Code No: 156FP **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, August/September - 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.

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PART – A

(25 Marks)

1.a) Define the slack variable, surplus variable and artificial variable in linear programming problem. [2]
b) Explain the sensitivity analysis. [3]
c) Define the dual of a linear programming problem. [2]
d) Explain the revised simplex method briefly. [3]
e) What are the major limitations of the PERT technique? Discuss. [2]
f) Write Kuhn-Tucker conditions in non-linear programming. [3]
g) What is meant by deterministic inventory model? [2]
h) What is the difference between single server and multiple server models? [3]
i) State Bellman's principle of optimality. [2]
j) Explain: Minimax and Maximin principle used in the theory of games. [3]

PART – B

(50 Marks)

2. A company produces two products, A and B. The sales volume for A is at least 80% of the total sales of both A and B. However, the company cannot sell more than 110 units of A per day. Both products use one raw material, of which the maximum daily availability is 300 lb. The usage rates of the raw material are 2 lb per unit of A, and 4 lb per unit of B. The profit units for A and B are \$40 and \$90, respectively. Determine the optimal product mix for the company. [10]

OR

3. Solve the following problem by Big M method:
Maximize $Z = 5x_1 - 4x_2 + 3x_3$
subject to
$2x_1 + x_2 - 6x_3 = 20,\ 6x_1 + 5x_2 + 10x_3 \le 76,\ 8x_1 - 3x_2 + 6x_3 \le 50$ and $x_1,\ x_2,\ x_3 \ge 0$ [10]

4. Solve the following L.P.P.
Minimize $z = 3x_1 + 4x_2$
subject to $x_1 - x_2 \le 1,\ x_1 + x_2 \ge 4,\ -x_1 + 3x_2 \ge -3$ and $x_1, x_2 \ge 0$.
Further using the final simplex table, write the solution to the dual problem. [10]

OR

5. One unit of product A contributes Rs. 7 and requires 3 units of raw material and 2 hours of labour. One unit of product B contributes Rs. 5 and requires one unit of raw material and one hour of labour. Availability of raw material at present is 48 units and there are 40 hours of labour.
a) Formulate this problem as a linear programming problem.
b) Write its dual.
c) Solve the dual by the simplex method and find the optimal product mix and the shadow prices of the raw material and labour. [2+2+6]

6. Use the Beale's method to solve the following non-linear programming problem.
Maximize $z = 2x_1 + 3x_2 - x_1^2$
subject to $x_1 + 2x_2 \le 4$, and $x_1, x_2 \ge 0$. [10]

OR

7.a) What is meant by the term critical activities, and why is it necessary to know about them in project scheduling?
b) Explain the following terms in the context for project management:
(i) Resources float, (ii) Activity variance, (iii) Project variance (iv) Pessimistic time, optimize time of the activities. [4+6]

8. Explain and solve an inventory model with instantaneous stochastic demand with no set-up cost. A baking company sells cake by its weight in kilograms. It makes a profit of Rs 5.00 on every kilogram sold on the day it is baked. It disposes of all cakes not sold on the date they are baked, at a loss of Rs 1.20 per kg. If the demand is known to be rectangular between 2,000 and 3,000 kgs, determine the optimum daily amount baked. [10]

OR

9. Using geometric programming problem:
Minimize $f(x_1, x_2) = 7x_1 x_2^{-1} + 3x_2 x_3^{-2} + 5x_1^{-3} x_2 x_3 + x_1 x_2 x_3$
Subject to $x_i > 0,\ i = 1, 2, 3$. [10]

10. A book binder has one printing press, one binding machine and manuscripts of 7 different books. The times required for performing printing and binding operations for different books are shown below:

Book	1	2	3	4	5	6	7
Printing time (hours)	20	90	80	20	120	15	65
Binding time (hours)	25	60	75	30	90	35	50

Decide the optimum sequence of processing of books in order to minimize the total time required to bring out all the books. [10]

OR

11. Solve the following problem by dynamic programming:
Maximize $f(y_1, y_2, y_3) = y_1 y_2 y_3$
Subject to $y_1 + y_2 + y_3 = 9$, $y_i \ge 0$ for $i = 1, 2, 3$. [10]

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