Algebraic Combinatorixx (Women in Algebraic Combinatorics)
Combinatoire AlgébriXX (Les Femmes en Combinatoire Algébrique)

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SUNITA CHEPURI, University of Michigan

Kazhdan-Lusztig Immanants for k-Positive Matrices

Immanants are matrix functionals that generalize the determinant. One notable family of immanants are the Kazhdan-Lusztig immanants. These immanants are indexed by permutations and are defined as sums involving Kazhdan-Lusztig polynomials specialized at $q = 1$. Kazhdan-Lusztig immanants have several interesting combinatorial properties, including that they are nonnegative on totally positive matrices. We give a condition on permutations that allows us to extend this theorem to the setting of k-positive matrices.

SAMANTHA DAHLBERG, Arizona State University

Diameters of Graphs of Reduced Words of Permutations

It is a classical result that any permutation in the symmetric group can be generated by a sequence of adjacent transpositions. The sequences of minimal length are called reduced words. The graphs of these reduced words, with edges determined by relations in the underlying Coxeter group, have been well studied. Recently, the diameter has been calculated for the longest permutation $n \cdots 21$ by Reiner and Roichman as well as Assaf. In this talk we present our results on diameters for certain classes or permutations. We also make progress on conjectured bounds of the diameter by Reiner and Roichman, which are based on the underlying hyperplane arrangement.

MEGUMI HARADA, McMaster

Permutation bases for the cohomology rings of regular semisimple Hessenberg varieties.

Recent work of Shareshian and Wachs, Brosnan and Chow, and Guay-Paquet connects the well-known Stanley-Stembridge conjecture in combinatorics to the dot action of the symmetric group on the cohomology rings $H^*(Hess(\mathsf{S}, h))$ of regular semisimple Hessenberg varieties. In particular, in order to prove the Stanley-Stembridge conjecture, it suffices to construct for any Hessenberg function h a permutation basis of $H^*(Hess(\mathsf{S}, h))$ whose elements have stabilizers isomorphic to reflection subgroups. In this talk I will outline several recent results which contribute to this goal. Specifically, in some special cases, we give a new, purely combinatorial construction of classes in $H^*(Hess(\mathsf{S}, h))$ which form permutation bases for subrepresentations in $H^*(Hess(\mathsf{S}, h))$. Our techniques use the Goresky-Kottwitz-MacPherson theory in equivariant cohomology. Special cases of our construction have appeared in past work of Abe-Horiguchi-Masuda, Timothy Chow, and Cho-Hong-Lee. This is a report on joint work in progress with Martha Precup and Julianna Tymoczko.

PAMELA HARRIS, Williams College

Kostant's partition function and magic multiplex juggling sequences

Kostant's partition function is a vector partition function that counts the number of ways one can express a weight of a Lie algebra g as a nonnegative integral linear combination of the positive roots of g. Multiplex juggling sequences are generalizations of juggling sequences that specify an initial and terminal configuration of balls and allow for multiple balls at any particular discrete height. Magic multiplex juggling sequences generalize further to include magic balls, which cancel with standard balls when they meet at the same height. In this talk, we present a combinatorial equivalence between positive roots of a Lie algebra and throws during a juggling sequence. This provides a juggling framework to calculate Kostant's partition functions, and a partition function framework to compute the number of juggling sequences. This is joint work with Carolina Benedetti, Christopher R. H. Hanusa, Alejandro Morales, and Anthony Simpson.

OLYA MANDELSHTAM, Brown University
The multispecies TAZRP and modified Macdonald polynomials

Recently, a formula for the symmetric Macdonald polynomials $P_\lambda(X;q,t)$ was given in terms of objects called multiline queues, which also compute probabilities of a statistical mechanics model called the multispecies asymmetric simple exclusion process (ASEP) on a ring. It is natural to ask whether the modified Macdonald polynomials $\widetilde{H}_\lambda(X;q,t)$ can be obtained using a combinatorial gadget for some other statistical mechanics model. We answer this question in the affirmative. In this talk, we will give a new formula for $\widetilde{H}_\lambda(X;q,t)$ in terms of fillings of tableaux called polyqueue tableaux. We define a multispecies totally asymmetric zero range process (TAZRP) on a ring with parameter t, whose (unnormalized) stationary probabilities are computed by polyqueue tableaux, and whose partition function is equal to $\widetilde{H}_\lambda(X;1,t)$. This talk is based on joint work with Arvind Ayyer and James Martin.

LUCY MARTINEZ, Stockton University
Minimum Rank of Regular Bipartite Graphs

The rank of a graph G is defined as the rank of its adjacency matrix A. The smallest rank among all the matrices with the same pattern of non-zeros entries as A, over the field $\mathbb{F}$, is called the minimum rank of A over $\mathbb{F}$. The smallest among all the minimum ranks of A (considering all the fields) is called the minimum rank of G. In this work, we study regular bipartite graphs. Specifically, we used linear recursions with linear complexity 2 and zero forcing sets to prove that the minimum rank of a $(n-1)$-regular bipartite graph, with n vertices on each side, is 4.

ROSA ORELLANA, Dartmouth College
Restricting Howe Duality

Classical Howe duality provides a representation theoretical framework for classical invariant theory. In the classical Howe duality, the general linear group, $GL_n(\mathbb{C})$, is dual to $GL_k(\mathbb{C})$ when acting on the polynomial ring in the variables $x_{i,j}$ where $1 \le i \le n$ and $1 \le j \le k$. In this talk, I will introduce a multiset partition algebra, $MP_k(n)$, as the Howe dual to the action of the symmetric group S_n on the polynomial ring.

This is joint work with Mike Zabrocki

ANNA PUN, University of Virginia
Distribution properties for t-hooks in partitions

Partitions, the partition function $p(n)$, and the hook lengths of their Ferrers-Young diagrams are important objects in combinatorics, number theory and representation theory. For positive integers n and t, we study $p_t^e(n)$ (resp. $p_t^o(n)$), the number of partitions of n with an even (resp. odd) number of t-hooks. Using the Rademacher circle method, we find an exact formula for $p_t^e(n)$ and $p_t^o(n)$.

In this talk, we will discuss how we use this exact formula to show the distribution properties of $p_t^e(n)$ and $p_t^o(n)$ which is far from uniform, and the signs of $p_t^e(n) - p_t^o(n)$ for large n.

SOPHIE SPIRKL, University of Waterloo
A complete multipartite basis for the chromatic symmetric function

The complete multipartite basis r_λ for symmetric functions was introduced by Penaguiao. In this talk, I will tell you why this basis is interesting, and give a combinatorial interpretation for the r_λ-coefficients of the chromatic symmetric function.

Joint work with Logan Crew.

NANCY WALLACE, UQAM

Toward a Schurification of Schröder path formulas.

The Shuffle theorem of Carlsson and Mellit, states that $\nabla(e_n)$ is given by Parking function formulas. Schröder paths are a particular case of Parking functions. These formulas are symmetric in the variables q and t. More preciously, for all n, $\nabla(e_n)$ can be seen as a $GL_2 \times \mathbb{S}_n$-module. In this talk we will put forth a partial formula for the irreducible bicharacters of these modules. Namely we will write subsets of the Schröder paths formulas as products of Schur functions in the variables q and t and the usual Schur functions in the variables $X = \{x_1, x_2, \ldots\}$.