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q-DEFORMATIONS OF THE TSETLIN LIBRARY

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The Tsetlin library is a random shuffling process on permutations of n letters, where each letter i can be interpreted as a book; book i is brought to the front of the bookshelf with an assigned probability x_i. We define a q-deformation of the Tsetlin library by replacing the symmetric group action on permutations by the action of the type A Iwahori-Hecke algebra. We compute the stationary distribution and spectrum of this Markov chain by relating it to a Markov chain on complete flags over the finite field vector space $\mathbb{F}$ and applying techniques from semigroup theory. We prove that for a natural choice of x_i the total variation distance mixing time of the q-Tsetlin library on permutations of n is $O(n)$ compared to $\Theta(n \log n)$ for the Tsetlin library at $q = 1$, which demonstrates a phase transition. We also generalize the q-Tsetlin library to words (with repeated letters), and compute its stationary distribution and spectrum.

This talk is based on joint work with Arvind Ayyer, Sarah Brauner, and Jan de Gier (arXiv:2601.21195).