Exercise Set 8

Exercise 8.1:
Given rectangles $C_1, \ldots, C_n$ with widths $w_1, \ldots, w_n$ and heights $h_1, \ldots, h_n$, formulate an integer linear program that checks whether they can be packed (without overlaps) within a rectangle $[x_{\text{min}}, x_{\text{max}}] \times [y_{\text{min}}, y_{\text{max}}]$ allowing rotations by multiples of $90^\circ$.

(4 points)

Exercise 8.2:
Prove that the Standard Placement Problem can be solved optimally in

$$O\left( \left( \frac{(n+s)!}{s!} \right)^2 (n + k)(m + n^2 + k \log k) \log(n + k) \right)$$

time, where $n = |C|$, $s = |S|$, $k = |N|$ and $m = |P|$. Here, $C$ denotes the set of circuits, $S$ the set of blockages, $N$ the set of nets and $P$ the set of pins.

(6 points)

Exercise 8.3:
The Gridded Placement Problem is an extension of the Standard Placement Problem with a grid $\Gamma = \Gamma_x \times \Gamma_y$, $\Gamma_x := \{ k \cdot \delta_x : k \in \mathbb{Z} \}$ and $\Gamma_y := \{ k \cdot \delta_y : k \in \mathbb{Z} \}$ for some $\delta_x, \delta_y \in \mathbb{Z}$, where the lower left corner of each circuit is required to be located on one of the grid points. Prove: The Gridded Placement Problem is $NP$-hard even if an optimum solution of the associated ungridded placement problem is known.

(6 points)

Deadline: Thursday, June 5, before the lecture.
The websites for lecture and exercises are linked at

http://www.or.uni-bonn.de/lectures/ss14/ss14.html

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