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M.A./M. Sc. (Final) Examination, 2022
Mathematics
(Optional)
Paper Fourth (*i*)
(Operations Research)

Time : Three Hours] *[Maximum Marks:100*

Note: All questions are compulsory. Attempt any two parts from each question. All questions carry equal marks.

Unit - I

1. (A) Using the upper bound technique, solve the following linear programming problem:

Maximize $z = x_2 + 3x_3$

Subject to the constraints:

$x_1 + x_2 + x_3 \leq 10,$

$x_1 - 2x_3 \geq 0,$

$2x_2 - x_3 \leq 10,$

$0 \leq x_1 \leq 8,$

$0 \leq x_2 \leq 4,$

$x_3 \geq 0$

(B) Using dual simplex method, solve the following linear programming problem.

Minimize $z = x_1 + 2x_2 + 3x_3$

Subject to the constraints:

$x_1 - x_2 + x_3 \geq 4,$

$x_1 + x_2 + 2x_3 \leq 8,$

$x_2 - x_3 \geq 2,$

$x_1, x_2, x_3 \geq 0$

(C) For the following parametric linear programming problem:

Maximize-

$x_1 + 2x_2 + x_3 \leq 430 + \lambda,$

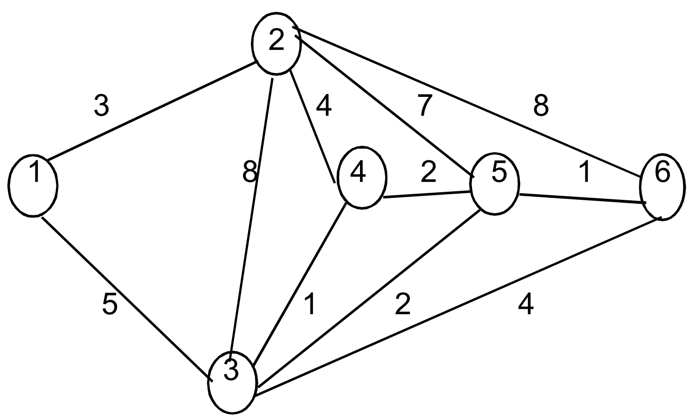
$3x_1 + 2x_3 \leq 460 - 4\lambda,$

$$x_1 + 4x_2 \leq 420 - 4\lambda,$$
$$x_1, x_2, x_3 \geq 0$$

Find the range of over which the solution remains basic feasible and optimal.

Unit - II

2. (A) Consider the distance network as shown below: Then



(i) Apply Floyd's algorithm to it and generate the final distance matrix and precedence matrix.

(ii) Find the shortest path and the corresponding distance from the source node to the destination

node as indicated in each of the cases: 1 - 6. 5-1 and 5 - 2

(B) Obtain an optimum basic feasible solution to the following transportation problem-

Factory	W1	W2	W3	W4	Capacity
F1	19	30	50	10	7
F2	70	30	40	60	9
F3	40	8	70	20	18
requirements	5	8	7	14	

(C) A small project is composed of 7 activities, whose time estimates are listed in the table below. Activates are identified by their beginning (*i*) and ending (*j*) nodes numbers:

Activity	Estimated Duration (in weeks)		
(i-j)	Optimistic	most likely	Pessimistic
1 - 2	1	1	7
1 - 3	1	4	7
1 - 4	2	2	8

2 - 5	1	1	1
3 - 5	2	5	14
4 - 6	2	5	8
5 - 6	3	6	15

Then:

(i) Draw the project network diagram and identify all the paths through it.

(ii) Find the expected duration and variance for each activity. What is the expected project length?

(iii) Calculate the variance and standard deviation of the project length.

Unit - III

3. (A) Use dynamic programming to solve the following L. P. P.

Maximize $z = x_1 + 9x_2$

Subject to the constraints:

$2x_1 + x_2 \leq 25.$

$x_2 \leq 11$

$x_1, x_2 \geq 0$

(B) Solve the game whose payoff matrix is given below by graphical method.

Player B

$$\text{Player A}\begin{bmatrix} 4 & -2 & 3 & -1 \\ -1 & 2 & 0 & 1 \\ -2 & 1 & -2 & 0 \end{bmatrix}$$

(C) Use branch and bound method to solve the following L. P. P.

Maximize $z = 7x_1 + 9x_2$

Subject to the constraints:

$-x_2 + 3x_2 \leq 6$

$7x_1 + x_2 \leq 35.$

$x_2 \leq 7$

$x_1, x_2 \geq 0$ and are integer.

Unit - IV

4. (A) Explain Indecomposable and decomposable economies with one example.

(B) Explain input - output analysis and its practical uses.

(C) Explain economic interpretation of dual linear programming problems with example.

Unit - V

5. (A) Use Wolfe's method to solve the following quadratic programming problem.

Maximize $z = x_1^2 - x_1x_2 + 2x_2^2 - x_1 - x_2$

Subject to the constraints:

$2x_1 + x_2 \leq 1.$

$x_1, x_2 \geq 0.$

(B) Use Beale's method to solve the following non-linear programming problem.

Maximize $f(x) = 2x_1 + 3x_2 - x_1^2$

Subject to the constraints:

$x_1 + 2x_2 \leq 4.$

$x_1, x_2 \geq 0.$

(C) Use the Kuhn - Tucker conditions to solve the N. L. P. P.

Maximize $f(x) = (x_1 + 1)^2 + (x_2 + 2)^2$

Subject to the constraints:

$0 \leq x_1 \leq 2.$

$0 \leq x_2 \leq 1.$