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Advanced Algorithms

Problem Set 4

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Exercise 1: Multicast Routing

For the *Multicast Routing Problem* we are given a graph $G = (V, E, c)$ with edge capacities $c : E \to \mathbb{R}_{\geq 0}$ and multi-cast groups $M_i \subseteq V$ with requirements r_i. We need to output a collection of trees $\mathcal{P} := \bigcup P_i$, where P_i is a tree which spans M_i whereas each edge has to reserve capacity r_i for each tree P_i that uses this edge. That means, we seek a set of trees $\bigcup P_i$, such that the maximal congestion: $\max_{e \in E} \frac{1}{c_i} \sum_{i:e \in P_i} r_i$ is minimized. Show that an $O(\log n)$ approximation to this problem can be computed efficiently and w.h.p.

Exercise 2: Minimum Bisection Problem

Let $G = (V, E, c)$ be a graph with an even number of nodes $|V|$ and edge capacities $c : E \to \mathbb{R}_{\geq 0}$. In the *Minimum Bisection Problem* we are asking for a partition of vertices into two *equally* sized sets (B, W) (black and white) with minimal cut (sum of edge capacities between B and W). Give an efficient approximation algorithm for the problem, using the tree decomposition designed for multi commodity flow approximation.

Hint: You can use that the leaves of trees can be efficiently and optimally bisected.