curricular/math/resources/. (The same page also has a link to the application for working as a tutor in the Math Skills Center!)

Job & Internship Opportunities

Carleton College: Horton Global Scholarship
Would you benefit from studying abroad, but are currently not thinking about doing so for financial reasons, because of competing academic goals, or because of status as a first-generation college student? In November 2015, Horton, Inc. donated money to the Minnesota Private College Fund for a scholarship supporting students studying business or in science, technology, engineering and math (STEM) fields. Each MPCC school, including Carleton, will award one $3000 scholarship annually for the next three years. First-years, sophomores, and junior economics, computer science, physics, chemistry, biology, geology, math and math/stats majors are all welcome to apply.

More information about the application process (as well as the application itself) can be found at https://apps.carleton.edu/curricular/ocs/money_matters/carletonscholarships/horton/.

BMS Intermediaries: Accounting and Claims Analyst

BMS Intermediaries is seeking an Accounting and Claims Analyst. Analysts work with the general assistance of and support from senior team members and will provide technical reinsurance expertise for clients, reinsurers, and BMS operating productions units. Candidates are required to have a Finance, Mathematics, or Economics major, work well in collaborative environments, and have advanced skills in the Microsoft Office Suite of programs.

BMS offers competitive salary, 401k plans, insurance including life, health, dental, vision, and both short- and long-term disability. Visit the Tunnel to learn more about the position and to apply!

Problems of the Fortnight

Solutions to these problems are due by Tuesday, April 26 at noon. You may notice that there is one more problem than usual; the third one is a corrected version, with apologies, of problem 2 from March 4.

1. Find

$$\lim_{N \to \infty} \lim_{n \to \infty} \sum_{k=1}^{N} \left(\frac{2016}{n}\right)^k \binom{n}{k}.$$

(As usual, $\binom{n}{k}$ denotes the binomial coefficient "n choose k".)

2. Let f be a continuous function which is defined for all real numbers. Show that f is periodic if and only if there exist real numbers k and T such that $T > 0$ and such that for all real numbers a,

$$\int_a^{a+T} f(x)\, dx = k.$$

3. In this problem we consider functions f, defined for all real numbers, with the property that $f(f(x)) = -x$ for all x.

    a) Does a continuous function with this property exist? If so, give an example; if not, show why not.

    b) Does a function with this property exist whose graph, with the possible exception of points with integer values of x, consists only of straight line segments? Again, if so, give an example; if not, show why not.

      Thanks to the generosity of Loren Larson, who taught at St. Olaf for many years and at Carleton for several, the Big Box O' Prizes has received a very substantial infusion of splendid books, so if you needed more incentive to turn in solutions, this might give you the extra nudge. (You should also check out the new wooden game board by Loren in the waiting area outside CMC 217.) The first beneficiary of the new expanded selection will be Mikyla Carpenter, who solved the "April Fool's" problem from two weeks ago. Correct solutions to that problem also arrived from Marshall Ma, from "Auplume", and from John Snyder (using *Mathematica*). Meanwhile, the second problem (about the blocks) from April 1 is still awaiting solution ...

<div align="right">- Mark Krusemeyer</div>

Having trouble seeing the problem of the fortnight? Try enabling images for the message.

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