H-4/26/22

Roll No. .....

IV Semester Examination, 2022

M.Sc.

MATHEMATICS

Paper IV

(Operation Research-II)

Time : 3 Hours] [Max. Marks : 80

Note : *All questions are compulsory. Question Paper comprises of 3 sections. Section **A** is objective type/multiple choice questions with no internal choice. Section **B** is short answer type with internal choice. Section **C** is long answer type with internal choice.*

SECTION A **1×10=10**

(Objective Type/Multiple Choice Questions)

Choose the correct answer :

1. Dynamic programming problem :

(a) Can be solved only be recursive equation approach

(b) Can be solved using recursive equation approach

(c) Under certainty involves these problems whose conditions at each stage are know with certainty

(d) None of the above

2. When a positive quantity c is divided into 8 parts, the maximum value of their product is :

(a) $8c$ (b) $\left(\frac{c}{8}\right)^8$

(c) $(8c)^8$ (d) $8\left(\frac{c}{8}\right)$

3. The pay-off value for which each player in game always selects the same strategy is called :

(a) saddle point (b) equilibrium point

(c) both (a) and (b) (d) none of these

4. The size of the pay off matrix of a game can be reduced by using principle of :

(a) game inversion (b) game transpose

(c) dominance (d) rotation reduction

5. In a mixed integer programming problem :

(a) only few of decision variables require integer solution

(b) different objective functions are mixed together

(c) all the dicision variables require integer solution

(d) none of the above

6. Branch and bounding method divides, the feasible solution space into smaller parts by :

(a) enumerating (b) bounding

(c) branching (d) all of these

7. When there are more than one seners, customer behaviour in which he moves from one queue to another is known as :

(a) balking (b) alternating

(c) reneging (d) jockeying

8. In deterministic model :

(a) arrival rate is known and the service time is also certain

(b) arrival rate must not exceed the service rate

(c) the service rate and service time are reciprocal each other

(d) none of the above

9. The relative minimum of the function

$$f(x_1, x_2) = x_1^3 + x_2^3 - 3x_1 - 12x_2 + 25$$

is at the point

(a) $x_1 = -1, x_2 = -2$ (b) $x_1 = -1, x_2 = 2$

(c) $x_1 = 1, x_2 = 2$ (d) $x_1 = 1, x_2 = -2$

10. Which of the following method of solving a quadratic programming problem, is based on modified simplex method ?

(a) Fletcher's method

(b) Wolfe method

(c) Frank-Wolfe method

(d) Beal's method

SECTION B **4×5=20**

(Short Answer Type Questions)

Unit-I

1. State the "principle of optamality" in dynamic programming and give mathematical formulation of a dynamic programming problem.

Or

What are the essential characteristic of dynamic programming problem ?

Unit-II

2. Obtain the solution for the following game by algebric method.

Player B

$$\text{Player } A \begin{pmatrix} 3 & 4 \\ 2 & 4 \end{pmatrix}$$

Or

Solve the game graphically :

$$\begin{array}{c} \\ \text{Player } A \end{array} \begin{array}{c} \text{Player } B \\ \begin{pmatrix} 1 & 2 \\ 5 & 4 \\ -7 & 9 \\ -4 & -3 \\ 2 & 1 \end{pmatrix} \end{array}$$

Unit-III

3. Distinguish between pure and mixed integer programming problem.

Or

Describe Gomory's method of solving an all-integer linear programming problem.

Unit-IV

4. What do you understand by a queue ? Give some important applications of queuing theory.

Or

T.V. repairman finds that the time spent on his job has an exponential distribution with mean 30 minutes. If the repairs sets in the order in which they come in, and if the arrival of sets is approximately poisson with an average rate of

10 per 8 hour day. What is repairman's expected idle time each day ? How many jobs are ahead of the average set just brought ?

Unit-V

5. Give the necessary conditions for maximization non-linear programming problem in the form of Kuhn-Tucker conditions.

Or

Write short note on Quadratic programming.

SECTION C **10×5=50**

(Long Answer Type Questions)

Unit-I

1. Use dynamic programming to solve the following problem :

Minimize $Z = y_1^2 + y_2^2 + y_3^2$

Subject to,

$$y_1 + y_2 + y_3 \geq 15$$

$$y_1, y_2, y_3 \geq 0$$

Or

Solve the following L.P.P. by dynamic programming

$$\text{Max } Z = 3x_1 + 4x_2$$

Subject to constraints

$$2x_1 + x_2 \leq 40$$

$$2x_1 + 5x_2 \leq 180$$

$$x_1 \geq 0,\ x_2 \geq 0.$$

Unit-II

2. Solve the following game by using dominance properly :

$$\begin{array}{c} \\ A_1 \\ A_2 \\ A_3 \end{array} \begin{array}{c} \begin{array}{cccc} B_1 & B_2 & B_3 & B_4 \end{array} \\ \begin{bmatrix} 4 & -2 & 3 & -1 \\ -1 & 2 & 0 & 1 \\ -2 & 1 & -2 & 0 \end{bmatrix} \end{array}$$

Or

Two companies A and B are competing for the same product their different strategies are given in the following pay-off matrix :

$$\begin{array}{c} \\ \text{Company } B \end{array} \begin{array}{c} \text{Company } A \\ \begin{pmatrix} 2 & -2 & 3 \\ -3 & 5 & -1 \end{pmatrix} \end{array}$$

Use linear programming to determine the best strategies for both the players.

Unit-III

3. Solve the following T.P.P.

Maximize $Z = 9x_1 + 10x_2$

Subject to constraints

$$x_1 \leq 9$$

$$x_2 \leq 8$$

$$4x_1 + 3x_2 \geq 40$$

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

Or

Use Branch and bound method to solve the following I.P.P.

$$\text{Max } Z = 7x_1 + 9x_2$$

Subject to constraints,

$$-x_1 + 3x_2 \leq 6$$

$$7x_1 + x_2 \leq 35$$

$$x_2 \leq 7$$

$x_1,\ x_2 \geq 0$ and are integers

Unit-IV

4. Obtain the steady state solution of the $(M/M/1)$: $(\infty/\text{Fc Fs})$ quening system.

Or

As same that the goods trains are coming in a yard at rate of 30 trains per day and suppose that the interarrival times follow an exponential

distribution. The service time for each train is assumed to be exponential with an average of 36 minutes. If the yard can admit 9 trains at a time (there being 10 lines, one of which is reserved for shunting process), calcutate the probability that the yeard is empty and find average queue length.

Unit-V

5. Use Wolfe's method to solve quadratic programming problem

Maximize $Z = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$

Subject to constraints.

$$x_1 + 2x_2 \leq 2, \quad x_1 \geq 0, x_2 \geq 0$$

Or

Use separable convex programming to solve the NLPP.

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

Subject to constraints,

$$g(x) = 4x_1^2 + x_2^2 \leq 16.$$

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

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