A two-sided analogue of the Coxeter complex

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Abstract

For any Coxeter system (W, S) of rank n, we introduce an abstract boolean complex (simplicial poset) of dimension 2n – 1 which contains the Coxeter complex as a relative subcomplex. Faces are indexed by triples (J,w,K), where J and K are subsets of the set S of simple generators, and w is a minimal length representative for the double parabolic coset WJ wWK . There is exactly one maximal face for each element of the group W . The complex is shellable and thin, which implies the complex is a sphere for the finite Coxeter groups. In this case, a natural refinement of the h-polynomial is given by the "two-sided" W -Eulerian polynomial, i.e., the generating function for the joint distribution of left and right descents in W .

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