Applied Operations Research

Simplex method at a glance

Question 1.

Consider the following linear programming model

$$\begin{array}{lrcl} \text{Max} & Z = x_1 - x_2 + x_3 & & \\ \text{s.t.} & 2x_1 - x_2 + 2x_3 & \leq & 6 \\ & -2x_1 + 4x_2 - x_3 & \geq & \alpha \qquad (\alpha \in \mathbb{R}) \\ & x_1 - x_2 + 2x_3 & \geq & 4 \\ & x_1, \quad x_2, \quad x_3 & \geq & 0 \end{array}$$

and the point $P = (0, 2, 4)$.

1. Write the problem in the standard form.
2. Find, if any, a value for α such that P is a vertex of the feasible region and give the corresponding value of the objective function.
3. Consider that P is an optimal solution of the problem for the α value found previously. Comment the following sentence: "The plan $x_1 - x_2 + x_3 = 3$ intercepts the feasible region of the problem."

Question 2.

Consider the following linear programming model

$$\begin{array}{lrcl} \text{Max} & Z = x_1 + 2x_2 - x_3 & & \\ \text{s.t.} & 2x_1 + 4x_2 + 3x_3 & \geq & 8 \\ & x_1 + x_2 & \leq & 6 \\ & -x_1 + x_2 & \leq & 4 \\ & x_1 + x_3 & \leq & 4 \\ & x_1, \quad x_2, \quad x_3 & \geq & 0 \end{array}$$

1. Write the problem in the standard form.
2. Find an optimal solution of the problem that is obtained from the initial problem by adding the restriction $x_3 = 0$ and indicate the corresponding binding constraints.
3. Does the solution of the previous question correspond to a vertex of the feasible region of the initial problem?