The Mixing Rate of Non-backtracking Random Walks on Graphs

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Given a graph G, a random walk on G is a sequence of vertices $v_0, v_1, v_2, ...$ in which the vertex v_k is chosen randomly among the neighbors of v_{k-1}. Random walks on graphs are well studied, and many tools from spectral graph theory are used in the analysis of properties of random walks. A *non-backtracking* random walk is a random walk in which $v_{k+1} \neq v_{k-1}$. That is, at any step in the random walk, we are restricted only to the vertices not visited on the previous step. Non-backtracking random walks are somewhat more difficult to analyze, although results on their mixing rate exist for regular graphs. We will apply spectral tools to discuss the mixing rate of non-backtracking random walks on more general graphs. In particular, we present a weighted version of a result known as Ihara's Theorem to analyze the spectrum of the transition probability matrix describing a non-backtracking random walk on a graph.