

Algorithms and Data Structures – Quiz 1: Dynamic Programming and Greedy Algorithms

Due: Tuesday 02.02.2010 – 13:30 in class

1. **The 0-1 knapsack problem.** A thief is robbing a store that has n items $i_1 \dots i_n$. Each item i is worth v_i Euros and weighs w_i kilograms. (Here v_i and w_i are positive integer values.) The thief wants to take the most amount of loot but his backpack can only hold weight W . What items should he take?
 - (a) Show that this problem has optimal substructure.
 - (b) Design a dynamic programming algorithm that solves this problem. Use pseudo-code to formulate the algorithm.
 - (c) One possible greedy algorithm for this problem would do the following: From the items not yet in the backpack always choose the item i for which the value $|v_i - w_i|$ is maximal. Is this greedy algorithm optimal? If so, prove its optimality. If not, provide a counter-example.
2. Write down a flow network with 6 nodes and at least 8 edges each of them having positive capacity. Apply the Ford-Fulkerson's algorithm from the text book to the problem. Show detailed the steps of the algorithm.