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Sample Complexity in Graph Problems

We present the use of sample complexity tools in two randomized algorithms for graph problems. We first show a $\tilde{\mathcal{O}}(m)$ algorithm for a directed weighted graph G that, for $0 < \epsilon, \delta < 1$, it estimates the percolation centrality of every vertex of G within ϵ of the original value with probability at least $1 - \delta$. The second problem we deal with is the all-pairs shortest paths problem (APSP) for undirected graphs with non-negative real weights. We propose an algorithm that computes the exact shortest path SP between a pair of vertices depending on a certain measure of "importance" of SP, called shortest path centrality. That is, for $0 < \epsilon, \delta < 1$, SP is computed with probability at least $1 - \delta$ whenever its centrality is at least ϵ. The algorithm has expected running time $\mathcal{O}(\log \mathrm{Diam}_V(G) \cdot \max(m + n \log n, \mathrm{Diam}_V(G)^2))$, where $\mathrm{Diam}_V(G)$ is the vertex-diameter of G.