Exercise Set 8

Exercise 8.1. Consider the following wirelength model for $(\mathcal{C}, P, \gamma, \mathcal{N})$. For a net $N \in \mathcal{N}$, define SmoothBB(N) as

$$\ln\left(\sum_{p\in N} \exp\left(x(\gamma(p)) + x(p)\right)\right) + \ln\left(\sum_{p\in N} \exp\left(-x(\gamma(p)) - x(p)\right)\right)$$
$$+ \ln\left(\sum_{p\in N} \exp\left(y(\gamma(p)) + y(p)\right)\right) + \ln\left(\sum_{p\in N} \exp\left(-y(\gamma(p)) - y(p)\right)\right).$$

Prove:

$$\mathrm{BB}(N) \leq \mathrm{SmoothBB}(N) \leq \mathrm{BB}(N) + 4\ln|N|$$

(3 points)

Exercise 8.2. Consider the fractional Multisection Problem with $m = 2$ regions and n circuits. 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.

(3 points)

Exercise 8.3. Consider an instance of the Multisection Problem with m regions and a feasible fractional partition.

(a) Prove that there is an integral partition that violates capacity constraints by at most

$$\frac{m-1}{m}\max\left\{\mathrm{size}(C) : C \in \mathcal{C}\right\}.$$

(b) Can this violation of capacity constraints always be achieved with an integral partition that has at most the same cost as the fractional partition?

(4+2 points)

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Deadline: June 6, before the lecture. The websites for lecture and exercises can be found at:

`http://www.or.uni-bonn.de/lectures/ss23/chipss23_ex.html`

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