Exercise Set 6

Exercise 6.1. Prove that the Standard Placement Problem can be solved optimally in
\[ O \left( \left( (n + s)! \right)^2 (m + n^2 + k \log k)(n + k) \log(n + k) \right) \]
time, where \( n := |\mathcal{C}|, \ k := |\mathcal{N}|, \ m := |\mathcal{P}| \) and \( s := |\mathcal{S}|. \) (5 points)

Exercise 6.2. 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 6.3. Consider the Standard Placement Problem on instances without blockages, where \( h(C) \equiv 1 \equiv w(C) \) (unit size for \( C \in \mathcal{C} \)) as well as \( w(N) \equiv 1 \) (unit net weights for \( N \in \mathcal{N} \)).

Prove or disprove that this problem is NP-hard. (5 points)

Exercise 6.4. Let \( \mathcal{N} \) be a finite set of pins, and let \( S_p \) be a set of axis-parallel rectangles for each \( p \in \mathcal{N} \). We want to compute the bounding box netlength of \( \mathcal{N} \), i.e. an axis-parallel rectangle \( R \) with minimum perimeter s.t. for every \( p \in \mathcal{N} \) there is an \( S \in S_p \) with \( R \cap S \neq \emptyset \).

Show how to compute such a rectangle in \( O(n^3) \) time where \( n := \sum_{p \in \mathcal{N}} |S_p| \). (5 points)

Deadline: June 13th, before the lecture. The websites for lecture and exercises can be found at [http://www.or.uni-bonn.de/lectures/ss17/chipss17.html](http://www.or.uni-bonn.de/lectures/ss17/chipss17.html)

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