

Problem 1. Solve the following problem

$$\begin{aligned} &\text{Maximize} && x_1 + 2x_2 \\ &\text{subject to} && x_1 + 3x_2 + x_3 = 4 \\ &&& 2x_2 + x_3 = 2 \\ &&& x_1, x_2, x_3 \geq 0. \end{aligned}$$

Problem 2. Solve the following problem

$$\begin{aligned} &\text{Maximize} && x_1 + 2x_2 \\ &\text{subject to} && x_1 - x_2 \leq 2 \\ &&& -x_1 + x_2 \leq 1 \\ &&& 2x_1 + x_2 \leq 7 \\ &&& x_1, x_2 \geq 0. \end{aligned}$$

Problem 3. Solve the following problem

$$\begin{aligned} &\text{Maximize} && x_2 \\ &\text{subject to} && -x_1 + x_2 \leq 0 \\ &&& x_1 \leq 2 \\ &&& x_1, x_2 \geq 0 \end{aligned}$$

Problem 4. Solve the following problem

$$\begin{aligned} &\text{Maximize} && 3x_1 + x_2 \\ &\text{subject to} && x_1 - x_2 \leq -1 \\ &&& -x_1 - x_2 \leq -3 \\ &&& 2x_1 + x_2 \leq 2 \\ &&& x_1, x_2 \geq 0 \end{aligned}$$

Problem 5. Solve the following problem

$$\begin{aligned} &\text{Maximize} && 3x_1 + x_2 \\ &\text{subject to} && x_1 - x_2 \leq -1 \\ &&& -x_1 - x_2 \leq -3 \\ &&& 2x_1 - x_2 \leq 2 \\ &&& x_1, x_2 \geq 0 \end{aligned}$$

Problem 6. Solve the following problem

$$\begin{aligned} &\text{Maximize} && x_1 + 2x_2 - x_3 \\ &\text{subject to} && 2x_1 + x_2 + x_3 \leq 14 \\ &&& 4x_1 + 2x_2 + 3x_3 \leq 28 \\ &&& 2x_1 + 5x_2 + 5x_3 \leq 30 \\ &&& x_1, x_2, x_3 \geq 0 \end{aligned}$$

Problem 7 (Homework – 2 points). Solve the following problem

$$\begin{aligned} &\text{Maximize} && 10x_1 - 57x_2 - 9x_3 - 24x_4 \\ &\text{subject to} && x_5 = -0,5x_1 + 5,5x_2 + 2,5x_3 - 9x_4 \\ &&& x_6 = -0,5x_1 + 1,5x_2 + 0,5x_3 - x_4 \\ &&& x_7 = 1 - x_1 \\ &&& x_1, x_2, x_3, x_4, x_5, x_6, x_7 \geq 0 \end{aligned}$$

First, try to use the pivot rule “largest coefficient”. Then, solve the problem using “Bland rule”.

Problem 8 (Homework – 2 points). Find all optimal vertices of the following problem.

$$\begin{array}{ll} \text{Maximize} & 2x_1 + 3x_2 + 5x_3 + 4x_4 \\ \text{subject to} & x_1 + 2x_2 + 3x_3 + x_4 \leq 5 \\ & x_1 + x_2 + 2x_3 + 3x_4 \leq 3 \\ & x_1 + x_2 + 2x_3 + 7x_4 \geq 3 \\ & x_1, x_2, x_3, x_4 \geq 0 \end{array}$$