



Escuela de Ingeniería en Computación  
Investigación de Operaciones

Knapsack Problem  
Dynamic Programming

Group 40  
Professor: Francisco Torres Rojas

Carmen Hidalgo Paz  
Id: 2020030538

Melissa Carvajal Charpentier  
Id: 2022197088

Josué Soto González  
Id: 2023207915

19 september 2025

# 1 Knapsack

## 2 Problem

Agua: Amount:30, Profit:1, and Cost:2

Barrita: Amount:  $\infty$ , Profit:2, and Cost:13

Linterna: Amount:10, Profit:5, and Cost:5

Encendedor: Amount:  $\infty$ , Profit:3, and Cost:3

Kit de Costura: Amount:1, Profit:4, and Cost:7

This translates to:

Maximize  $Z = 1X_{\text{Agua}} + 2X_{\text{Barrita}} + 5X_{\text{Linterna}} + 3X_{\text{Encendedor}} + 4X_{\text{Kit de Costura}}$

Subject to:

$20 \geq 2X_{\text{Agua}} + 13X_{\text{Barrita}} + 5X_{\text{Linterna}} + 3X_{\text{Encendedor}} + 7X_{\text{Kit de Costura}}$

$X_{\text{Agua}} \leq 30$

$X_{\text{Barrita}} \leq \infty$

$X_{\text{Linterna}} \leq 10$

$X_{\text{Encendedor}} \leq \infty$

$X_{\text{Kit de Costura}} \leq 1$

## 3 Costs Table

Capacity	Agua	Barrita	Linterna	Encendedor	Kit de Costura
0	0 x=0	0 x=0	0 x=0	0 x=0	0 x=0
1	0 x=0	0 x=0	0 x=0	0 x=0	0 x=0
2	1 x=1	1 x=0	1 x=0	1 x=0	1 x=0
3	1 x=1	1 x=0	1 x=0	3 x=1	3 x=0
4	2 x=2	2 x=0	2 x=0	3 x=1	3 x=0
5	2 x=2	2 x=0	5 x=1	5 x=0	5 x=0
6	3 x=3	3 x=0	5 x=1	6 x=2	6 x=0
7	3 x=3	3 x=0	6 x=1	6 x=0,2	6 x=0
8	4 x=4	4 x=0	6 x=1	8 x=1	8 x=0
9	4 x=4	4 x=0	7 x=1	9 x=3	9 x=0
10	5 x=5	5 x=0	10 x=2	10 x=0	10 x=0
11	5 x=5	5 x=0	10 x=2	11 x=2	11 x=0
12	6 x=6	6 x=0	11 x=2	12 x=4	12 x=0
13	6 x=6	6 x=0	11 x=2	13 x=1	13 x=0
14	7 x=7	7 x=0	12 x=2	14 x=3	14 x=0
15	7 x=7	7 x=0	15 x=3	15 x=0,5	15 x=0
16	8 x=8	8 x=0	15 x=3	16 x=2	16 x=0
17	8 x=8	8 x=0	16 x=3	17 x=4	17 x=0
18	9 x=9	9 x=0	16 x=3	18 x=1,6	18 x=0
19	9 x=9	9 x=0	17 x=3	19 x=3	19 x=0
20	10 x=10	10 x=0	20 x=4	20 x=0,5	20 x=0

## 4 Optimal Solutions

$$\begin{array}{l} X_{\text{Agua}} = 0 \ X_{\text{Barrita}} = 0 \ X_{\text{Linterna}} = 4 \ X_{\text{Encendedor}} = 0 \ X_{\text{Kit de Costura}} = 0 \\ X_{\text{Agua}} = 0 \ X_{\text{Barrita}} = 0 \ X_{\text{Linterna}} = 1 \ X_{\text{Encendedor}} = 5 \ X_{\text{Kit de Costura}} = 0 \end{array}$$