Research Institute for Discrete Mathematics
Chip Design
Summer Term 2014

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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 $90°$.

(4 points)

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

$$\mathcal{O}\Big(\big((n+s)!/s!\big)^2 (n+k)(m+n^2+k\log k)\log(n+k)\Big)$$

time, where $n = |\mathcal{C}|, s = |\mathcal{S}|, k = |\mathcal{N}|$ and $m = |P|$. Here, $\mathcal{C}$ denotes the set of circuits, $\mathcal{S}$ the set of blockages, $\mathcal{N}$ 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 .