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HOW TO BOUNCE YOUR CANON PERMUTATION

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We study a new class of palindromic descent polynomials. Given a Dyck path d of semilength n and a permutation σ of size n, one can label the up-steps and down-steps of d with the elements of σ. The labeled Dyck path determines a multiset permutation called a canon (or nonnesting) permutation. Such permutations also arise as linear extensions of posets and as regions of hyperplane arrangements. Elizalde showed that the descent polynomial for all canon permutations of fixed length factors as a product of an Eulerian and a Narayana polynomial.

We refine these polynomials by associating to d a descent polynomial C_d over the canon permutations obtained from d. We prove that C_d is palindromic and free of internal zeros, though not unimodal in general. Its degree is determined by the number of peaks in the bounce path of d. We establish a correspondence between canon permutations attaining the maximum number of descents and Dyck paths below d in the Dyck lattice satisfying a valley condition. Each such path contributes a number of maximizers equal to the number of linear extensions of an associated poset, yielding a combinatorial interpretation of the leading coefficient of C_d.

Joint work with Krishna Menon.