Time: 3 hours   Stats III   Marks: 100

N.B. 1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Use of non-programmable calculator is allowed.
4. Graph papers will be provided on request.

Q.1 (a) Choose correct Answer for the following (ANY FIVE)   **(10)**

i. In critical path analysis, the word CPM stands for   **(2)**
   a) critical path method   b) crash project management
   c) critical project Management   d) critical path management

ii. In critical path analysis, the CPM is   **(2)**
   a) event oriented   b) probabilistic in nature
   c) deterministic in nature   d) dynamic in nature

iii. The slack for an activity in network is equal to   **(2)**
   a) Latest Start Time – Earliest Start Time   b) Latest Finish Time - Latest Start Time
   c) Earliest Finish Time – Earliest Start Time   d) Earliest Finish Time – Latest Start Time

iv. When maximin and minimax values of the game are same, then   **(2)**
   a) there is saddle point   b) solution does not exist
   c) strategies are mixed   d) none of the above

v. The pay-off value for which each player in a game always selects the same   **(2)**
   strategy is called
   a) equilibrium point   b) saddle point
   c) both a) and b)   d) none of the above

vi. The decision maker's knowledge and experience may influence the decision   **(2)**
   making process when using the criterion of
   a) Hurwicz   b) maximin
   c) maximax   d) minimax regret

vii. Which of the following is not used in decision making under uncertainty?   **(2)**
   a) minimax criterion   b) maximax criterion
   c) minimize expected loss criterion   d) maximin criterion

Q.1 (b) Answer the following in one/ two sentences (ANY FIVE)   **(10)**
i.   Define an activity.   **(2)**
ii. Define Burst event.   **(2)**
iii. Define merge event.   **(2)**
iv. What is risk in Decision theory?   **(2)**
v.   Define a strategy in decision theory   **(2)**
vi. Define Pay off matrix in game theory.   **(2)**
vii. Define optimum strategy in game theory.   **(2)**

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Q2 **Attempt Any Two sub-questions:** (20)

i A project manager has made following 3 time estimates for various activities of the (10) project.
   (a) Draw PERT network and find out Expected project completion time
   (b) What project duration will have 90% confidence of completion.
      $P(0 < Z < 1.29 = 0.4015)$

Events	1-2	1-3	1-4	2-5	3-5	4-6	5-6
Optimistic	6	6	12	6	12	12	18
Most likely	6	12	12	6	30	30	30
Pessimistic	24	18	30	6	48	42	54

ii Write a note on - (10)
(a) Fulkerson's rule
(b) Rules of constructing network

iii Differentiate between CPM and PERT (10)

Q3 **Attempt Any Two sub-questions:** (20)

i Two firms are competing for business under the condition so that one firm's (10) gain is another firm's loss. Firm A's payoff matrix is given below:

<div align="center">

Firm B's advertising

		No	Medium	Heavy
	No	10	5	-2
Firm A's advertising	Medium	13	12	15
	Heavy	16	14	10

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Suggest using dominance property optimum strategies for the two firms and the net outcome thereof.

ii (a) Explain the graphical method of solving $2 \times n$ game. (07)
(b) Solve the game whose payoff matrix is given by: (03)

$$\text{Player A} \quad \begin{array}{c} A_1 \\ A_2 \\ A_3 \end{array} \overset{\begin{array}{ccc} B_1 & B_2 & B_3 \end{array}}{\begin{bmatrix} 10 & 5 & -2 \\ 6 & 7 & 3 \\ 4 & 8 & 4 \end{bmatrix}} \quad \text{Player B}$$

iii (a) Consider the game G with the following payoff matrix: (05)

$$\text{Player A} \quad \begin{array}{c} A_1 \\ A_2 \end{array} \overset{\begin{array}{cc} B_1 & B_2 \end{array}}{\begin{bmatrix} 2 & 6 \\ -2 & \mu \end{bmatrix}} \quad \text{Player B}$$

Show that G is strictly determinable whatever μ may be. Also determine the value of G.

(b) Determine the range of values of p and q that will make the payoff element (05) a_{22}, a saddle point for the game whose payoff matrix (a_{ij}) is given below:

Player B

$$\begin{array}{c c} & \begin{array}{c c c} B_1 & B_2 & B_3 \end{array} \\ \text{Player A} \begin{array}{c} A_1 \\ A_2 \\ A_3 \end{array} & \begin{bmatrix} 2 & 4 & 7 \\ 10 & 7 & q \\ 4 & p & 8 \end{bmatrix} \end{array}$$

Q4 Attempt Any Two sub-questions: (20)

i   (a) Explain maximin criterion, with reference to decision theory. Illustrate with (05)
an example.

(b) Find maximax payoff and maximin payoff actions form the following: (05)
Also construct a regret table from the given data and then find minimax regret
action.

Payoff Table			
States of Nature	Actions		
	a_1	a_2	a_3
S_1	7	-3	8
S_2	-5	4	5
S_3	6	8	2
S_4	10	7	-11

ii   A retailer wants to decide how much stock of a product 'X' to be kept for the (10)
next month. Monthly demand can be 10, 20, 30 or 40 units. Demand
probabilities are 0.2, 0.3, 0.4 and 0.1 respectively. The selling price of the
product is Rs. 30 and its purchasing cost is Rs. 20. If any units are unsold
quantity can be disposed of at a scrap value of Rs. 5. (a) construct a payoff table,
(b) using EMV criterion, find optimal decision and (c) calculate EPPI and EVPI.

iii   Explain the following terms with reference to decision theory: (10)
(a) Course of action
(b) State-of-Nature,
(c) Payoff Table
(d) Payoff
(e) Opportunity Loss

Q5 Attempt Any Two sub-questions: (20)

i   (a) Write the advantages of network analysis. (05)
(b) Draw network diagram using following data: (05)

Activity	A	B	C	D	E	F	G	H
Preceding Activities	--	A	A	B	B	C, D	E	F
Time	4	6	2	6	3	4	1	2

Find critical path and project completion time.

ii   Using dominance property, solve the following game: (10)

$$
\begin{array}{c}
 & & \text{Player B} \\
 & & \begin{array}{cccc} \text{I} & \text{II} & \text{III} & \text{IV} \end{array} \\
\text{Player A} \begin{array}{c} \text{I} \\ \text{II} \\ \text{III} \\ \text{IV} \end{array} &
\left[\begin{array}{cccc}
6 & 4 & 8 & 0 \\
4 & 8 & 4 & 8 \\
8 & 4 & 8 & 0 \\
0 & 8 & 0 & 16
\end{array} \right]
\end{array}
$$

iii   (a) Explain the decision tree analysis.   (05)

       (b) Explain minimum expected opportunity loss criterion.   (05)

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