

NOVEMBER/DECEMBER 2018

**MMA33 — OPERATIONS RESEARCH**

Time : Three hours

Maximum : 75 marks

**SECTION A — (5 × 6 = 30 marks)**

Answer ALL questions.

1. (a) Solve the following linear integer programming problem by cutting plane method.

$$\text{Maximize } Z = 14x_1 + 16x_2$$

$$\text{Subject to } 4x_1 + 3x_2 \leq 12$$

$$6x_1 + 8x_2 \leq 24$$

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

Or

- (b) Write down the procedure for Gomory's mixed-integer programming algorithm.



2. (a) Determine the value of  $u_1$ ,  $u_2$  and  $u_3$

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

$$\text{Subject to } u_1 + u_2 + u_3 = 10 \\ \text{and } u_1, u_2, u_3 \geq 0$$

Or

- (b) Using dynamic programming to solve the following problem.

$$\text{Minimize } Z = y_1^2 + y_2^2 + y_3^2$$

$$\text{Subject to } y_1 + y_2 + y_3 = 10 \\ y_1, y_2, y_3 \geq 0$$

3. (a) A firm has a total revenue function  $R = 20x - 2x^2$  and a total cost function,  $C = x^2 - 4x + 20$  where  $x$  represents the quantity. Find the revenue maximizing output level and the corresponding value of profit, price and total revenue.

Or

- (b) Solve the following problem by using the method of Lagrangian multipliers.

$$\text{Minimize } Z = x_1^2 + x_2^2 + x_3^2$$

$$\text{Subject to } x_1 + x_2 + 3x_3 = 2 \\ 5x_1 + 2x_2 + x_3 = 5 \\ \text{and } x_1, x_2 \geq 0$$

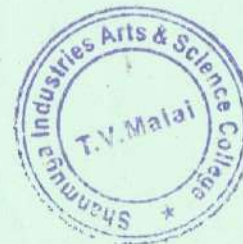
4. (a) Write down the simplex algorithm for bounded variable LPP.

Or

- (b) Solve the following LPP.

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

$$\text{Subject to } x_1 + 2x_2 + 2x_3 \leq 14 \\ 2x_1 + 4x_2 + 3x_3 \leq 23 \\ 0 \leq x_1 \leq 4 \\ 2 \leq x_2 \leq 5 \\ 0 \leq x_3 \leq 3$$



5. (a) Explain the criteria for decision making under uncertainty.

Or

- (b) The probability of demand for hiring cars on any day in a given city is follows.

No. of cars demand : 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 (variable cost of running) Rs. 200. If the car-hire company owns 4 cars, what is its daily expectation? If the company is about to go into business and currently has no car, how many cars should it buy?

SECTION B — (3 × 15 = 45 marks)

Answer any THREE questions.

6. Solve the following mixed integer programming problem by Gomory's algorithm.

Maximize  $Z = x_1 + x_2$

Subject to the constraints

$$3x_1 + 2x_2 \leq 5$$

$$x_2 \leq 2$$

$$x_1, x_2 \geq 0, x_1 \text{ non-negative integer.}$$

7. Solve the following LPP by dynamic programming approach.

$$\text{Maximize } Z = 8x_1 + 7x_2$$

$$\text{Subject to } 2x_1 + x_2 \leq 8$$

$$5x_1 + 2x_2 \leq 15$$

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

8. Find the optimum value of the objective function when separately subject to the following three sets of constraints.

$$\text{Maximize } Z = 10x_1 - x_1^2 + 10x_2 - x_2$$

Subject to

$$(a) \quad x_1 + x_2 \leq 14$$

$$-x_1 + x_2 \leq 6$$

$$x_1, x_2 \geq 0$$

$$(b) \quad x_1 + x_2 \leq 8$$

$$-x_1 + x_2 \leq 5$$

$$x_1, x_2 \geq 0$$

$$(c) \quad x_1 + x_2 \leq 9$$

$$x_1 - x_2 \geq 6$$

$$x_1, x_2 \geq 0$$



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

Maximize  $Z = 2x_1 + x_2$

Subject to  $3x_1 + 4x_2 \leq 6,$   
 $6x_1 + x_2 \leq 3,$   
and  $x_1, x_2 \geq 0$

10. Write down the steps of decision making process.
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