

Seminar & Events Bulletin: Student Combinatorics Seminar

01-01-2012 to 06-30-2012

Monday, January 09, 2012	
4:00pm-5:00pm	Student Combinatorics Seminar -- () <i>Cookies and Planning</i> -- 3088 East Hall
Monday, January 23, 2012	
4:00pm-5:00pm	Student Combinatorics Seminar -- Harry Altman (U Michigan) <i>Some q-binomial identities</i> -- 3088 East Hall
Monday, January 30, 2012	
4:00pm-5:00pm	Student Combinatorics Seminar -- Robert Walker (U Michigan) <i>Q-analogues, Part II: A "Steampunk" version of Fleck's congruence.</i> -- 3088 East Hall
Monday, February 06, 2012	
4:00pm-5:00pm	Student Combinatorics Seminar -- Kevin Carde (U Michigan) <i>Classical Invariant Theory</i> -- 3088 East Hall
Monday, February 13, 2012	
4:00pm-5:00pm	Student Combinatorics Seminar -- Michael Chmutov (U Michigan) <i>Knotting the (Iwahori)-Hecke algebra</i> -- 3088 East Hall
Monday, February 20, 2012	
4:00pm-5:00pm	Student Combinatorics Seminar -- Chris Fraser (U Michigan) <i>K-theory for Kombinatorialists</i> -- 3088 East Hall
Monday, March 05, 2012	
4:00pm-5:00pm	Student Combinatorics Seminar -- Shifra Reif (U Michigan) <i>Affine Lie algebras and the Weyl-Kac character formula</i> -- 3088 East Hall
Monday, March 12, 2012	
4:00pm-5:00pm	Student Combinatorics Seminar -- Max Glick (U Michigan) <i>Why do type A cluster algebras work?</i> -- 3088 East Hall
Monday, March 19, 2012	
4:00pm-5:00pm	Student Combinatorics Seminar -- Anna Bertiger (Cornell) <i>The Combinatorics of the Action of the Symplectic Group on Flags(C^{2n})</i> -- 3088 East Hall
Monday, March 26, 2012	
4:00pm-5:00pm	Student Combinatorics Seminar -- Stefan Froehlich (UM) <i>The Probabilistic Method</i> -- 3088 East Hall
Monday, April 02, 2012	
4:00pm-5:00pm	Student Combinatorics Seminar -- Will Drobný (U Michigan) <i>The RSK Algorithm</i> -- 3088 East Hall
Monday, April 09, 2012	
4:00pm-5:00pm	Student Combinatorics Seminar -- Various Students (U Michigan) <i>Bring Your Work to Work Day!</i> -- 3088 East Hall

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Abstracts

Student Combinatorics Seminar
Monday, January 09, 2012, 4:00pm-5:00pm
3088 East Hall
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Cookies and Planning

Come eat cookies while we plan our semester!

Student Combinatorics Seminar
Monday, January 23, 2012, 4:00pm-5:00pm
3088 East Hall
Harry Altman (U Michigan)
Some q -binomial identities

I will recall some identities and congruences of binomial coefficients and present their q -analogues. This is largely setup for Robert's talk next week so this will mostly be pretty basic.

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Student Combinatorics Seminar

Monday, January 30, 2012, 4:00pm-5:00pm

3088 East Hall

Robert Walker (U Michigan)

Q-analogues, Part II: A "Steampunk" version of Fleck's congruence.

Some binomial coefficient identities are proper/strong in the sense that they read as "THIS equals THAT," where THIS could look fairly complicated, while THAT strikes us as non-intimidating or elementary; other identities are improper/weak, not reading as "THIS equals THAT," such as modular congruences. For instance, compare (1) "the alternating sum across row $n > 0$ of Pascal's triangle equals 0" with (2) Lucas' theorem. As noted in the previous seminar, the q -binomial coefficients are polynomial cousins of traditional binomial coefficients. If you insert these relatives into classical binomial coefficient identities, perturbing the latter results, then q -analogues of those identities can be unveiled; for example, (1) becomes the Gaussian Formula, and (2) the q -Lucas theorem. Let's call a result of this process a " q -binomial perturbation."

In 1913, Fleck proved that if p is any prime integer, there is a simple formula for bounding (from below) the multiplicity of p in a "modularly-defined" sum of signed binomial coefficients. This result is known as Fleck's congruence. Algebraist Andrew Schultz and I manufactured a q -binomial perturbation of Fleck's sum, and we asked if this perturbation admits a congruence property like Fleck's congruence. It does. In fact, our q -binomial congruence synthesizes each of Fleck's result, the Gaussian Formula and a third binomial coefficient identity. This new congruence (along with some context and questions, time permitting) will be the subject of my talk. I will aim to provide sufficient background for the talk to be student-friendly (even for fellow first-years!), and to embed some humor as well.

