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Cleaning random d-regular graphs with brooms

A model for *cleaning* a graph with brushes was recently introduced. We consider the maximum number of brushes that can be used to clean d-regular graphs in this model, focusing on the asymptotic number for random d-regular graphs. Various lower and upper bounds are proposed. To get an asymptotically almost sure lower bound we use a degree-greedy algorithm to clean a random d-regular graph on n vertices (with dn even) and analyze it using the differential equations method to find the (asymptotic) number of brushes needed to clean a random d-regular graph using this algorithm (for fixed d).

We further show that for any d-regular graph on n vertices there is a cleaning sequence such at least $n(d+1)/4$ brushes are needed to clean a graph using this sequence. For an asymptotically almost sure upper bound, the pairing model is used to show that at most $n(d + 2\sqrt{d \ln 2})/4$ brushes can be used when a random d-regular graph is cleaned. This implies that for fixed large d, the maximum possible number of brushes that can be used to clean a random d-regular graph on n vertices is asymptotically almost surely $\frac{n}{4}\left(d + O(\sqrt{d})\right)$.