Three New Refined Arnold Families

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Abstract

The Springer numbers, introduced by Arnold, are generalizations of Euler numbers in the sense of Coxeter groups. They appear as the row sums of a double triangular array $(v_{n,k})$ of integers, $1 \leq |k| \leq n$, defined recursively by a boustrophedon algorithm. We say a sequence of combinatorial objects $(X_{n,k})$ is an Arnold family if $X_{n,k}$ is counted by $v_{n,k}$. A polynomial refinement $V_{n,k}(t)$ of $v_{n,k}$, together with the combinatorial interpretations in several combinatorial structures was introduced by Eu and Fu recently. We provide three new Arnold families of combinatorial objects, namely the cycle-up-down permutations, the valley signed permutations and Knuth's flip equivalences on permutations. We shall find corresponding statistics to realize the refined polynomial arrays.

Keywords: cycle-up-down permutations, valley signed permutations, flip equivalence, Springer numbers, Arnold family.

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