Summer Term 2015
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Approximation Algorithms

Exercise Sheet 6

Exercise 6.1:
Consider the restriction of the Bin Packing Problem to instances $a_1, \ldots, a_n$ with $a_i > \frac{1}{3}$ for $1 \leq i \leq n$.

(i) Show that this problem can be solved in polynomial time.

(ii) Describe an algorithm that solves this problem in time $O(n \log(n))$.

(3 + 2 points)

Exercise 6.2:
An algorithm for the Bin Packing Problem is called *monotone* if for all inputs S and T with $S \subseteq T$ the algorithm needs at least as many bins for T as for S. For each of the following algorithms, prove or disprove whether it is montone:

(i) Next Fit

(ii) First Fit

(2 + 2 points)

Exercise 6.3:
Consider the following Multiprocessor Scheduling Problem: Given a finite set A of tasks, a number $t(a) \in \mathbb{N}$ for each $a \in A$ (the *processing time*) and a number m of processors, find a partition $A = \dot{\bigcup}_{i=1}^{m} A_i$ of A into m pairwise disjoint sets A_i such that $\max_{i=1}^{m} \left\{ \sum_{a \in A_i} t(a) \right\}$ is minimum.

(i) Is there a fully polynomial approximation scheme?

(ii) Consider a greedy algorithm that successively assigns jobs (in an arbitrary order) to the currently least used machine. Show that this is a 2-approximation algorithm.

(iii) Show that, for fixed values of m, the Multiprocessor Scheduling Problem has an approximation scheme.

(2 + 2 + 3 points)

Please turn in your solutions on Tuesday, **May 26th**, before the lecture.