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Exercise Set 7

Exercise 7.1. Given a chip area A and a set $\mathcal{C}$ of circuits. A *movebound* for $C \in \mathcal{C}$ is a subset $A_C \subseteq A$ in which C must be placed entirely. Assume that the height and width of every circuit is 1 and that A and each movebound A_C ($C \in \mathcal{C}$) are axis-parallel rectangles with integral coordinates.

Describe an algorithm with running time polynomial in $|\mathcal{C}|$ that decides whether there is a feasible placement meeting all movebound constraints.

(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 $w \equiv 1$, $c \equiv 0$, $d : U \times U \to \{0, 1\}$ is metric and G is a tree.

Hint: Transformation of 4-Partition, where G is chosen as a collection of stars (one for each item) whose centers are connected to (an additional) common root vertex. U can be chosen as $|U| = |V(G)|$.

(5 points)

Exercise 7.3. Provide a polynomial time algorithm for the Standard Placement Problem restricted to instances with only one circuit.

(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: May 31, before the lecture. The websites for lecture and exercises can be found at:

`http://www.or.uni-bonn.de/lectures/ss22/chipss22_ex.html`

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