

R18

Code No: 156FP

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, March - 2024

OPERATIONS RESEARCH

(Computer Science and Business Systems)

Time: 3 Hours

Max. Marks: 75

- Note:** i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A**(25 Marks)**

- 1.a) What are the situations where operations research techniques will be applicable? [2]
- b) What is meant by sensitivity analysis? Explain it briefly. [3]
- c) State the primal-dual relationship. [2]
- d) State various steps involved in the dual simplex method briefly. [3]
- e) Write basic difference between PERT and CPM. [2]
- f) State Kuhn-Tucker necessary and sufficient conditions in non-linear programming. [3]
- g) Give two different examples of sequencing problems from your daily life. [2]
- h) What is the difference between single server and multiple server models? [3]
- i) What is the dynamic recursive relation? State the general process of backward recursion. [2]
- j) Define 'saddle point'. Is it necessary that a game should always possess a saddle point? [3]

PART – B**(50 Marks)**

2. A businessman has the options of investing his money in two plans. Plan A guarantees that each rupee invested will earn seventy paise a year hence, while plan B guarantees that each rupee invested will earn two rupees two years hence. In plan B, only investments for periods that are multiples of two years are allowed. The problem is how he should invest ten thousand rupees in order to maximize the earning at the end of three years.
 - a) Formulate this problem as a linear programming model,
 - b) Find the optimal solution. [3+7]

OR

3. Find the alternative solutions (if exists) to the following L.P.P.
Minimum $z = -5x_1 - 2x_2$
subject to $x_1 + (5/4)x_2 \leq (5/2)$, $-5x_1 - 2x_2 \geq -10$, $3x_1 + 8x_2 - 12 \leq 0$, and $x_1 \geq 0$, $x_2 \geq 0$. [10]

4. By solving the dual of the L.P.P.

$$\text{Minimize } z = 2x_1 + 2x_2$$

$$\text{Subject to } 2x_1 + 4x_2 \geq 1, \quad x_1 + 2x_2 \geq 1, \quad 2x_1 + x_2 \geq 1 \quad \text{and } x_1, x_2 \geq 0.$$

Show that the optimal value of the primal as also of the dual is 4/3. Show further that the optimal solution of the dual can be read off from the final optimal table of the primal. [10]

OR

5. Use the revised simplex method to solve the following LP problem.

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

$$\text{Subject to } 3x_1 + 4x_2 \leq 6, \quad 6x_1 + x_2 \leq 3, \quad \text{and } x_1, x_2 \geq 0.$$

[10]

6. Use the Wolfe's method to solve the following non-linear LP problem.

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

$$\text{Subject to } 2x_1 + 3x_2 \leq 6, \quad 2x_1 + x_2 \leq 4, \quad \text{and } x_1, x_2 \geq 0.$$

[10]

OR

7. Explain about forward and backward pass methods. [10]

8. A manufacturing company processes 6 different jobs on two machines **A** and **B**. Number of units of each job and its processing times on **A** and **B** are given below. Find the optimal sequence, the total minimum elapsed time and idle time for either machine. [10]

Job number	No. of units of each job	Processing time (in minutes)	
		Machine A	Machine B
1	3	5	8
2	4	16	7
3	2	6	11
4	5	3	5
5	2	9	7.5
6	3	6	14

OR

9. Using geometric programming problem: Minimize $f(x_1, x_2) = x_1$ subject to $-4x_1^2 + 4x_2 \leq 1, \quad x_1 + x_2 \geq 1, \quad x_1 > 0, \quad x_2 > 0$ [10]

10. 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 losses 1/2 unit of value when there is one head and one tail. Determine the payoff matrix, the best strategies for each player and the value of the game to **A**. [10]

OR

11. Solve the following problem by dynamic programming:

$$\text{Minimize } f(y_1, y_2, y_3) = y_1^2 + y_2^2 + y_3^2 \quad \text{subject to } y_1 y_2 y_3 = 27, \quad y_i \geq 0 \quad \text{for } i=1,2,3. \quad [10]$$