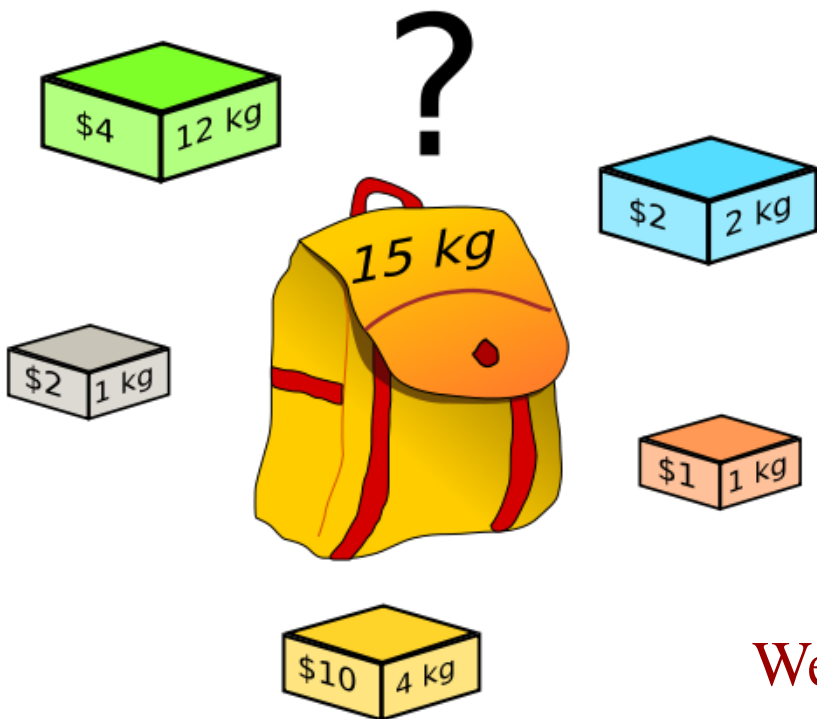


# Knapsack Problem

- Each item has a value and a weight
- **Objective**: maximize value
- **Constraint**: knapsack has a weight limitation



Two versions:

**0-1 knapsack problem**: take each item or leave it

**Fractional knapsack problem**: items are divisible

We study the 0-1 problem today.

# Formal definition (0-1 problem)

- Knapsack has weight limit  $W$
- Items labeled  $1, 2, \dots, n$  (arbitrarily)
- Items have weights  $w_1, w_2, \dots, w_n$ 
  - Assume all weights are integers
  - For practical reason, only consider  $w_i < W$
- Items have values  $v_1, v_2, \dots, v_n$
- Objective: find a subset of items,  $S$ , such that  $\sum_{i \in S} w_i \leq W$  and  $\sum_{i \in S} v_i$  is maximal among all such (*feasible*) subsets

# Knapsack Problem (0-1)

	A	B	C
Weight	1	4	3
Value	15	30	20