5th Problem Set for the MDS Block Course on

High-Dimensional Computational Geometry

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The problems will be discussed in the afternoon session.

Problem 1 #P

Show that the following problem (a) is in FP and (b) and (c) are in #P and, thus, #P-complete.

(a) Computing the permanent of a matrix with entries from $\{0, 1\}$ in $\mathbb{Z}_2$.

(b) Computing the permanent of a matrix with entries from $\{0, 1\}$ in $\mathbb{Q}$.

(c) #LEXT

Problem 2 FPRAS

Show that to any FPRAS there exists an equivalent (ε, δ)-FPRAS.

Problem 3 stationary distribution

Determine (by calculation or experimentally) the stationary distribution for the 2-state Markov chain example in the course.

Problem 4 irreducible

Show that the Markov chain corresponding to the random walk in the algorithm of Dyer/Frieze/Kannan is irreducible

Problem 5 lollipop graph

The *lollipop graph* on n vertices is a clique on $n/2$ vertices with a path on $n/2$ vertices attached to some vertex u of the clique, Let v be the other end of the path. The graph is undirected and the transition probabilities from a node w to its neighbors are all $1/d(w)$ where $d(w)$ is the degree of w. Show that $h_{uv} = \Theta(n^3)$ whereas $h_{vu} = \Theta(n^2)$.