Spring Term Comps Gala!

Thursday, May 21, 3:30-6:00 in Olin 141
Dinner will be provided for those attending the talks

2nd Grade Challenge Math
Aparna Dua, Hannah Breckbill, Luke Hankins, Rob Trettin
Was the regular math curriculum not challenging enough when you were in second grade? This comps group created a curriculum for Challenge Math pull-outs to be run by parents as a mathematical enrichment for second graders. Come hear about their adventures in second grade.

Weighted Voting Systems
Elissa Brown, Chrissy Donovan, Charles Noneman
Weighted voting is the obvious solution when one desires a decision-making procedure in which some participants should have more influence than others (e.g., stockholders in a corporation, decision making power should reflect amount of stock owned). Unfortunately, counter-intuitive and paradoxical outcomes arise in such systems. In particular, power is not necessarily proportional to number of votes. Our first step towards understanding what can happen and why is to try to count all the possibilities.

Many Thanks

We would like thank all of the math graders, math lab assistants, stats lab assistants, assistant system administrators, math department office assistants, and Math Skills tutors for all of their hard work this year. We do appreciate all that you do for us and thank you all for a great year. We invite you to stop by the Mathematics Department on May 28 from 1:30-3:30 p.m. for some treats as a thank you!

Job in Institutional Research

Carleton’s Office of Institutional Research has available a Research Intern position for Summer 2009. The Intern will work with IR staff on research projects and reports. The work is generally quantitative and requires skills in at least three of the following areas: research methods, survey research, analysis, statistical techniques, Web design, and computer-based skills. The position requires skills in Excel, expertise with Microsoft Office products, and good writing. Familiarity with SPSS or another statistics package, HTML/web-based programming or Dreamweaver are desired. One course using basic statistics is also desirable. This position will be open June 15. From June 15 to July 17, it is full-time; from July 21 to Aug. 22 time is negotiable. Availability to work with the Writing Portfolio evaluation the week after Commencement is essential, and there is the possibility to extend the position into Fall at 5 – 10 hours per week. For more information, contact: Jody Friedow, Assistant Director of Institutional Research and Assessment jfriedow@carleton.edu 222-4284; Application Deadline: May 27.
**Course Descriptions, Fall 2009**

Math 236: Mathematical Structures  
**Prerequisite:** Math 232 or permission  
**Instructor:** Deanna Haunsperger  
**Time:** 2a

The great architectural wonder that is mathematics cannot be built up without mathematical clay (logic, axiomatic systems, set theory, and algebraic structures) or without mathematical tools (techniques of proof and problem solving). You’ll get your hands dirty with these and more while building (or strengthening) your own mathematical foundation in preparation for the edifice of higher mathematics. Along the way we’ll have some fun asking and answering many questions about set theory and graph theory. For example, we’ll discover the shocking fact that not all infinite sets are the same size, and we may discover which infinite set is “biggest.”

Math 244: Geometries  
**Prerequisite:** Math 236  
**Instructor:** Steve Kennedy  
**Time:** 3a

Goethe described it as “the fountain of all truth,” Plato said it’s how god thinks, Poincaré said it’s how you think, Edna St. Vincent Millay called it, “Beauty bare.” It has been inspiring poets, philosophers, scientists and schoolboys/girls for 3000 years. It’s geometry. Come see what all the fuss is about. We’ll start with a quick revisit to Euclid’s Elements, quickly skim over a couple of millennia of progress and then wallow in the creations of the last few centuries. We’ll learn some fabulous theorems about circles and triangles that, had they been known, would have delighted Euclid. Then we’ll wander in non-Euclidean space and learn some stuff that would have absolutely flipped him out—it should have the same effect on you. Required for prospective high-school teachers, recommended for anyone interested in really cool ideas.

Math 265: Probability  
**Prerequisite:** Math 211  
**Instructor:** Katie St Clair, Laura Chihara  
**Time:** 3a, 5a

If the “immortal monkey” randomly strikes keys on a keyboard for eternity, what is the probability that it will eventually produce the complete works of Shakespeare? If in a small town, out of 12 accidents that occurred in June 1986, four of them occurred on Friday the 13th, would this confirm your hunch that “13” is unlucky?

Probability is a fundamental branch of mathematics and is the foundation for all methods of statistical inference. In this course we will use the tools of counting and calculus to model random events, compute probabilities, and have lots of fun with balls in urns, poker hands, and coins and dice (fair or otherwise).

Math 321: Real Analysis I  
**Prerequisite:** Math 236  
**Instructor:** Gail Nelson  
**Time:** 4a

Why does calculus work the way it does? In this course we will take a close look at the theory behind the problems you did in those earlier courses. Everything in calculus is in some way based on looking at things up close, that is, taking a limit. For the most part, in calculus courses one sees examples and problems where things work out well. However, one should proceed with caution. For example, there are times when interchanging the order of operations defined by limits gives different results. In order to understand why this can happen, we will be taking a very close look at limits and these objects we call functions of a real variable. Issues surrounding these functions appear in many different places including differential equations, complex analysis, dynamical systems, and probability. This course is highly recommended for anyone considering grad school.
**Math 332: Advanced Linear Algebra**  
**Prerequisite:** Math 232 and 236  
**Instructor:** Jack Goldfeather  
**Time:** 2a

What links the study of waves in physics, digital image analysis and compression in computer science, web search engines like Google, and population dynamics in ecology? The answer is linear algebra. In Math 232, you were introduced to the concepts of vector space and linear transformation, and used them to explore some elementary applications. You probably won’t be surprised to hear that this is only the “tip of the iceberg”. For example, you learned if a matrix is diagonalizable, then the underlying linear transformation it represents has a simple geometric description in terms of scaling, projection, rotation, and reflection. How can this be generalized to the non-diagonalizable case? You will find out in this course as we explore the surprising relationship between linear transformations, the complex numbers (and other fields), and polynomials.

**Problems of the Week**

1. The small prairie town of Wohascum Center, Minnesota is laid out in no-nonsense fashion as a rectangle subdivided by a square grid, with equally spaced north-south streets and east-west avenues forming blocks that are perfect squares. A long-time resident has found that there are exactly 792 ways to bicycle from the extreme northwest corner of town (where he lives at the corner of First Street and First Avenue) to the intersection at the southeast corner (where he works) efficiently, that is, by heading either east or south to begin with and also at each subsequent intersection. However, now that the frost is out of the ground, all four sides of the central block of the town are under construction, and so he now avoids bicycling along any side of that block (although he is willing to pass through an intersection at a corner of the block). With this constraint, how many different ways does he still have to bicycle to work efficiently?

2. A bishop moves diagonally (as usual) on the white squares of a rectangular “chessboard”, starting in one corner. When the bishop reaches a square along any of the edges of the board, it makes the only possible right-angle turn and continues moving diagonally. When the bishop reaches a corner (where no turn is possible) it simply reverses direction. Depending on the dimensions of the “chessboard”, the bishop may or may not visit all the white squares; for example, on a square board the bishop will never get off its original diagonal, but on a 7 x 8 board the bishop will visit all the white squares. Find a necessary and sufficient condition on \( m \) and \( n \) for the bishop to visit all the white squares on an \( m \times n \) board.

Alas, nothing new to report. Good luck on the new problems, and on any earlier problems you may still be considering!

- Mark Krusemeyer