

## Homework 2.1

8 points. End term: 7-th week (november 13, 2025)

1. (7 points) Devise an implementation (C, C++, C#, Java) for the Two Phase Algorithm (reusing the Simplex Algorithm code).

2. (1 point) Run the Two Phase implemented algorithm on the following problems and verify the results using Gurobi LP solver:

$$\begin{array}{l} \text{(a)} \left\{ \begin{array}{l} \min \quad z = x_1 - 2x_2 + x_3 \\ \text{s. t.} \quad x_1 + 2x_2 - x_3 \leq 3 \\ \quad \quad \quad 3x_1 + 2x_2 \geq 8 \\ \quad \quad \quad x_1 - x_2 + 2x_3 = 4 \\ \quad \quad \quad x_1, x_2, x_3 \geq 0 \end{array} \right. \end{array} \quad \begin{array}{l} \text{(b)} \left\{ \begin{array}{l} \min \quad z = x_1 - x_2 - 2x_3 \\ \text{s. t.} \quad x_1 + x_2 + 2x_3 = 6 \\ \quad \quad \quad x_1 + 2x_2 - x_3 = 4 \\ \quad \quad \quad 2x_1 - 2x_2 + x_3 \geq 7 \\ \quad \quad \quad x_1, x_2, x_3 \geq 0 \end{array} \right. \end{array}$$

$$\begin{array}{l} \text{(c)} \left\{ \begin{array}{l} \min \quad z = x_1 + 2x_2 - x_3 + x_4 \\ \text{s. t.} \quad 2x_1 + x_2 + x_3 - x_4 = 3 \\ \quad \quad \quad 2x_1 - 2x_2 + x_3 + 2x_4 = 7 \\ \quad \quad \quad -x_1 + x_2 - 2x_3 - x_4 \geq 6 \\ \quad \quad \quad -x_1 + 2x_2 - x_3 - x_4 \leq 8 \\ \quad \quad \quad x_1, x_2, x_3, x_4 \geq 0 \end{array} \right. \end{array} \quad \begin{array}{l} \text{(d)} \left\{ \begin{array}{l} \min \quad z = x_1 - 2x_2 - x_3 \\ \text{s. t.} \quad 2x_1 + x_2 + x_3 \leq 6 \\ \quad \quad \quad 3x_1 + 2x_2 - x_3 = 4 \\ \quad \quad \quad 2x_1 - 2x_2 - x_3 \leq 5 \\ \quad \quad \quad x_1, x_2, x_3 \geq 0 \end{array} \right. \end{array}$$