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Exercise Set 11

Exercise 11.1. Given a power consumption $P_l > 0$ for each buffer $l \in L$, extend the algorithm by van Ginneken from the lecture to obtain a PTAS for the problem of finding an assignment of buffers such that all required arrival times are met and power is minimized.

(a) First assume that for all $l \in L$, both P_l and $\frac{1}{P_l}$ are polynomially bounded in the input size.

(b) Then solve the general case using binary search.

(3+2 points)

Exercise 11.2. (a) Given a linear time-cost tradeoff instance $(G, \mathcal{T}, c)$, show that a solution x is time-cost optimal if and only if $C(x) = C_{OPT}(T(x))$.

(b) Given a discrete time-cost tradeoff instance $(G, \mathcal{T}, c)$ and $D, B \in \mathbb{R}_{\geq 0}$, the Discrete Time-Cost Tradeoff Decision Problem is to decide whether a solution x with $T(x) \leq D$ and $C(x) \leq B$ exists.

Prove that the Discrete Time-Cost Tradeoff Decision Problem is $\mathcal{NP}$-complete even if G is a path.

(3+2 points)

Exercise 11.3. Given a weighted directed acyclic graph G, show how to compute a maximum weighted set $C \subset E(G)$ such that there is no directed path in G that contains two edges from C, using a maximum flow algorithm. Such a set C is also called an antichain.

(Given a feasible solution for an instance of the Discrete Time-Cost Tradeoff problem, it possibly can be made cheaper along antichains).

(5 points)

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Deadline: July 17th, before the lecture. The websites for lecture and exercises can be found at:

`http://www.or.uni-bonn.de/lectures/ss18/chipss18.html`

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