

Instituto Tecnológico de Costa Rica

Knapsack Problem

Members:

Adrián Zamora Chavarría
Daniel Romero Murillo

Date: September 16, 2025

Problem

Maximize

$$Z = 7x_1 + 9x_2 + 5x_3 + 12x_4 + 14x_5 + 6x_6 + 12x_7$$

Subject to

$$3x_1 + 4x_2 + 2x_3 + 6x_4 + 7x_5 + 2x_6 + x_7 \leq 15$$

$$0 \leq x_1 \leq 1$$

$$0 \leq x_2 \leq 1$$

$$0 \leq x_3 \leq 1$$

$$0 \leq x_4 \leq 1$$

$$0 \leq x_5 \leq 1$$

$$0 \leq x_6 \leq 1$$

$$0 \leq x_7 \leq 1$$

Data Table

	A	B	C	D	E	F	G
0	$0/x_0 = 0$	$0/x_1 = 0$	$0/x_2 = 0$	$0/x_3 = 0$	$0/x_4 = 0$	$0/x_5 = 0$	$0/x_6 = 0$
1	$0/x_0 = 0$	$0/x_1 = 0$	$0/x_2 = 0$	$0/x_3 = 0$	$0/x_4 = 0$	$0/x_5 = 0$	$12/x_6 = 1$
2	$0/x_0 = 0$	$0/x_1 = 0$	$5/x_2 = 1$	$5/x_3 = 0$	$5/x_4 = 0$	$6/x_5 = 1$	$12/x_6 = 1$
3	$7/x_0 = 1$	$7/x_1 = 0$	$7/x_2 = 0$	$7/x_3 = 0$	$7/x_4 = 0$	$7/x_5 = 0$	$18/x_6 = 1$
4	$7/x_0 = 1$	$9/x_1 = 1$	$9/x_2 = 0$	$9/x_3 = 0$	$9/x_4 = 0$	$11/x_5 = 1$	$19/x_6 = 1$
5	$7/x_0 = 1$	$9/x_1 = 1$	$12/x_2 = 1$	$12/x_3 = 0$	$12/x_4 = 0$	$13/x_5 = 1$	$23/x_6 = 1$
6	$7/x_0 = 1$	$9/x_1 = 1$	$14/x_2 = 1$	$14/x_3 = 0$	$14/x_4 = 0$	$15/x_5 = 1$	$25/x_6 = 1$
7	$7/x_0 = 1$	$16/x_1 = 1$	$16/x_2 = 0$	$16/x_3 = 0$	$16/x_4 = 0$	$18/x_5 = 1$	$27/x_6 = 1$
8	$7/x_0 = 1$	$16/x_1 = 1$	$16/x_2 = 0$	$17/x_3 = 1$	$17/x_4 = 0$	$20/x_5 = 1$	$30/x_6 = 1$
9	$7/x_0 = 1$	$16/x_1 = 1$	$21/x_2 = 1$	$21/x_3 = 0$	$21/x_4 = 0$	$22/x_5 = 1$	$32/x_6 = 1$
10	$7/x_0 = 1$	$16/x_1 = 1$	$21/x_2 = 1$	$21/x_3 = 1 - 0$	$21/x_4 = 1 - 0$	$23/x_5 = 1$	$34/x_6 = 1$
11	$7/x_0 = 1$	$16/x_1 = 1$	$21/x_2 = 1$	$24/x_3 = 1$	$24/x_4 = 0$	$27/x_5 = 1$	$35/x_6 = 1$
12	$7/x_0 = 1$	$16/x_1 = 1$	$21/x_2 = 1$	$26/x_3 = 1$	$26/x_4 = 1 - 0$	$27/x_5 = 1$	$39/x_6 = 1$
13	$7/x_0 = 1$	$16/x_1 = 1$	$21/x_2 = 1$	$28/x_3 = 1$	$28/x_4 = 1 - 0$	$30/x_5 = 1$	$39/x_6 = 1$
14	$7/x_0 = 1$	$16/x_1 = 1$	$21/x_2 = 1$	$28/x_3 = 1$	$30/x_4 = 1$	$32/x_5 = 1$	$42/x_6 = 1$
15	$7/x_0 = 1$	$16/x_1 = 1$	$21/x_2 = 1$	$33/x_3 = 1$	$33/x_4 = 0$	$34/x_5 = 1$	$44/x_6 = 1$

Optimal Solution

$$Z = 44$$

$$x_7 = 1$$

$$x_6 = 1$$

$$x_5 = 0$$

$$x_4 = 1$$

$$x_3 = 1$$

$$x_2 = 1$$

$$x_1 = 0$$

Optimal Solution

$$Z = 44$$

$$x_7 = 1$$

$$x_6 = 1$$

$$x_5 = 1$$

$$x_4 = 0$$

$$x_3 = 1$$

$$x_2 = 0$$

$$x_1 = 1$$