Exercise Sheet 12

Handout: December 5th — Deadline: December 12th, 4pm

Question 12.1 (0.5 marks)

Suppose that you modify Greedy-Activity-Selector to use the following greedy strategies. State whether each strategy would yield an optimal solution or not. If they do, then provide a proof of optimality. If they don't, then provide an example instance where the strategy fails.

1. Always select the activity of least duration amongst those that are compatible with all previously selected activities
2. Always select the compatible activity that overlaps with the fewest remaining activities
3. Always select the last activity to start that is compatible with all previously selected activities
4. Always select the compatible activity with the earliest start time

Question 12.2 (0.25 marks)

Prove that the fractional knapsack problem has the greedy choice property, hence always finds an optimal solution.

Question 12.3 (0.5 marks)

Eddy takes part in a cycle race from start s_1 to finish s_n with feed stations $s_2, \ldots, s_{n-1}$ along the way and distances d_i between s_i and s_{i+1}. To save time, Eddy plans to stop at the smallest possible number of stations. He knows that he can cycle distance ℓ without stopping for supplies, where $\ell > d_i$ for all $1 \leq i \leq n-1$.

(a) Design a greedy algorithm that computes the minimal number of stops for Eddy.

(b) Argue why your greedy strategy yields an optimal solution.

Question 12.4 (0.25 marks)

Implement both Recursive-Activity-Selector(s, f, k, n) and Greedy-Activity-Selector(s, f, n). The algorithms take in input the array s of starting times, the array f of ending times and the number of activities n. The elements are already sorted according to finish times.