Design and Analysis of Algorithms — Lab

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Session 7: Greedy Algorithms

Knapsack Problem

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You are given a set of items $\{1, 2, \ldots, n\}$ and a capacity W; each item i has an itegral weight w_i and a value v_i. Design an algorithm to select a subset S of items so that

▷ Total value $\sum_{i \in S} v_i$ is maximum, subject to the constraint that

▷ Total weight does not exceed W, $\sum_{i \in S} v_i \leq W$

Implement the algorithm in stages:

1. Represent the items, with their values and weights, using a suitable datastructure in Python.

2. Implement a program using Dynamic Programming to find the maximal value of the knapsack.

3. Implement a function to find out the items in the knapsack, by retracing the decisions made by the DP solution.

4. Measure the emprical time taken by your algorithm.