

Instituto Tecnológico de Costa Rica

Operations Research - Semester II

Knapsack Problem

Members:

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Simple

Maximize

$$Z = 3.00x_1 + 4.00x_2$$

Subject to

$$1.00x_1 + 1.00x_2 \leq 40.00$$

$$1.00x_1 + 2.00x_2 \leq 60.00$$

Simplex Table

	Z	x_1	x_2	s_1	s_2	b
	1.00	-3.00	-4.00	0.00	0.00	0.00
	0.00	1.00	1.00	1.00	0.00	40.00
	0.00	1.00	2.00	0.00	1.00	60.00

Intermediate Tables

Pivoting 1

Most Negative

Column 3 (-4.00)

	Z	x_1	x_2	s_1	s_2	b
	1.00	-3.00	-4.00	0.00	0.00	0.00
	0.00	1.00	1.00	1.00	0.00	40.00
	0.00	1.00	2.00	0.00	1.00	60.00

Fractions

	Z	x_1	x_2	s_1	s_2	b	Frac
	1.00	-3.00	-4.00	0.00	0.00	0.00	
	0.00	1.00	1.00	1.00	0.00	40.00	40.00
	0.00	1.00	2.00	0.00	1.00	60.00	30.00

$$40.00/1.00 = 40.00$$

$$60.00/2.00 = 30.00$$

Pivot

	Z	x_1	x_2	s_1	s_2	b
	1.00	-3.00	-4.00	0.00	0.00	0.00
	0.00	1.00	1.00	1.00	0.00	40.00
	0.00	1.00	2.00	0.00	1.00	60.00

Canonization

$$R_3 \leftarrow R_3/2.00$$

	Z	x_1	x_2	s_1	s_2	b
	1.00	-3.00	-4.00	0.00	0.00	0.00
	0.00	1.00	1.00	1.00	0.00	40.00
	0.00	0.50	1.00	0.00	0.50	30.00

$$R_1 \leftarrow R_1 + 4.00R_3$$

	Z	x_1	x_2	s_1	s_2	b
	1.00	-1.00	0.00	0.00	2.00	120.00
	0.00	1.00	1.00	1.00	0.00	40.00
	0.00	0.50	1.00	0.00	0.50	30.00

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

	Z	x_1	x_2	s_1	s_2	b
	1.00	-1.00	0.00	0.00	2.00	120.00
	0.00	0.50	0.00	1.00	-0.50	10.00
	0.00	0.50	1.00	0.00	0.50	30.00

Pivot Result

	Z	x_1	x_2	s_1	s_2	b
	1.00	-1.00	0.00	0.00	2.00	120.00
	0.00	0.50	0.00	1.00	-0.50	10.00
	0.00	0.50	1.00	0.00	0.50	30.00

Pivoting 2

Most Negative

Column 2 (-1.00)

	Z	x_1	x_2	s_1	s_2	b
	1.00	-1.00	0.00	0.00	2.00	120.00
	0.00	0.50	0.00	1.00	-0.50	10.00
	0.00	0.50	1.00	0.00	0.50	30.00

Fractions

	Z	x_1	x_2	s_1	s_2	b	Frac
	1.00	-1.00	0.00	0.00	2.00	120.00	
	0.00	0.50	0.00	1.00	-0.50	10.00	20.00
	0.00	0.50	1.00	0.00	0.50	30.00	60.00

$$10.00/0.50 = 20.00$$

$$30.00/0.50 = 60.00$$

Pivot

	Z	x_1	x_2	s_1	s_2	b
	1.00	-1.00	0.00	0.00	2.00	120.00
	0.00	0.50	0.00	1.00	-0.50	10.00
	0.00	0.50	1.00	0.00	0.50	30.00

Canonization

$$R_2 \leftarrow R_2/0.50$$

	Z	x_1	x_2	s_1	s_2	b
	1.00	-1.00	0.00	0.00	2.00	120.00
	0.00	1.00	0.00	2.00	-1.00	20.00
	0.00	0.50	1.00	0.00	0.50	30.00

$$R_1 \leftarrow R_1 + 1.00R_2$$

	Z	x_1	x_2	s_1	s_2	b
	1.00	0.00	0.00	2.00	1.00	140.00
	0.00	1.00	0.00	2.00	-1.00	20.00
	0.00	0.50	1.00	0.00	0.50	30.00

$$R_3 \leftarrow R_3 + -0.50R_2$$

	Z	x_1	x_2	s_1	s_2	b
	1.00	0.00	0.00	2.00	1.00	140.00
	0.00	1.00	0.00	2.00	-1.00	20.00
	0.00	0.00	1.00	-1.00	1.00	20.00

Pivot Result

	Z	x_1	x_2	s_1	s_2	b
	1.00	0.00	0.00	2.00	1.00	140.00
	0.00	1.00	0.00	2.00	-1.00	20.00
	0.00	0.00	1.00	-1.00	1.00	20.00

Results

	Z	x_1	x_2	s_1	s_2	b
	1.00	0.00	0.00	2.00	1.00	140.00
	0.00	1.00	0.00	2.00	-1.00	20.00
	0.00	0.00	1.00	-1.00	1.00	20.00

Objective Value

$$Z = 140.00$$

Variables

$$x_1 = 20.00$$

$$x_2 = 20.00$$

Slack or Surplus

$$s_1 = 0.00$$

$$s_2 = 0.00$$