

Problem Set 7

Problem 1

Prove that the existence of an NP-hard problem Π with $\Pi \in \text{ZPP}$ implies $\text{ZPP} = \text{NP}$.

Problem 2

Prove that in any round i of the SSP algorithm, the flow f_i is a minimum-cost flow among all flows with value $|f_i|$ (Theorem 5.1).

Problem 3

Argue why Dijkstra's algorithm can be used in every iteration of the SSP algorithm despite the negative arc costs in the residual network.

Problem 4

In the analysis of the SSP algorithm we have assumed that all ϕ -perturbed costs are chosen from the interval $[0, 1]$. Now consider the case that for every edge e the costs c_e equal $|X_e|$, where X_e follows a normal distribution with mean in $[0, 1]$ and standard deviation 1. Can the smoothed analysis of the SSP algorithm be extended to this case?