

# The peak algebra of the symmetric group

Kathryn Nyman  
Willamette University

Thursday, December 1, 2011  
007 Kemeny Hall, 4:00 pm  
(Tea 3:30 pm, 300 Kemeny Hall)

## Abstract

A peak of a permutation  $w \in S_n$  is a position  $i$  for which  $w_{i-1} < w_i$  and  $w_i > w_{i+1}$ . Taking sums of permutations with a common peak set gives rise to a subalgebra of the symmetric group algebra. Peaks of ordinary permutations are closely related to descents of signed permutations, and, as such, we find that this Peak Algebra is intrinsically tied to Solomon's Descent Algebras of Types  $B$  and  $D$ . Related algebras arise by reinterpreting the notion of what constitutes a peak and by grouping permutations based on the number of peaks they contain.

In this talk, we explore some of the properties and structure of these peak algebras and look at applications including those to card shuffling and flag vectors of polytopes.