I. Restate the following LP so that it is in the standard form - do NOT try solving it...

\[ \text{Min} \quad -3X_1 + 4X_2 - X_3 + 2X_4 \]
\[ \text{st} \quad -4X_1 + 2X_3 + X_4 = -3 \]
\[ X_1 - 2X_2 + 2X_3 \geq 6 \]
\[ X_2 - 2X_3 + X_4 \leq -1 \]
\[ 2X_1 = X_2 + X_3 \]
\[ X_1 \leq 0; \quad X_2 \text{ unrestricted}; \quad X_3 \geq 0; \quad X_4 \geq 0 \]

II. Consider a linear program whose four constraints are

1) \[ 2X_1 - 2X_2 \leq 5 \]
2) \[ -3X_1 + X_2 \leq 1 \]
3) \[ -X_1 + X_2 \leq 3 \]
4) \[ X_1 \leq 4 \quad X_1, X_2 \geq 0 \]

a) Graph (neatly...) the feasible region.
b) Calculate the total number of basic solutions that could exist. How many of these actually exist? Explain any discrepancy.
c) How many basic feasible solutions does the problem have?
d) Mark the basic (both infeasible and feasible) solutions on the graph, and calculate the values of all variables (including slacks) at each of these basic solutions.

III. Use the simplex method to Maximize \( Z = X_2 - X_1 \) subject to the four constraints of Part (II) listed above. What is the optimum value and what is the optimum solution? Do you see anything unusual or special about reduced costs in the optimum tableau?

III. Use the simplex method to solve the following LP

\[ \text{Min} \quad -6X_1 - 4X_2 + X_3 - 5X_4 \]
\[ \text{st} \quad 3X_1 + 3X_2 - 3X_3 + X_4 \leq 24 \]
\[ 3X_1 + 3X_2 + X_3 + 3X_4 \leq 36 \]
\[ -X_1 + 2X_2 + 5X_3 \leq 5 \]
\[ X_1, X_2, X_3, X_4 \geq 0 \]