Roll.No. | 21UBBAT2002

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(AUTONOMOUS)
(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai - 600 044.
B.Com. BIM - END SEMESTER EXAMINATIONS - NOVEMBER 2025
SEMESTER - II
21UBBAT2002 - Elements of Operations Research

Total Duration : 2 Hrs.30 Mins. Total Marks : 60

Section B

Answer any **SIX** questions $(6 \times 5 = 30$ Marks)

1. Define Operation Research and discuss its key characteristic features.

2. A manufacturer has three plants (A, B, C) and three distribution centers (X, Y, Z).
   The cost per unit of transportation and available supply/demand are as follows:

	X	Y	Z	Supply
A	2	3	1	30
B	5	4	8	40
C	5	6	8	20
Demand	20	50	20	

   (i) Obtain the initial basic feasible solution using the Least Cost Method.
   (ii) Calculate the total transportation cost for the obtained solution.

3. Find the initial feasible solution using North-West Corner Method for the following data:

	D_1	D_2	D_3	Supply
S_1	3	1	7	20
S_2	2	6	5	30
S_3	8	3	3	25
Demand	25	25	25	

   (i) Allocate using North-West Corner Method
   (ii) Find the total transportation cost

4. The following is the payoff matrix for Player A:

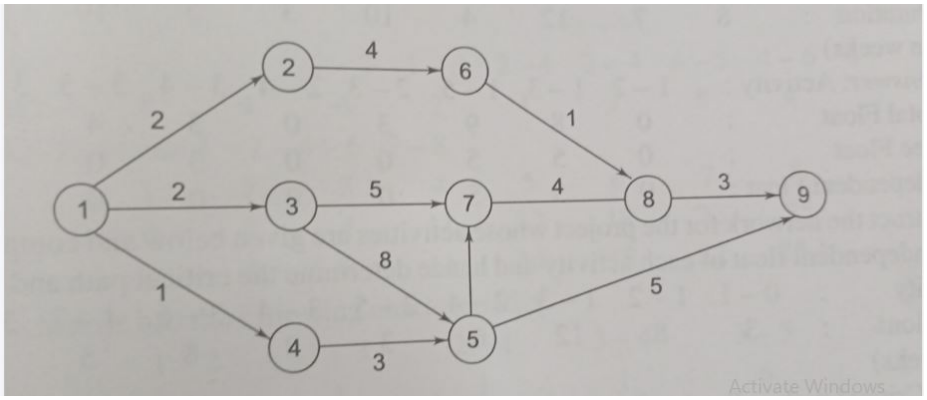
	B_1	B_2	B_3
A_1	4	2	3
A_2	1	2	0

Contd...

(i) Find the row minima and column maxima.
(ii) Check whether a saddle point exists.
(iii) Determine the value of the game and the optimal pure strategies for both players.

5. Minimize Z=4x1+6x2
   Subject to: $3x1+2x2 \leq 18$
   $x1+4x2 \leq 16$
   $x1,x2 \geq 0$
   (i) Introduce slack variables to convert inequalities into equations.
   (ii) Formulate the initial simplex tableau.
   (iii) Determine the initial basic feasible solution.

6. Find the critical path and calculate the slack time of each event for the following PERT diagram



7. The following activities and their immediate predecessors and durations (in days) are given:

Activity	**Immediate predecessor**	**Duration (Days)**
A	-	4
B	A	6
C	A	5
D	B	3
E	B,C	2
F	D,E	4

(i) Construct the network diagram.
(ii) Find Earliest Start Time (EST) and Earliest Finish Time (EFT) for all activities.
(iii) Determine the Critical Path and Total Project Duration.

Contd...

8. (a) Define Game Theory and state any three basic assumptions of Game Theory.
   (b) Using the following payoff matrix, find whether a saddle point exists and the value of the game:

	B_1	B_2
A_1	3	1
A_2	2	1

Section C

Answer any **THREE** questions $(3 \times 10 = 30$ Marks)

9. What are the limitations and scope of Operation Research?

10. A dietitian wants to design a diet containing two foods, F_1 and F_2.
Each unit of F_1 contains 3 units of vitamin A and 2 units of vitamin B.
Each unit of F_2 contains 1 unit of vitamin A and 2 units of vitamin B.
The daily requirement is at least 12 units of vitamin A and at least 8 units of vitamin B.
The cost per unit is ₹4 for F_1 and ₹2 for F_2.
    (i) Formulate the LPP to minimize the total cost subject to the vitamin requirements.
    (ii) Solve graphically to find the minimum cost and quantities of each food.

11. (i) Obtain an Initial Basic Feasible Solution using the Least Cost Method.
    (ii) Verify whether the solution is degenerate or not using the condition m+n−1
    (iii) If degenerate, show how you remove degeneracy by assigning $\in$.
    (iv) Find the total transportation cost for the obtained solution.

Source/ Destination	D_1	D_2	D_3	D_4	**Supply**
S_1	8	6	10	9	20
S_2	9	12	13	7	40
S_3	14	9	16	5	30
Demand	30	20	25	15	

12. The following table shows the three-time estimates for each activity:

Activity	**Predecessor(s)**	**Optimistic (a)**	**Most Likely(m)**	**Pessimistic(b)**
A	=	2	4	6
B	A	3	5	9
C	A	2	3	8
D	B,C	4	6	8

Contd...

(i) Compute the expected time for each activity.

(ii) Draw the network diagram.

(iii) Calculate Earliest and Latest Times, identify the Critical Path, and find the Expected Project Duration.

(iv) Determine the variance of each activity and the variance along the critical path.

13. Consider the following pay-off matrix of a game where Player A is the maximizer and Player B is the minimizer:

	$\mathbf{B}_1$	$\mathbf{B}_2$	$\mathbf{B}_3$
$\mathbf{A}_1$	4	6	8
$\mathbf{A}_2$	3	5	7

(i) Compute row minima and column maxima.

(ii) Find maximin and minimax values.

(iii) Determine if there is a saddle point.

(iv) Find the value of the game and optimal pure strategies for Players A and B.

(v) State whether the game is determinate or indeterminate.

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