PG EVEN SEMESTER EXAMINATION, 2023

MATHEMATICS

2nd Semester

Course No. : MAT - 552

(Basic Operations Research)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

(Answer one question from each unit)

Unit - I

1. What do you mean by Sensitivity Anslysis? How does it work for linear programming problem? Explain. 14

2. (a) Obtain the optimal solution to LPP
Max $Z = 3x_1 + 5x_2$
subject to $x_1 + x_2 \leq 1$
$2x_1 + 3x_2 \leq 1$ and $x_1, x_2 \geq 0$
Using post optimal analysis obtain the variation in C_j (j = 1, 2) which are permitted without changing the optimal solution. 7

(b) Solve the following problem by revised simplex method :
Max $Z = x_1 + 2x_2$, subject to
$x_1 + x_2 \leq 3$, $x_1 + 2x_2 \leq 5$, $3x_1 + x_2 \leq 6$
and $x_1, x_2 \geq 0$ 7

Unit - II

3. (a) Solve the game graphically 7

$$A = \begin{array}{c} \\ \text{I} \\ \text{II} \\ \text{II} \end{array} \begin{array}{c} \begin{array}{cc} \text{I} & \text{II} \end{array} \\ \begin{bmatrix} 2 & 7 \\ 3 & 5 \\ 11 & 2 \end{bmatrix} \end{array} \quad \text{B}$$

(b) Using the principle of dominance, find the optimal strategies for the following game 7

		Company B			
		I	II	III	IV
Company A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

4. (a) Solve the following game by matrix method. 7

$$\begin{bmatrix} -3 & -1 & 1 & 2 \\ -2 & 3 & 2 & 3 \\ 2 & -2 & -1 & 1 \end{bmatrix}$$

(b) Find the value of the game and optimal strategies for two players of the rectangular game whose pay off matrix is given by 7

$$A = \begin{array}{c} \\ \text{I} \\ \text{II} \\ \text{II} \end{array} \begin{array}{c} \begin{array}{ccc} \text{I} & \text{II} & \text{III} \end{array} \\ \begin{bmatrix} 1 & -1 & -1 \\ -1 & -1 & 3 \\ -1 & 2 & -1 \end{bmatrix} \end{array} \quad \text{B}$$

Unit - V

9. (a) Use Gomory's technique to derive the integer optimal solution for the following :

$2x_1 + 5x_2 \leq 16$

$6x_1 + 5x_2 \leq 30$ and

$x_1 , x_2 \geq 0$ and integers.

Obtain the geometrical interpretation of Gomory's cutting plane method. 14

10. (a) Draw the flow chart of Gomory's all IPP algorithm. 4

(b) Use Branch and Bound technique to obtain the integer optimal solution of

Max : $Z = 7x_1 + 9x_2$

subject to

$- x_1 + 3x_2 \leq 6$

$7x_1 + x_2 \leq 35$

$0 \leq x_1 , \ x_2 \leq 7 , \ x_1, x_2$ are integers. 10

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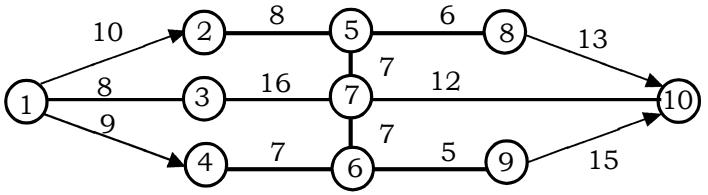
Unit - III

5. (a) There are give jobs, each of which must go through the machines A, B and C in the order ABC.
Determine the optimal sequence with minimum elapsed time. 7

Processing times (in hours)

Job No	1	2	3	4	5
Machine A	5	7	6	9	5
Machine B	2	1	4	5	3
Machine C	3	7	5	6	7

(b) Determine the critical path for the following network : 7



6. (a) The following table lists the jobs of a network with their time estimates : 10

Job (i - j)	Duration (in days)		
	Optimistic	Most likely	Pessimistic
1 - 2	3	6	15
1 - 6	2	5	14
2 - 3	6	12	30
2 - 4	2	5	8
3 - 5	5	11	17
4 - 5	3	6	15
6 - 7	3	9	27
5 - 8	1	4	7
7 - 8	4	19	28

(i) Draw the project network
(ii) Calculate the length and variance of the critical path.

(b) Discuss the similarity and differences between CPM and PERT. 4

Unit - IV

7. (a) Develope the inventory model with non uniform demand. 7

(b) What is finite replenishment rate? How does it work in developing the inventory model for cost minimisation. 7

8. (a) Deduce the inventory model with uniform demand allowing shortages which are fully backlogged. 8

(b) Consider the inventory systems with the following data in usual notations : 6

r = 1000 units / year

I = 0.30

P = Rs 0.50 / unit

C_3 = Rs 10.00

Determine the following :

(i) optimal older quantity

(ii) minimum average cost.