Efficient Algorithms and Datastructures II

Aufgabe 1 (10 Punkte)

Show that for any input to the problem of minimizing the makespan on identical parallel machines for which the processing requirement of each job is more than $\frac{1}{3}$rd the optimal makespan, the longest processing time rule computes an optimal schedule.

Aufgabe 2 (10 Punkte)

The First-Fit heuristic for solving the bin packing problem takes each object in turn and places it in the first bin that can accomodate it. Show that this approach gives a factor 2 approximation algorithm for bin packing. Give an example on which First-Fit does as bad as $\frac{5}{3}$ OPT.

Aufgabe 3 (10 Punkte)

Consider a more restricted algorithm than First-Fit, called Next-Fit, which tries to pack the next item only in the most recently started bin. If it does not fit, it is packed in a new bin. Show that this algorithm also achieves factor 2. Give a factor 2 tight example.

Aufgabe 4 (10 Punkte)

Say that a bin packing algorithm is monotonic if the number of bins it uses for packing a subset of the items is at most the number of bins it uses for packing all n items. Show that whereas Next-Fit is monotonic, First-Fit is not.