

Instituto Tecnológico de Costa Rica

Operations Research - Semester II

Knapsack Problem

Members:

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Date: November 8, 2025

asdasd

Maximize

$$Z = 3.00x_1 + 5.00x_2$$

Subject to

$$\begin{aligned} 1.00x_1 + 0.00x_2 + + + &\leq 4.00 \\ 0.00x_1 + 2.00x_2 + + + &\leq 12.00 \\ 3.00x_1 + 2.00x_2 + + + &\leq 18.00 \end{aligned}$$

Simplex Table

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	-3.00	-5.00	0.00	0.00	0.00	0.00
	0.00	1.00	0.00	1.00	0.00	0.00	4.00
	0.00	0.00	2.00	0.00	1.00	0.00	12.00
	0.00	3.00	2.00	0.00	0.00	1.00	18.00

Intermediate Tables

Pivoting 1

Most Negative

Column 3 (-5.00)

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	-3.00	-5.00	0.00	0.00	0.00	0.00
	0.00	1.00	0.00	1.00	0.00	0.00	4.00
	0.00	0.00	2.00	0.00	1.00	0.00	12.00
	0.00	3.00	2.00	0.00	0.00	1.00	18.00

Fractions

	Z	x_1	x_2	s_0	s_1	s_2	b	Frac
	1.00	-3.00	-5.00	0.00	0.00	0.00	0.00	
	0.00	1.00	0.00	1.00	0.00	0.00	4.00	inf
	0.00	0.00	2.00	0.00	1.00	0.00	12.00	6.00
	0.00	3.00	2.00	0.00	0.00	1.00	18.00	9.00

$$4.00/0.00 = \text{inf}$$

$$12.00/2.00 = 6.00$$

$$18.00/2.00 = 9.00$$

Pivot

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	-3.00	-5.00	0.00	0.00	0.00	0.00
	0.00	1.00	0.00	1.00	0.00	0.00	4.00
	0.00	0.00	2.00	0.00	1.00	0.00	12.00
	0.00	3.00	2.00	0.00	0.00	1.00	18.00

Canonization

$$R_3 \leftarrow R_3/2.00$$

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	-3.00	-5.00	0.00	0.00	0.00	0.00
	0.00	1.00	0.00	1.00	0.00	0.00	4.00
	0.00	0.00	1.00	0.00	0.50	0.00	6.00
	0.00	3.00	2.00	0.00	0.00	1.00	18.00

$$R_1 \leftarrow R_1 + 5.00R_2$$

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	-3.00	0.00	0.00	2.50	0.00	30.00
	0.00	1.00	0.00	1.00	0.00	0.00	4.00
	0.00	0.00	1.00	0.00	0.50	0.00	6.00
	0.00	3.00	2.00	0.00	0.00	1.00	18.00

$$R_2 \leftarrow R_2 + -0.00R_2$$

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	-3.00	0.00	0.00	2.50	0.00	30.00
	0.00	1.00	0.00	1.00	0.00	0.00	4.00
	0.00	0.00	1.00	0.00	0.50	0.00	6.00
	0.00	3.00	2.00	0.00	0.00	1.00	18.00

$$R_4 \leftarrow R_4 + -2.00R_2$$

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	-3.00	0.00	0.00	2.50	0.00	30.00
	0.00	1.00	0.00	1.00	0.00	0.00	4.00
	0.00	0.00	1.00	0.00	0.50	0.00	6.00
	0.00	3.00	0.00	0.00	-1.00	1.00	6.00

Pivot Result

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	-3.00	0.00	0.00	2.50	0.00	30.00
	0.00	1.00	0.00	1.00	0.00	0.00	4.00
	0.00	0.00	1.00	0.00	0.50	0.00	6.00
	0.00	3.00	0.00	0.00	-1.00	1.00	6.00

Pivoting 2

Most Negative

Column 2 (-3.00)

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	-3.00	0.00	0.00	2.50	0.00	30.00
	0.00	1.00	0.00	1.00	0.00	0.00	4.00
	0.00	0.00	1.00	0.00	0.50	0.00	6.00
	0.00	3.00	0.00	0.00	-1.00	1.00	6.00

Fractions

	Z	x_1	x_2	s_0	s_1	s_2	b	Frac
	1.00	-3.00	0.00	0.00	2.50	0.00	30.00	
	0.00	1.00	0.00	1.00	0.00	0.00	4.00	4.00
	0.00	0.00	1.00	0.00	0.50	0.00	6.00	inf
	0.00	3.00	0.00	0.00	-1.00	1.00	6.00	2.00

$$4.00/1.00 = 4.00$$

$$6.00/0.00 = \text{inf}$$

$$6.00/3.00 = 2.00$$

Pivot

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	-3.00	0.00	0.00	2.50	0.00	30.00
	0.00	1.00	0.00	1.00	0.00	0.00	4.00
	0.00	0.00	1.00	0.00	0.50	0.00	6.00
	0.00	3.00	0.00	0.00	-1.00	1.00	6.00

Canonization

$$R_4 \leftarrow R_4/3.00$$

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	-3.00	0.00	0.00	2.50	0.00	30.00
	0.00	1.00	0.00	1.00	0.00	0.00	4.00
	0.00	0.00	1.00	0.00	0.50	0.00	6.00
	0.00	1.00	0.00	0.00	-0.33	0.33	2.00

$$R_1 \leftarrow R_1 + 3.00R_3$$

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	0.00	0.00	0.00	1.50	1.00	36.00
	0.00	1.00	0.00	1.00	0.00	0.00	4.00
	0.00	0.00	1.00	0.00	0.50	0.00	6.00
	0.00	1.00	0.00	0.00	-0.33	0.33	2.00

$$R_2 \leftarrow R_2 + -1.00R_3$$

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	0.00	0.00	0.00	1.50	1.00	36.00
	0.00	0.00	0.00	1.00	0.33	-0.33	2.00
	0.00	0.00	1.00	0.00	0.50	0.00	6.00
	0.00	1.00	0.00	0.00	-0.33	0.33	2.00

$$R_3 \leftarrow R_3 + -0.00R_3$$

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	0.00	0.00	0.00	1.50	1.00	36.00
	0.00	0.00	0.00	1.00	0.33	-0.33	2.00
	0.00	0.00	1.00	0.00	0.50	0.00	6.00
	0.00	1.00	0.00	0.00	-0.33	0.33	2.00

Pivot Result

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	0.00	0.00	0.00	1.50	1.00	36.00
	0.00	0.00	0.00	1.00	0.33	-0.33	2.00
	0.00	0.00	1.00	0.00	0.50	0.00	6.00
	0.00	1.00	0.00	0.00	-0.33	0.33	2.00

Results

	Z	x_1	x_2	s_0	s_1	s_2	b
	1.00	0.00	0.00	0.00	1.50	1.00	36.00
	0.00	0.00	0.00	1.00	0.33	-0.33	2.00
	0.00	0.00	1.00	0.00	0.50	0.00	6.00
	0.00	1.00	0.00	0.00	-0.33	0.33	2.00

Objective Value

$$Z = 36.00$$

Variables

$$x_1 = 2.00$$

$$x_2 = 6.00$$

Slack or Surplus

$$s_0 = 2.00$$

$$s_1 = 0.00$$

$$s_2 = 0.00$$