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Flipping edges and vertices in graphs

We study a certain random process on a graph G which is a variation of a classical voter model and is also a special case of the so-called Tsetlin library random walk. Initially each vertex of G is colored either blue or red.

At each step an edge is chosen at random and both endpoints change their colors to blue with probability p and to red otherwise. This edge-flipping process corresponds to a random walk on the associated state graph in which each coloring configuration is a node. We show that the eigenvalues for the random walk on the state graph can be indexed by subsets of the vertex set of G. For example, for the uniform case of $p = 1/2$, for each subset T of the vertex set V of G, the eigenvalue λ_T (with multiplicity 1) is the ratio of the number of edges in the induced subgraph of T divided by the total number of edges in G. We analyze the stationary distribution of the state graph of colorings of G for several special familie of graphs, such as paths, cycles and trees. We also mention related problems in connection with memoryless games.

This is a joint work with Ron Graham