

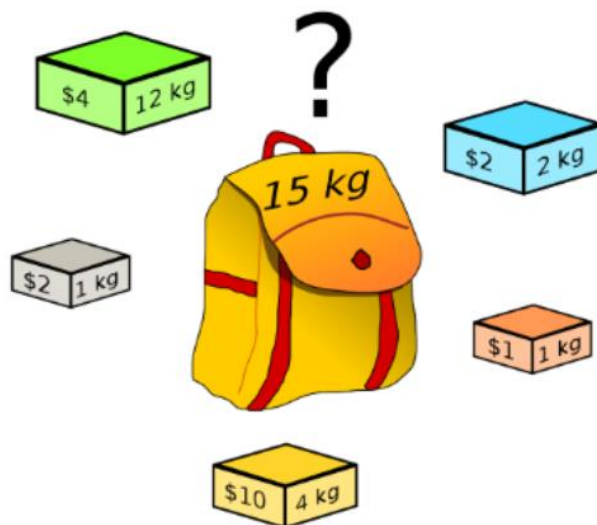
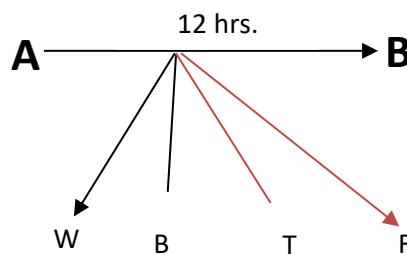
Knapsack Problem

- It is a maximization problem

Variants - Fractional --- where objects are divisible

0/1 --- where objects are indivisible

Greedy



Algorithm

- 1) For each Item ,compute it's profit/weight ratio
- 2) Arrange all the items in decreasing order of there value/weight ratio
- 3) Start putting the items into the knapsack beginning from the item with highest ratio.

Object	1	2	3	4	5	6	7
Profit	10	5	15	7	6	18	3
Weight	2	3	5	7	1	4	1

Bag weight = 15 kg

Step-1

➔ We need to find the profit/weight ratio

Object	1	2	3	4	5	6	7
Profit	10	5	15	7	6	18	3
Weight	2	3	5	7	1	4	1
Profit/weight	10/2	5/3	15/5	7/7	6/1	18/4	3/1
Value	5	1.6	3	1	6	4.5	3

Step-2

Now we need to sort the complete table in an descending order based on the value

Initial Table

Object	1	2	3	4	5	6	7
Profit	10	5	15	7	6	18	3
Weight	2	3	5	7	1	4	1
Value	5	1.6	3	1	6	4.5	3

After Sorting

Object	5	1	6	3	7	2	4
Profit	6	10	18	15	3	5	7
Weight	1	2	4	5	1	3	7
Value	6	5	4.5	3	3	1.6	1

Step-3

Now I need to fill the bag with objects based upon my values

Bag Weight is = 15kg



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Object	5	1	6	3	7	2	4
Profit	6	10	18	15	3	5	7
Weight	1	2	4	5	1	3	7
Value	6	5	4.5	3	3	1.6	1

- 1) Initially I am filling my bag with object 5 which is 1Kg so $15-1=14\text{kg}$
- 2) Now my bag size is of 14kg and I am filling my bag with object 1 which is of 2kg so $14-2=12\text{kg}$
- 3) Now my bag size is of 12kg and I am filling my bag with object 6 which is of 4kg so $12-4=8$
- 4) Now my bag size is of 8kg and I am filling my bag with object 3 which is of 5 kg so my bag size becomes $8-5=3\text{kg}$
- 5) Now my bag size is of 3kg and I am filling my bag with object 7 which is of 1 kg so my bag size becomes $3-1=2\text{kg}$
- 6) Now my bag size is of 2kg and I am filling my bag with object 2 which is of 3kg so $2-3=-1$ which is not possible so I am taking $2/3$ rd part of object 2 which is 2kg so $2-2=0$

The object 4 is not considered as there is no space in my bag

Total Cost

$$\begin{aligned}
 &(1*10) + (2/3 * 5) + (1*15) + (1*6) + (1*18) + (1*3) \\
 &= 10 + 3.3 + 15 + 6 + 18 + 3 \\
 &= 54.6
 \end{aligned}$$