



Operational Research (New) (1240)

P. Pages : 5

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** sub questions from each unit.
5. Non programmable calculator is allowed.
6. Assume suitable data if necessary.
7. Draw the graphs on graph papers only.
8. Figures to right indicate full marks.

UNIT - I

1. a) A person wants to invest maximum Rs. 1,00,000 in two stock portfolios, with the maximum investment allowed in either portfolios at Rs. 75,000. The first portfolio has an average rate of return of 10% whereas the second has 20%. In terms of risk factors associated with these portfolios, the first has a risk rating of 4 (on a scale from 0 to 10), and the second has 9. Since he wish to maximise his return, he will not accept an average rate of return below 12% or risk factor above 6. Find how much should he invest in each portfolio. **10**
- b) A medium scale factory specializes in the manufacture of 2 types of motor, A and B. Each type of motor is first done in the assembly department then in winding and finally in testing departments. The limiting capacity of the individual department per month is as follows. **10**

Department	Capacity
Assembly	1200 motors of A or 2000 motors of B
Winding	2400 motors of type A or 800 motors of type B
Testing & Packing	1500 motors of type A or 1000 motors of type B

The profit is Rs. 400 for each type of motor A and Rs. 300 for each type of motor B. Solve graphically to find the number of each type motors are manufacture to maximise profit.

- c) i) Solve following problem graphically. 6

$$\begin{aligned} \text{Max } Z &= 6x_1 + 4x_2 \\ \text{subject to} \\ x_1 + x_2 &\geq 12 \\ 2x_1 + 3x_2 &\leq 42 \\ 2x_1 - 4x_2 &\geq 0 \\ x_1, x_2 &\geq 0 \end{aligned}$$

- ii) Explain sensitivity analysis. 4

UNIT - II

2. a) i) What do you understand from an unbounded solution ? When does the simplex arithmetic (table) indicate that the LPP has unbound solution ? 4

- ii) Construct the dual of the following LPP. 6

$$\begin{aligned} \text{minimize } Z &= x_2 + 3x_3 \\ \text{subject to } 2x_1 + x_2 &\leq 3 \\ x_1 + 2x_2 + 6x_3 &\geq 5 \\ -x_1 + x_2 + 2x_3 &= 2 \\ x_1, x_2, x_3 &\geq 0 \end{aligned}$$

- b) Solve by Big M method. 10

Objective function

$$\begin{aligned} \text{maximize } Z &= 300x_1 + 400x_2 - 600x_3 \\ \text{subject to } x_3 &\leq 3000 \\ \frac{x_1}{3} + x_3 &\leq 4500 \\ x_1 - 2x_3 &= 0 \\ x_2 - x_3 &= 0 \\ x_1, x_2, x_3 &\geq 0 \end{aligned}$$

- c) Solve by simplex method.

10

Objective function

$$\max Z = 10x + 6y + 6z$$

subjecto

$$3x + 2y + 2z \leq 240$$

$$2x + 3y + 3z \leq 270$$

$$x \leq 60$$

$$x, y, z \geq 0$$

UNIT - III

3. a) A company has four terminals u, v, w and x. At the start of a particular day 10, 4, 6 and 5 trailers respectively are available at these terminals. During the previous night 13, 10, 6 and 6 trailers respectively loaded at plant A, B, C and D. The company despatcher has come up with the cost between the terminals and plants as follows. 10

		Plants			
		A	B	C	D
Terminals	u	20	36	10	28
	v	40	20	45	20
	w	75	35	45	50
	x	30	35	40	25

Find the allocation of loaded trailers from plants to terminals in order to minimize transportation cost. Calculator total transportation cost.

- b) The processing time (minutes) taken by 5 operators to make 5 different products are given below. The effective working hours in a day is 6 hours. 10

Operator	Products				
	1	2	3	4	5
A	10	12	18	15	9
B	12	10	20	18	10
C	8	9	15	10	8
D	9	8	24	12	12
E	10	15	18	12	10

Profit per product are Rs. 4, 2, 3, 3 and 4 for product 1, 2, 3, 4 and 5 respectively. Find out the allocation of operators to product in order to maximize total profit & also calculate total profit.

- c) i) What is degeneracy in transportation problems ? How is it resolved ? 5

- ii) Differentiate between dynamic programming and linear programming. 5

UNIT – IV

4. a) i) What is the difference between "Pure Strategy" games and a "mixed strategy" games ? 4

- ii) In a game of matching coins with two players, suppose A wins one unit of value when there are two heads, wins nothing when there are two tails and loses $\frac{1}{2}$ unit of value when there are one head and one tail. Determine the payoff matrix, the best strategies for each player and the value of the game to A. 6

- b) A stockist of a particular commodity makes a profit of Rs. 30 on each unit sale made within the same week of purchase, otherwise he incurs a loss of Rs.30 on each item. The data of the past sales are given below : 10

No. of item sold with the same week	6	7	8	9	10	11
Probability	0.15	0.20	0.40	0.15	0.10	0.00

Find out the optimum numbers of items the stockist should buy every week in order to maximize the profit and also find the expected value of perfect information.

- c) What do you understand from "decision making under uncertainty"? List and explain any four methods which are used to solve the problems of decision making under uncertainty. 10

UNIT - V

5. a) Following table shows processing time in hours for 7 jobs on 3 machines. The order of processing is ACB. Determine optimum sequence and minimum elapsed time. Also calculate percentage utilization of each machine. 10

		Job						
		1	2	3	4	5	6	7
M/c	A	7	8	1	1	2	7	10
	B	7	11	9	7	10	9	8
	C	5	2	1	3	7	6	3

- b) A company has a machine whose cost is Rs. 7000. Its maintenance cost and resale value at the end of different years are as given below. 10

Year	1	2	3	4	5	6	7	8
Running cost (Rs.)	1100	1300	1500	1900	2400	2900	3500	4100
Resale Price (Rs.)	3100	1600	850	475	300	300	300	300

What is the economic life of the machine and what is minimum average cost?

- c) The probability P_n of failure just before age n is shown below. If individual replacement cost Rs. 12.50 and group replacement costs Rs. 3.00 per item. Find the optimal replacement policy. Assume number of item $S = 1000$. 10

n	1	2	3	4	5
P_n	0.1	0.2	0.25	0.3	0.15
