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Exercise Set 7

Exercise 7.1. The Gridded Placement Problem is an extension of the Standard Placement Problem with a grid $\Gamma = \Gamma_x \times \Gamma_y$ where $\Gamma_z := \{k \cdot \delta_z : k \in \mathbb{Z}\}$ with $\delta_z \in \mathbb{Z}$ for $z \in \{x, y\}$. In this variant, the lower left corner of each circuit is required to be in Γ.

Prove that the Gridded Placement Problem is NP-hard even if an optimum solution of the associated ungridded placement problem is known.

(5 points)

Exercise 7.2. Prove that unless P = NP, there is no polynomial time n^α approximation algorithm for the Quadratic Assignment Problem for any $\alpha < 1$ even if $w \equiv 1$, $c \equiv 0$, d is metric and G is a tree.

(5 points)

Exercise 7.3. Consider an instance of the Multisection Problem with k regions and a feasible fractional assignment. Prove that there is an integral partition which violates capacity constraints by at most

$$\frac{k-1}{k} \max \{\text{size}(C) : C \in \mathcal{C}\} .$$

(5 points)

Exercise 7.4. Consider the fractional Multisection Problem with $k = 2$ regions. Provide an alternative, simple (not using network flows) $\mathcal{O}(n \log n)$ algorithm that computes an optimum fractional partition with the additional property that all but one circuit are assigned to only one region.

(5 points)

Deadline: Mai 23rd, before the lecture. The websites for lecture and exercises can be found at:

`http://www.or.uni-bonn.de/lectures/ss19/chipss19.html`

In case of any questions feel free to contact me at klotz@or.uni-bonn.de.