INSTRUCTIONS

Work with your group members to answer the following questions.

QUESTIONS

Question 1:

Which of the following constraints are not linear or cannot be included as a constraint in a linear programming (LP) problem?

A. $2X_1 + X_2 - 3X_3 \geq 50$
B. $2X_1 + \sqrt{X_2} \geq 60$
C. $4X_1 - \frac{1}{3}X_2 = 75$
D. $\frac{3X_1 + 2X_2 - 3X_3}{X_1 + X_2 + X_3} \leq 0.9$
E. $3X_1^2 + 7X_2 \leq 45$

Question 2:

American Auto is evaluating their marketing plan for the sedans, SUVs, and trucks they produce. A TV ad featuring this SUV has been developed. The company estimates each showing of this commercial will cost $500,000 and increase sales of SUVs by 3%. However, it will reduce sales of trucks by 1% and have no effect of the sales of sedans.

The company also has a print ad campaign developed that it can run in various nationally distributed magazines at a cost of $750,000 per title. It is estimated that each magazine title the ad runs in, will increase the sales of sedans, SUVs, and trucks by 2%, 1%, and 4%, respectively. The company desires to increase sales of sedans, SUVs, and trucks by at least 3%, 14%, and 4%, respectively, in the least costly manner.

A. Formulate an LP model for this problem.
B. Sketch the feasible region.
C. What is the optimal solution?

Note: Please use objective function line (level curves) to find the optimal solution.

Question 3:

Zippy motorcycle manufacturing produces two popular pocket bikes (miniature motorcycles with 49cc engines): the Razor and the Zoomer.

In the coming week, the manufacturer wants to produce up to 700 bikes and wants to ensure the number of Razors produced does not exceed the number of Zoomer bikes by more than 300.

Each Razor produced and sold results in a profit of $70 while each Zoomer results in a profit of $40.

The bikes are mechanically identical and only differ in the appearance of the polymer-based trim around the fuel tank and seat. Each Razor's trim requires 2 pounds of polymer and 3 hours of production time while each Zoomer requires 1 pound of polymer and 4 hours of production time.

Assume that 900 pounds of polymer and 2,400 labor hours are available for production of these items in the coming week.

A. Formulate an LP model for this problem.
B. Sketch the feasible region for this problem.
C. Find the optimal solution.

Note: Please use Gurobi to find the optimal solution.