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Homework for

Komplexitätstheorie

A. Y. 16/17

Assignment 6

Exercise 6.1

In the lecture, we introduced the MST-based PTAA A for TSP with a performance ratio of at most 2. Show that there are instances for which this bound is actually tight.

Exercise 6.2

BIN PACKING as an optimization problem asks for packing items of sizes $s_1, \ldots, s_n$ into as few as possible bins, taken from a possibly infinite sequence $B_1, B_2, \ldots$, where each bin B_j has a capacity of C and is empty initially. There is a PTAA named FIRST FIT (FF) for BP which works as follows: for $i = 1, \ldots, n$, put item i into the lowest-indexed bin in which it fits (without exceeding the capacity). Show that the performance ratio of FF is at most 2.

Exercise 6.3

In the lecture, Sahni's PTA-scheme $(A_k)_{k\geq 0}$ for the KNAPSACK problem has been presented. Run A_0 and A_1 on the following instance of KNAPSACK and determine the packings they deliver.

- $U = \{u_1, u_2, u_3, u_4, u_5\}$ is the set of items.
- $W = 19$ is the knapsack capacity.
- The weight function $w\colon U \to \mathbb{Z}^+$ is defined as follows: $w(u_1) = 4$, $w(u_2) = 11$, $w(u_3) = 8$, $w(u_4) = 12$, $w(u_5) = 10$.
- The profit function $p\colon U \to \mathbb{Z}^+$ is defined as follows: $p(u_1) = 5$, $p(u_2) = 24$, $p(u_3) = 18$, $p(u_4) = 30$, $p(u_5) = 16$.

Exercise 6.4

Show that Sahni's algorithm A_0 for KNAPSACK has performance ratio ∞.