UNIVERSITY OF MICHIGAN
Department of Mathematics

Seminar & Events Bulletin: Combinatorics

01-01-2013 to 06-30-2013

Friday, January 18, 2013	
4:10pm-5:00pm	**Combinatorics** -- Tomoo Matsumura (KAIST) *(Factorial) Schur functions and weighted Grassmannians* -- 3866 East Hall

Friday, February 01, 2013	
4:10pm-5:00pm	**Combinatorics** -- Andreas Blass (University of Michigan) *Shelah's bipartite matching algorithm* -- 3866 East Hall

Friday, February 08, 2013	
4:10pm-5:00pm	**Combinatorics** -- Michael Shapiro (Michigan State University) *Growth rate classification for cluster algebras* -- 3866 East Hall

Friday, February 22, 2013	
4:10pm-5:00pm	**Combinatorics** -- Li Li (Oakland University) *Positivity and tameness in rank 2 cluster algebras* -- 3866 East Hall

Friday, March 01, 2013	
4:10pm-5:00pm	**Combinatorics** -- Alexander Barvinok (University of Michigan) *Thrifty approximations of convex bodies by polytopes* -- 3866 East Hall

Friday, March 15, 2013	
4:10pm-5:00pm	**Combinatorics** -- Bruce Sagan (Michigan State University) *Factoring the characteristic polynomial of a poset* -- 3866 East Hall

Friday, March 22, 2013	
4:10pm-5:00pm	**Combinatorics** -- Michael Chmutov (University of Michigan) *Type A molecules are of Kazhdan-Lusztig type* -- 3866 East Hall

Friday, March 29, 2013	
4:10pm-5:00pm	**Combinatorics** -- Kevin Carde (University of Michigan) *Cluster structures on mixed invariant rings, and related combinatorics* -- 3866 East Hall

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Abstracts

Combinatorics
Friday, January 18, 2013, 4:10pm-5:00pm
3866 East Hall
Tomoo Matsumura (KAIST)
(Factorial) Schur functions and weighted Grassmannians

It is a well-known fact that the so-called Schur functions that form a basis of the algebra of symmetric functions represent the Schubert classes of the cohomology of Grassmannians. After a brief introduction, I will explain how to generalize this fact to the case of weighted Grassmannians.

Combinatorics
Friday, February 01, 2013, 4:10pm-5:00pm
3866 East Hall
Andreas Blass (University of Michigan)
Shelah's bipartite matching algorithm

I'll present an algorithm, due to Shelah, for deciding in choiceless polynomial time with counting whether a given bipartite graph admits a complete matching. I'll begin by describing what "choiceless polynomial time with counting" means, and then I'll describe two familiar bipartite matching algorithms that don't qualify: the path-augmenting algorithm isn't choiceless, and the marriage theorem isn't polynomial time. Both of these nevertheless play a role, along with some other ideas, in Shelah's result.

Combinatorics
Friday, February 08, 2013, 4:10pm-5:00pm
3866 East Hall
Michael Shapiro (Michigan State University)
Growth rate classification for cluster algebras

The growth rate function of a cluster algebra counts the number of cluster variables that can be obtained from the initial cluster in a given number of steps. We classify cluster algebras according to whether their growth rate is bounded, polynomial, or exponential. In particular, we show that all exceptional non-affine mutation-finite cluster algebras have exponential growth.

This is joint work with A. Felikson, H. Thomas, and P. Tumarkin.

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Combinatorics
Friday, February 22, 2013, 4:10pm-5:00pm
3866 East Hall
Li Li (Oakland University)
Positivity and tameness in rank 2 cluster algebras

A lot of recent activity in the theory of cluster algebras has been directed towards various constructions of "natural" bases. In a joint work with A.Zelevinsky and K.Lee we construct a new basis in any rank 2 cluster algebra following an approach developed by P.Sherman and A.Zelevinsky. This basis consists of a special family of indecomposable positive elements that we called greedy elements. Inspired by the work of K.Lee, R.Schiffler and D.Rupel, we give an explicit combinatorial description for the greedy elements using the language of Dyck paths. Furthermore, we show that the indecomposable positive elements form a basis if and only if the cluster algebra is tame (that is, of finite or affine type).

Combinatorics
Friday, March 01, 2013, 4:10pm-5:00pm
3866 East Hall
Alexander Barvinok (University of Michigan)
Thrifty approximations of convex bodies by polytopes

Given a d-dimensional convex body C containing the origin in its interior and a real t>1, we seek to construct a polytope P with as few vertices as possible such that P is contained in C and C is contained in tP. I plan to present a construction which breaks some long-held records and is nearly optimal for a vide range of parameters d and t. The construction uses the maximum volume ellipsoid, the John decomposition of the identity and its recent sparsification by Batson, Spielman and Srivastava, Chebyshev polynomials, and some tensor algebra.

Combinatorics
Friday, March 15, 2013, 4:10pm-5:00pm
3866 East Hall
Bruce Sagan (Michigan State University)
Factoring the characteristic polynomial of a poset

Given a poset P, its characteristic polynomial x(P;t) is the generating function in the variable t for the Moebius function of P. For many families of posets, every root of x(P;t) is in the set P of positive integers. A number of different techniques have been devised for showing that x(P;t) factors over P including Zaslavsky's theory of signed graphs, results by Saito and Terao about free hyperplane arrangements, and Stanley's Supersolvability Theorem. We will present a new, totally combinatorial method for proving factorization. This is joint work with Joshua Hallam.

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Combinatorics
Friday, March 22, 2013, 4:10pm-5:00pm
3866 East Hall
Michael Chmutov (University of Michigan)
Type A molecules are of Kazhdan-Lusztig type

Let (W, S) be a Coxeter system. A W-graph is an encoding of a representation of the corresponding Iwahori-Hecke algebra. Especially important examples include the W-graph corresponding to the action of the Iwahori-Hecke algebra on the Kazhdan-Lusztig basis as well as this graph's strongly connected components (cells). In 2008, Stembridge identified some common features of the Kazhdan-Lusztig graphs and gave a combinatorial characterization of all W-graphs that have these features. He conjectured, and checked up to n = 9, that all such A_n-cells are of Kazhdan-Lusztig type. In this talk I will discuss a possible first step toward the proof of the conjecture. More concretely, I will describe why the connected subgraphs of A_n-cells consisting of "simple" (i.e. directed both ways) edges are of Kazhdan-Lusztig type.

Combinatorics
Friday, March 29, 2013, 4:10pm-5:00pm
3866 East Hall
Kevin Carde (University of Michigan)
Cluster structures on mixed invariant rings, and related combinatorics

Let V be a k-dimensional complex vector space. The Pluecker ring of polynomial SL(V) invariants of a collection of n vectors in V can be alternatively described as the homogeneous coordinate ring of the Grassmannian Gr(k,n). In 2003, using combinatorial tools developed by A. Postnikov, J. Scott showed that the Pluecker ring carries a cluster algebra structure. Over the ensuing decade, this has become one of the central examples of cluster algebra theory.

In the 1930s, H. Weyl described the structure of the "mixed" Pluecker ring, the ring of polynomial SL(V) invariants of a collection of n vectors in V and m covectors in V*. We generalize Scott's construction and Postnikov's combinatorics to this more general setting. In particular, we show that each mixed Pluecker ring carries a natural cluster algebra structure. This was previously established by S. Fomin and P. Pylyavskyy in the case k=3.