

# Optimization and Decision Support Methodologies

## 2<sup>nd</sup> Assessment Test

Date: January 6, 2023

Duration: 1h 30m

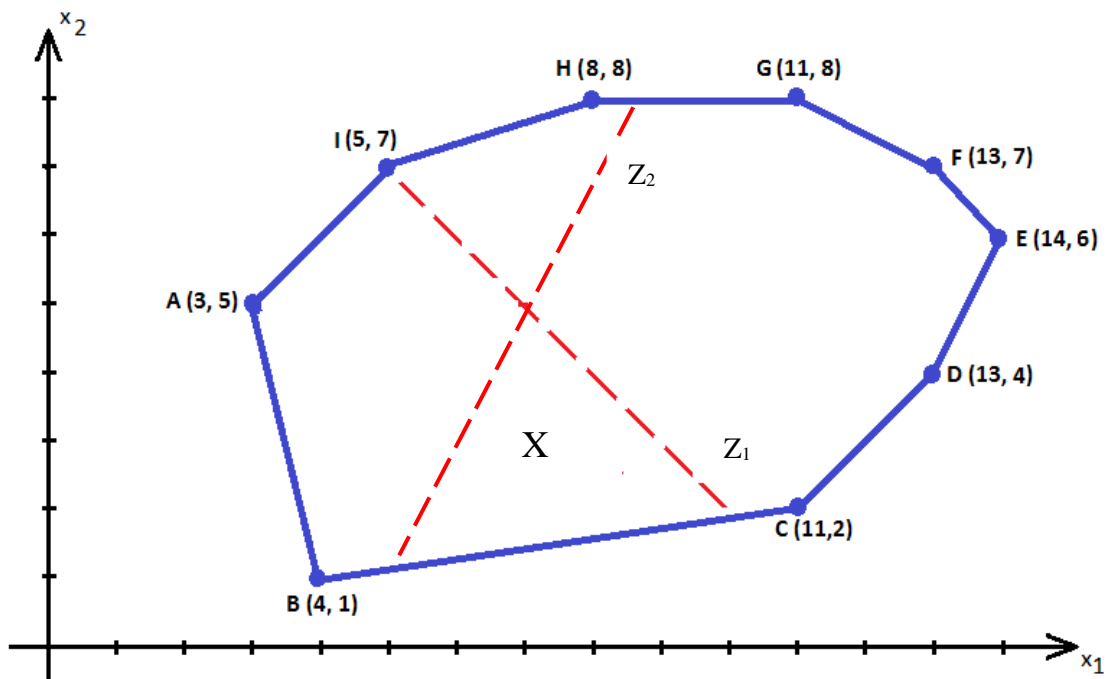
**Note:** Present all the calculations you carry out, as well as any comments, justifications or conclusions you deem appropriate.

Name: \_\_\_\_\_ No.: \_\_\_\_\_

**1.** (quotation 4,5 = 2,5 + 1,0 + 1,0 points)

Consider the following **linear programming** problem with **two objective functions**:

$$\begin{aligned} \text{Min } Z_1 &= x_1 + x_2 \\ \text{Max } Z_2 &= 2x_1 - x_2 \\ \text{subject to } \underline{x} &= (x_1, x_2)^T \in X \end{aligned}$$



- Based on the previous graph, identify the **efficient region** and, if it exists, also the **weakly efficient region** of this problem, conveniently justifying your answer.
- Obtain the corresponding **pay-off table** and identify the **ideal solution** and the **anti-ideal solution**.
- If, when exercising his choice in the domain of non-dominated solutions, the decision maker opted for the solution  $Z_P = \left(\frac{83}{7}, \frac{127}{7}\right)$ , what would be the resulting solution in the space of decision variables? Would this solution be an efficient solution?

**2.** (quotation 4,0 = 3,0 + 1,0 points)

Consider the following **goal programming** problem:

$$\text{Minimizar } Z = \{d_3^+, d_4^-, d_5^+, d_6^-\}$$

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$$3x_1 - x_2 - d_1^+ = 6 \quad (1)$$

$$x_1 + 2x_2 + d_2^- = 10 \quad (2)$$

$$x_2 + d_3^- - d_3^+ = 12 \quad (3)$$

$$x_1 - x_2 + d_4^- - d_4^+ = 4 \quad (4)$$

$$x_1 + 4x_2 + d_5^- - d_5^+ = 4 \quad (5)$$

$$x_1 + d_6^- - d_6^+ = 10 \quad (6)$$

$$x_1 \geq 0, x_2 \geq 0, d_i^- \geq 0, d_i^+ \geq 0, i = 1, \dots, 6$$

- a) Solve this problem **graphically**.
- b) Indicate, justifying, what was the intended objective for the **goals with priority levels 2 and 4**, as well as whether this was achieved or not.