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H-5343

M.A./M.Sc. (Semester-IV) Examination, 2022

MATHEMATICS

(Operation Research-II)

Time Allowed : Three Hours

Maximum Marks : 70

Minimum Passing Marks : 25

Note : Question paper is divided into **four** sections. Attempt questions of all four sections as per given direction. Distribution of marks is given in each section.

SECTION-A

(Objective Type Questions)

Note: Attempt all **ten** questions. Each question carries **1** mark.

[1×10=10]

1. **Fill in the blanks :**

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(1)

[P.T.O.]

- (i) The technique of dynamic programming was developed by
- (ii) A game which is not a finite game is called an
- (iii) In a two-person zero sum game the resulting gain can, easily be represented in the form of a matrix, called the
- (iv) A network is a graphical representation of a
- (v) A function $f(x)$ is concave if

Multiple Choice Questions :

- (vi) Function $f(x)$ is convex if the Hession matrix $H(x)$ of $f(x)$ is :
 - (a) Positive definite
 - (b) Positive indefinite
 - (c) Both (a) and (b)
 - (d) None of these

(vii) Gomory constraint equation is :

$$(a) \quad -\sum_{j \in R} f_{ij} X_j \leq -f_{Bi}$$

$$(b) \quad -\sum_{j \in R} f_{ij} X_j \leq f_{Bi}$$

$$(c) \quad \sum_{j \in R} f_{ij} X_j \leq -f_{Bi}$$

$$(d) \quad \sum_{j \in R} f_{ij} X_j \leq f_{Bi}$$

(viii) Which of the following is/are property/properties of a dynamic programming problem?

- (a) Optimal substructure
- (b) Overlapping subproblems
- (c) Greedy approach
- (d) Both (a) and (b)

(ix) PERT analysis is based on :

- (a) Optimistic time

- (b) Pesimistic time
 - (c) Most likely time
 - (d) All of these
- (x) Game theory models are classified by the :
- (a) Number of players
 - (b) Sum of all pay-offs
 - (c) Number of strategies
 - (d) All of the these

SECTION-B

(Very Short Answer Type Questions)

Note: Attempt **any five** questions. Each question carries **02** marks. (**25-30** words) [2×5=10]

- 2.
- (i) Explain dummy activity.
 - (ii) Define looping error.
 - (iii) Define Saddle point for game theory.
 - (iv) Write Bellman's principle of optimality in Dynamic Programming.

- (v) Define Zero Sum Game.
- (vi) Define I.P.P.
- (vii) Write notes on total float.

SECTION-C

(Short Answer Type Questions)

Note: Attempt **any five** questions. Each question carries **04** marks. (**250** words) [5×4=20]

3. (i) Write the method of Branch and Bound-Technique.
- (ii) Write the characteristics of dynamic programming problem.
- (iii) Explain pay-off matrix.
- (iv) Solve the following game by matrix method :

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

- (v) Write the difference between CPM and PERT.

- (vi) Obtain the set of necessary condition for the NLPP

$$\text{Maximize } Z = x_1^2 + 3x_2^2 + 5x_3^2$$

subject to the constraints:

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

$$5x_1 + 2x_2 + x_3 = 5$$

and $x_1, x_2, x_3 \geq 0$

SECTION-D

(Essay Type Questions)

Note: Attempt **any three** questions. Each question carries **10** marks. (**500** words) [3×10=30]

4. (i) Solve the following NLPP

$$\text{Maximize } Z = (x_1 - 2)^2 + (x_2 - 1)^2$$

Subject to the constraints

$$x_1^2 - x_2 \leq 0$$

$$x_1 + x_2 \leq 2$$

and $x_1, x_2 \geq 0$

- (ii) Draw a network diagram on the basis of the following data :

Activity	Duration (days)
1-2	2
1-4	2
1-7	1
2-3	4
3-6	1
4-5	5
4-8	8
5-6	4
6-9	3
7-8	3
8-9	5
9-10	2

Find the critical path, total duration and slack times.

- (iii) Solve the game whose pay-off matrix is given by :

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

- (iv) By dynamic programming technique,

Solve the problem :

$$\text{Minimize } Z = x_1^2 + x_2^2 + x_3^2$$

Subject to the constraints

$$x_1 + x_2 + x_3 \geq 15$$

$$\text{and } x_1, x_2, x_3 \geq 0$$

- (v) Find Min $Z = x_1 + x_2 + \dots + x_n$, when

$$x_1 \cdot x_2 \cdot \dots \cdot x_n = d$$

$$\text{and } x_1, x_2, \dots, x_n \geq 0$$

-----x-----