

8. Determine  $x_1$  and  $x_2$  so as to

$$\text{Maximize } z = 12x_1 + 21x_2 + 2x_1x_2 - 2x_1^2 - 2x_2^2$$

$$\text{Subject to } x_2 \leq 8$$

$$x_1 + x_2 \leq 10$$

$$\text{and } x_1, x_2 \geq 0.$$

9. Use the revised simplex method, solve the following LPP.

$$\text{Maximize } z = 3x_1 + 5x_2$$

$$\text{Subject to } x_1 \leq 4,$$

$$x_2 \leq 6,$$

$$3x_1 + 2x_2 \leq 18,$$

$$x_1, x_2 \geq 0.$$

10. The probability of demand for hiring cars on any day in a given city is as follows :

No. of cars demanded: 0    1    2    3    4

Probability:            0.1   0.2   0.3   0.2   0.2

Cars have a fixed cost of Rs. 90 each day to keep the daily hire charges Rs. 200. If the car-hire company own 4 cars, what is its daily expectation? If the company is about to go into business and currently has no car, how many car should it buy?



APRIL/MAY 2019

### MMA33 — OPERATIONS RESEARCH

Time : Three hours

Maximum : 75 marks

#### SECTION A — (5 × 6 = 30 marks)

Answer ALL questions.

1. (a) Discuss the types of integer programming problem.

Or

- (b) Solve the following mixed — integer programming problem

$$\text{Maximize } z = -3x_1 + x_2 + x_3$$

$$\text{Subject to } -x_1 + 2x_2 + x_3 \leq 4$$

$$2x_2 - \frac{3}{2}x_3 \leq 1$$

$$x_1 - 3x_2 + 2x_3 \leq 3$$

$$x_1, x_2 \geq 0, x_3$$

non-negative integer.

2. (a) Write down the general procedure for solving DPP approach:

Or



- (b) Determine the value of  $u_1, u_2$  and  $u_3$

$$\text{Maximize } z = u_1 \cdot u_2 \cdot u_3$$

$$\text{Subject to } u_1 + u_2 + u_3 = 10 \text{ and}$$

$$u_1, u_2, u_3 \geq 0.$$

3. (a) Find the optimum solution of the following constrained multivariable problem.

$$\text{Maximize } z = x_1^2 + (x_2 + 1)^2 + (x_3 - 1)^2$$

$$\text{Subject to } x_1 + 5x_2 - 3x_3 = 6$$

$$x_1, x_2, x_3 \geq 0.$$

Or

- (b) Derive the necessary condition for local minimum and maximum value.

4. (a) Write down the procedure for revised simplex method.

Or

- (b) Solve the following LPP :

$$\text{Maximize } z = 3x_1 + 5x_2 + 2x_3$$

$$\text{Subject to } x_1 + 2x_2 + 2x_3 \leq 14$$

$$2x_1 + 4x_2 + 3x_3 \leq 23$$

$$0 \leq x \leq 4$$

$$2 \leq x_2 \leq 5$$

$$0 \leq x_3 \leq 3.$$

5. (a) Discuss the types of decision making environments.

Or

- (b) What are the criteria for decision making under uncertainty?

SECTION B — (3 × 15 = 45 marks)

Answer any THREE questions.

6. Using Gomory technique Derive the optimal integer solution for the following problem

$$\text{Maximize } z = 3x_1 + 12x_2$$

$$\text{Subject to } 2x_1 + 4x_2 \leq 7$$

$$5x_1 + 3x_2 \leq 15$$

and  $x_1, x_2 \geq 0$  are integers.

7. Use dynamic programming to solve the following LPP.

$$\text{Maximize } z = 3x_1 + 5x_2$$

$$\text{Subject to } x_1 \leq 4,$$

$$x_2 \leq 6,$$

$$3x_1 + 2x_2 \leq 18,$$

$$x_1, x_2 \geq 0.$$

