Optimization 1 solution

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The Knapsack Problem is about selecting a subset of items to maximize the total value while respecting the weight constraint of the knapsack.

Input

- Let I be the set of n items $I = 1, 2, ..., n$.
- Each item $i \in I$ has a weight w_i, a value v_i and a maximum amount max_i.
- The knapsack cannot contain more than a total weight W.

Output

Determine the amount a_i of each item $i \in I$

Questions

1. Formulate the objective function
2. Formulate the constraints

Solution

Objective Function

$$\text{Maximize} \quad \sum_{i=1}^{n} v_i \cdot a_i \tag{1}$$

Constraints

$$\sum_{i=1}^{n} w_i \cdot a_i \leq W \tag{2}$$

$$\forall i \in I, a_i \leq max_i \tag{3}$$