

IE 400: Principles of Engineering Management

Study Set 2

Spring 2021-2022

Question 1. For the given LP below:

$$\begin{array}{ll}\min & 2x + y \\ \text{s.t.} & -3x + y \geq 6 \\ & x \geq 0 \\ & y \text{ free (free)}\end{array}$$

- (a) Draw the feasible region.
- (b) What is the optimum solution and optimal (optimum) solution value?

Question 2. For the given LP below:

$$\begin{array}{ll}\min & 6x + 10y \\ \text{s.t.} & +8x + y \leq 13 \\ & 3x + 5y \geq 13 \\ & x \geq 0 \\ & y \geq 0\end{array}$$

- (a) Draw the feasible region.
- (b) What is the optimal solution and optimal solution value?

Question 3. There are 2 decision makers (DMs) with following objectives :

$$\max -x + 2y \quad (\text{DM 1})$$

$$\max 4x + 2y \quad (\text{DM 2})$$

and the feasible region is the following:

$$\begin{aligned} \text{s.t. } & x + 2y \leq 12 \\ & -x + y \leq 4 \\ & 4x - 3y \leq 26 \\ & x \geq 0 \\ & y \text{ urs} \end{aligned}$$

- (a) Draw the feasible region.
- (b) Find the optimal solution and optimal solution value for each DM.

Question 4. For the given LP below:

$$\begin{aligned} \min & ax + by \\ \text{s.t. } & x + 2y \geq -4 \\ & -3x + y \leq 6 \\ & x \geq 0 \\ & y \text{ urs} \end{aligned}$$

- (a) Draw the feasible region.
- (b) Give an example for a and b such that LP will have a unique optimal solution. For the chosen a and b, what is the optimal solution and optimal solution value?
- (c) Give an example for a and b such that LP will be unbounded.

Question 5. Consider the following linear programming problem (LP):

$$\begin{aligned} \min \quad & c_1x - c_2y \\ \text{s.t.} \quad & x - 2y \leq 4 \\ & -x + y \leq 3 \\ & x \geq 0 \\ & y \geq 0 \end{aligned}$$

Find positive coefficients c_1 and c_2 such that LP will have a unique optimal solution.

Question 6. For the given LP below :

$$\begin{aligned} \max \quad & 7x + 5y \\ \text{s.t.} \quad & 4x + 7y \geq -8 \\ & 5x - 2y \leq 20 \\ & -3x + 8y \leq b \\ & x \geq 0 \\ & y \geq 0 \end{aligned}$$

- (a) Give an example for b such that LP will have a unique optimal solution value greater than 75.
- (b) For the chosen b , draw the feasible region.
- (c) For the chosen b , what is the optimal solution and optimal solution value?