BLAKE SHIRMAN, York University

Instantaneous uniform mixing in tournament schemes

Following the examples of Chan (2011) and Godsil, Mullin, and Roy (2017), we search for graphs with uniform mixing by first exploring the Bose-Mesner algebra of a 2-class association scheme. While these authors looked at *symmetric* 2-class schemes, which are constructed around strongly regular graphs, we focus on the surprisingly simpler *non-symmetric* 2-class schemes, which correspond to doubly regular tournaments. We start by defining the Hamiltonian of a graph, the continuous-time quantum walk, and how to identify uniform mixing in this walk. We naively investigate uniform mixing on the smallest doubly regular tournament: Cay$(\mathbb{Z}_3, \{1\})$. Immediately we are confronted with a technical problem: the conventional Hamiltonian can*not* achieve mixing on an oriented graph with odd order (e.g. *every* doubly regular tournament). However, we have no attachment to this convention, and instead use a "general Hamiltonian," showing that Cay$(\mathbb{Z}_3, \{1\})$ has uniform mixing for several infinite families of alternative Hamiltonians. We return to the methods of Chan, Godsil, et al. to fully characterize which non-symmetric 2-class association schemes have complex Hadamard matrices in their Bose-Mesner algebra *and* which of those schemes have uniform mixing *and* for what choices of Hamiltonian. We close with remarks about extending uniform mixing results with the general Hamiltonian, and future research goals.