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Efficient Algorithms and Datastructures II

Aufgabe 1 (10 Punkte)

In the maximum directed cut problem, we are given a directed graph $G = (V, A)$, and non-negative weights $w_{ij} \geq 0, \forall (i, j) \in A$. The goal is to partition V into 2 parts U and V so as to maximize the total weights of the arcs going from U to W. (we say that (i, j) goes from U to W if $i \in U$ and $j \in W$). Give a randomized $\frac{1}{4}$ approximation algorithm for this problem.

Aufgabe 2 (10 Punkte)

(a) In the maximum k-cut problem, we are given an undirected graph $G = (V, E)$, and non-negative weights $w_{ij} \geq 0, \forall (i, j) \in E$. The goal is to partition the vertex set V into k parts $V_1, \ldots, V_k$ so as to maximize the weights of all edges whose endpoints are in different parts (i.e., $max_{(i,j) \in E: i \in V_a, j \in V_b, a \neq b} w_{ij}$). Give a randomized $\frac{k-1}{k}$ approximation algorithm for the maximum k-cut problem.

(b) Derandomize the above algorithm.

Aufgabe 3 (10 Punkte)

(a) Show that for everty $0 < \epsilon < 1$,

$$PCP_{\frac{2}{3},\frac{1}{3}}[r, q] \subseteq PCP_{1-\epsilon,\epsilon}[O(r \cdot \log(1/\epsilon)), O(q \cdot \log(1/\epsilon))]$$

(b) Show that for any r and $\epsilon > 0$,

$$PCP_{\frac{2}{3},\frac{1}{3}}[r, O(1)] \subseteq PCP_{1-\epsilon,\epsilon}[r, poly(1/\epsilon)]$$