ASSIGNMENT-01 (UNIT: 1)
Department of Mechanical Engineering
Faculty of Engineering and Technology, University of Lucknow
OPERATION RESEARCH (ME-6051)
Session: 2019-20 (Even Semester)

Q.01. Define Operation Research. Discuss the significance and scope of OR in modern management. What are the limitations of graphical method for solving LPP?

Q.02. Discuss the methodology of operation research explaining briefly the main phases of an OR.

Q.03. A company manufactures two products, X and Y by using three machines A, B, and C. Machine A has 4 hours of capacity available during the coming week. Similarly, the available capacity of machines Band C during the coming week is 24 hours and 35 hours, respectively. One unit of product X requires one hour of Machine A, 3 hours of machine B and 10 hours of machine C. Similarly one unit of product Y requires 1 hour, 8 hour and 7 hours of machine A, B and C respectively. When one unit of X is sold in the market, it yields a profit of Rs. 5/- per product and that of Y is Rs. 7/- per unit. Solve the problem by using graphical method to find the optimal product mix.

Q.04. Solve the following LP problem graphically:

$$\text{Maximize } Z = -X_1 + 2X_2$$
$$\text{Subject to the constraints}$$
$$X_1 - X_2 \leq -1$$
$$-0.5X_1 + X_2 \leq 2,$$
$$X_1, X_2 \geq 0$$

Q.05. Anita Electric Company produces two products P_1 and P_2. Product are produced and sold on a weekly basis. The weekly production cannot exceed 25 for product P_1 and 35 for P_2 because of limited available facilities. There are total 60 workers in the company. Product P_1 requires 2 man-week of labour while P_2 requires 1 man-week of labour. Profit margin on P_1 is Rs. 60 and on P_2 is Rs. 40. Formulate this problem as an LPP and solve using graphical method.

Q.06. A factory manufactures two products A and B on three machines X, Y, and Z. Product A requires 10 hours of machine X and 5 hours of machine Y a one hour of machine Z. The requirement of product B is 6 hours, 10 hours and 2 hours of machine X, Y and Z respectively. The profit contribution of products A and B are Rs. 23/– per unit and Rs. 32 /– per unit respectively. In the coming planning period the available capacity of machines X, Y and Z are 2500 hours, 2000 hours and 500 hours respectively. Using simplex method find the optimal product mix for maximizing the profit.

Q.07. A patient visits the doctor to get treatment for ill health. The doctor examines the patient and advises him to consume at least 40 units of vitamin A and 50 units of vitamin B daily for a specified

time period. He also advises the patient that to get vitamin A and vitamin B he has to drink tonic X and tonic Y that have both vitamin A and vitamin B in a proportion. One unit of tonic X consists 2 units of vitamin A and 3 units of vitamin B and one unit of tonic Y consists of 4 units of vitamin A and 2 units of vitamin B. These tonics are available in medical shops at a cost of Rs.3.00 and Rs.2.50 per unit of X and Y respectively. Now the problem of patient is how much of X and how much of Y is to be purchased from the shop to minimize the total cost and at the same time he can get required amounts of vitamins A and B, use simplex method to solve the problem.

Q.08. Use the Simplex method to solve the following LPP:

$$\text{Max } Z = 5X_1 + 3X_2$$
Subject to
$$4X_1 + 2X_2 \leq 10,$$
$$2X_1 + 2X_2 \leq 8$$
$$X_1, X_2 \geq 0$$

Q.09. Use the Simplex method to solve the following LPP:

$$\text{Min } Z = 48X_1 + 40X_2$$
Subject to
$$3X_1 + 2X_2 \geq 7$$
$$X_1 + X_2 \geq 5$$
$$X_1, X_2 \geq 0$$

Q.10. Solve the following LPP:

$$\text{Min } Z = X_1 + X_2$$
Subject to
$$20X_1 + 10X_2 \geq 120$$
$$50X_1 + 80X_2 \geq 740$$
$$10X_1 + 60X_2 \geq 240$$
$$X_1, X_2 \geq 0$$

Q.11. Find the solution of the following LP problem:

$$\text{Minimize } 3a + 2.5b$$
$$\text{Subject to } 2a + 4b \geq 40$$
$$4a + 2b \geq 50$$
$$a, b \geq 0$$

Q.12. Use penalty method to solve the following LP Problem:

$$\text{Min } Z = 3x_1 - x_2$$
Subject to
$$2x_1 + x_2 \geq 2,$$
$$x_1 + 3x_2 \leq 3,$$
$$x_2 \geq 4$$
$$x_1, x_1 \geq 0$$