CIVENG 3C03 Assignment 1

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Question 1

Using the graphic method of solution, find the optimal solution for the following LP model:

Minimize:

$$Z = 2200 - 7X_1 - 2X_2$$

Subject to:

$$X_1 <= 100 \quad (1)$$
$$3X_1 + 5X_2 <= 900 \quad (2)$$
$$4X_1 + 2X_2 <= 600 \quad (3)$$
$$X_1 >= 0, X_2 >= 0$$

The graphical solution to this problem is found in Figure 1. The optimal value for Z is approximately 184.857, when $X_1 = 85.714$ and $X_2 = 128.571$.

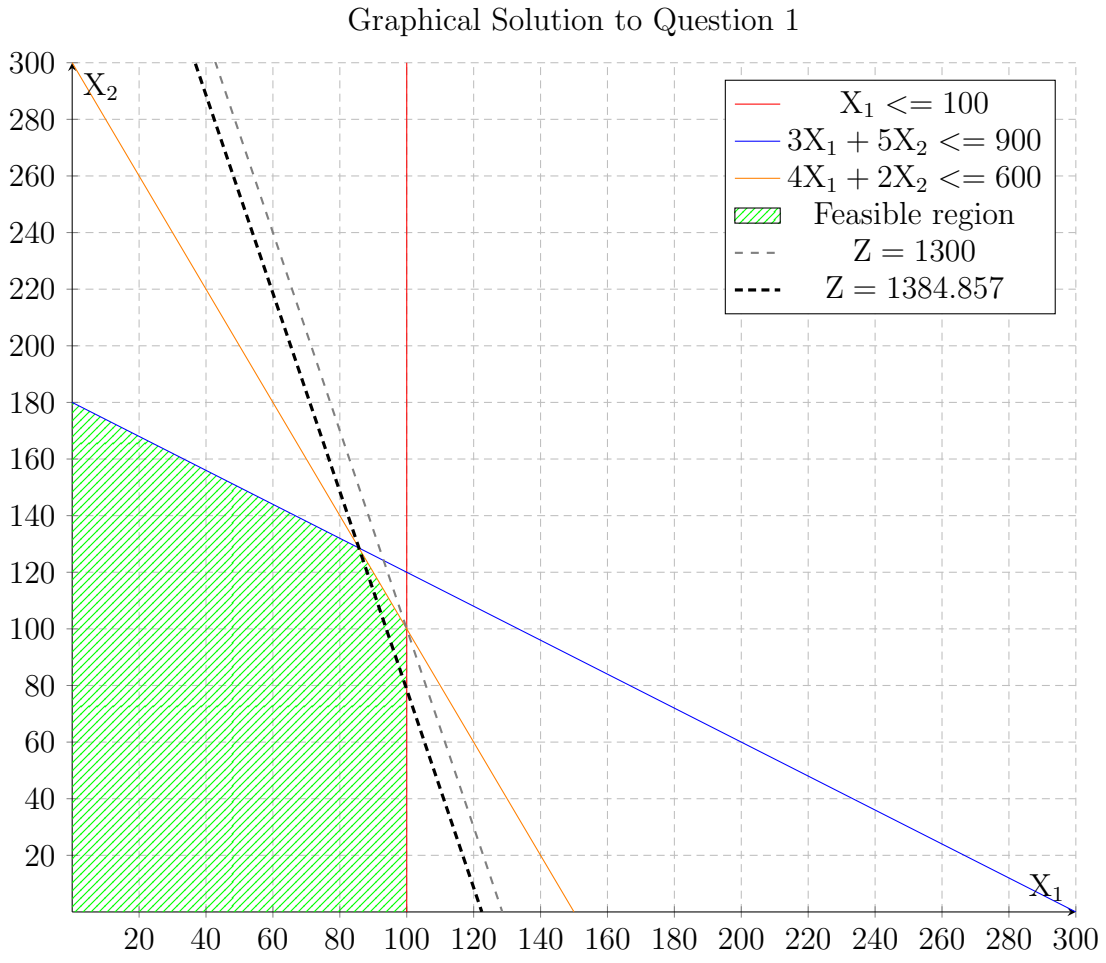

Figure 1: Question 1: Graphical Solution

Question 2

LP Model

$Z = 5400 - (15 + 2.5 \cdot 0.98 + 2 \cdot 0.51)X_1 - (20 + 2.5 \cdot 0.98 + 3.5 \cdot 0.51)X_2 - (10 + 2 \cdot 0.98 + 1.5 \cdot 0.51)X_3$
$Z = 5400 - 18.47X_1 - 24.235X_2 - 12.725X_3$

Minimize: $Z = 5400 - 18.47X_1 - 24.235X_2 - 12.725X_3$ (Objective Function)

Subject to:
$6X_1 + 8X_2 + 4X_3 <= 1000$ (Constraint on number of hours)
$2.5X_1 + 2.5X_2 + 2X_3 <= 380$ (C1 constraint)
$2X_1 + 3.5X_2 + 1.5X_3 <= 400$ (C2 constraint)
$X_1 \leq 50$ (Available X1 constraint)
$X_1, X_2, X_3 >= 0$

The canonical form of the model is expressed as follows:

Minimize: $Z = 5400 - 18.47X_1 - 24.235X_2 - 12.725X_3$

Subject to:
$6X_1 + 8X_2 + 4X_3 + S_1 = 1000$
$2.5X_1 + 2.5X_2 + 2X_3 + S_2 = 380$
$2X_1 + 3.5X_2 + 1.5X_3 + S_3 = 400$
$X_1 + S_4 = 50$

Question 3

1. From the Simplex Tableau provided, we can determine that the canonical form for the Linear Programming problem is:

   Minimize:
   $C = 250 - 3X_1 - 8X_2$

   Subject to:
   $4X_1 + X_2 + S_1 = 40$
   $3X_1 + 5X_2 + S_2 = 75$
   $X_2 + S_3 = 13$

   This means the LP model used to represent the LP problem is:

   Minimize:
   $C = 250 - 3X_1 - 8X_2$

   Subject to:
   $4X_1 + X_2 <= 40$
   $3X_1 + 5X_2 <= 75$
   $X_2 <= 13$
   $X_1, X_2 >= 0$

2. The optimal production policy for the $[X_1 = 3.33, X_2 = 13]$. The corresponding cost of the optimal production policy is $C = 250 - (3 * 3.33) - (13 * 8) = 136$.

3. Since $S_2, S_3 = 0$, the binding constraints are:
   $3X_1 + 5X_2 <= 75$
   $X_2 <= 13$