Student Combinatorics Seminar

Monday, February 06, 2012, 4:00pm-5:00pm

3088 East Hall

Kevin Carde (U Michigan)

Classical Invariant Theory

Classical invariant theory studies polynomials invariant under the action of a linear group. The First Fundamental Theorem for a given linear group specifies the invariants, and the Second Fundamental Theorem gives the relations among invariants. In this talk, I will outline some basic approaches to classical invariant theory, focusing primarily on the case of $SL(n)$.

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Student Combinatorics Seminar

Monday, February 13, 2012, 4:00pm-5:00pm

3088 East Hall

Michael Chmutov (U Michigan)

Knotting the (Iwahori)-Hecke algebra

The Iwahori-Hecke algebra is a q -analogue of the group algebra of a Coxeter group. In this talk we will exploit the connection between the braid group and the symmetric group to produce invariants of knots via the Hecke algebra. If time permits we will also briefly mention other places where the Hecke algebra comes up (quantum Schur-Weyl duality, Verma module multiplicities, Schubert calculus, modular forms).

Student Combinatorics Seminar

Monday, February 20, 2012, 4:00pm-5:00pm

3088 East Hall

Chris Fraser (U Michigan)

K-theory for Combinatorialists

In this talk I aim to convince combinatorialists why they might care about the words "K-theory". In particular, I will define the K-theory of an algebraic variety, focusing on some results on the K-theory of the Grassmannian. These results generalize "usual" intersection theory on the Grassmannian-- which is to say, Schubert calculus. If time permits, I will discuss some other K-theory directions one can go in. I plan on stating everything I use (including some necessary geometric prerequisites), but the talk will be the most satisfying if you have been sitting in on the Schubert Calculus class (which will closely mirror my talk).

Student Combinatorics Seminar

Monday, March 05, 2012, 4:00pm-5:00pm

3088 East Hall

Shifra Reif (U Michigan)

Affine Lie algebras and the Weyl-Kac character formula

Affine Lie algebras is one of the most important classes of infinite dimensional Lie algebras. One of their remarkable properties is that their integrable representations admit a Weyl character formula.

We will introduce these algebras as a natural infinite dimensional version of simple Lie algebras and show applications of their character formula to number theory. We will begin with recalling the theory of semisimple Lie algebras.

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Student Combinatorics Seminar

Monday, March 12, 2012, 4:00pm-5:00pm

3088 East Hall

Max Glick (U Michigan)

Why do type A cluster algebras work?

Ptolemy's theorem states that the four side lengths a, b, c, d and the two diagonal lengths e, f of a cyclic quadrilateral satisfy the relation $ef = ac + bd$. Suppose we have a triangulated polygon with positive real weights on each of its sides and diagonals. We can perform a "flip" by erasing a diagonal and drawing its complementary diagonal weighted in such a way that Ptolemy's identity holds in the surrounding quadrilateral. Amazingly, the weight of any diagonal reached after a sequence of such flips is independent of the sequence of flips chosen.

I will outline a proof of this fact that involves hyperbolic geometry. Both the result and the proof can be generalized to the setting of triangulations of oriented surfaces. Cluster algebras, introduced by S. Fomin and A. Zelevinsky, describe an even more general class of dynamical systems. Time allowing, I will give basic definitions and results pertaining to cluster algebras.

Student Combinatorics Seminar

Monday, March 19, 2012, 4:00pm-5:00pm

3088 East Hall

Anna Bertiger (Cornell)

The Combinatorics of the Action of the Symplectic Group on $Flags(C^{2n})$

I will present the seemingly geometric problem of understanding the orbits of the action of the symplectic group on the flag manifold and a very combinatorial plan of attack for studying this problem. Along the way we will meet such combinatorial objects as involutions, permutations matrix Schubert varieties, and pipedreams and also investigate unions of matrix Schubert varieties. I intend for this talk to be friendly with all of the appropriate notions defined.

Student Combinatorics Seminar

Monday, March 26, 2012, 4:00pm-5:00pm

3088 East Hall

Stefan Froehlich (UM)

The Probabilistic Method

I will provide a proof and applications of the Lovász Local Lemma, a useful tool in the probabilistic method.

If a set of events in a probability space are mutually independent and each occurs with probability less than 1, then the probability that none of the events will occur is positive. The Lovász Local Lemma can be used to get the same result while loosening the assumption to there being "much independence" among the events.

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Student Combinatorics Seminar
Monday, April 02, 2012, 4:00pm-5:00pm
3088 East Hall
Will Drobny (U Michigan)
The RSK Algorithm

The Robinson-Schensted-Knuth (RSK) algorithm establishes a bisection between permutations in S_n and pairs of Standard Young Tableaux of size n of the same shape. In this talk, we will discuss the algorithm and some of its geometric realizations, including growth and shadow diagrams.

Student Combinatorics Seminar
Monday, April 09, 2012, 4:00pm-5:00pm
3088 East Hall
Various Students (U Michigan)
Bring Your Work to Work Day!

6 combinatorialists, 7 minutes each. Come hear what we're thinking about!