DHANAMANJURI UNIVERSITY

Four-year course B.A/B.Sc 2^{nd} Semester

Examination - 2024 (June)

Name of Programme	**:**	**B.A/B.Sc Mathematics (Honours)**
Paper Type	**:**	**SEC(Theory)**
Paper Code	**:**	**SMA-003**
Paper Title	**:**	**Transportation and Game Theory**
Full mark	**:**	**40**
Pass Mark	**:**	**16**
Duration	**:**	**2 Hours**

The figures in the margin indicate full marks for the questions.
Answer all the questions:

1. Choose and rewrite the correct answer for the following questions: **$1 \times 4 = 4$**

a) The number of constraints in a general transportation problem having m origins and n destinations is:

i) $m+1$

ii) $n+1$

iii) $m+n$

iv) $m-n$

b) If v is the value of the game, then it will always satisfy the inequality:

i) minimax $\leq v \leq$ maximin

ii) maximin $\leq v \leq$ minimax

iii) minimax $= v =$ maximin

iv) minimax $\leq$ maximin $\leq v$

c) In a game, when the sum of gains of one player is equal to the sum of losses of the other player, the situation is known as:

i) fair game
ii) zero-sum game
iii) conflicting game
iv) biased game

d) In a pure strategy game:

i) any strategy may be selected arbitrarily.
ii) both players select their optimal strategy.
iii) a particular strategy is selected by each player.
iv) none of the above.

2. Answer the following questions: $1 \times 6 = 6$

a) What do you mean by a saddle point of a game?

b) Define value of a game.

c) What is a balanced transportation problem?

d) Define basic feasible solution of a general transportation problem.

e) Define a game.

f) When is the basic feasible solution said to be degenerate?

3. Answer the following questions: $3 \times 4 = 12$

a) Write the steps of North West Corner Method for finding the initial basic feasible solution of a transportation problem.

b) Obtain an initial basic feasible solution to the following transportation problem using the Vogel's approximation method.

	D_1	D_2	D_3	D_4	Supply
O_1	10	2	20	11	15
O_2	12	7	9	20	25
O_3	4	14	16	18	10
Demand	5	15	15	15	

c) The pay off matrix of a game is given below. Check if it has a saddle point and find the solution.

Player A	**Player B**					
		B_1	B_2	B_3	B_4	B_5
	A_1	4	0	1	7	-1
	A_2	0	-3	-5	-7	5
	A_3	3	2	3	4	3
	A_4	-6	1	-1	0	5
	A_5	0	0	6	0	0

d) Solve the following game using dominance property.

Company X	**Company Y**				
		P	Q	R	S
	A	6	-2	4	1
	B	6	1	12	3
	C	-3	-2	-2	6
	D	2	-3	7	7

4. Answer any two of the following questions: $9 \times 2 = 18$

a) Derive the formula for solving any 2×2 two person zero sum game without any saddle point where the pay off matrix of player A is

Player A	**Player B**		
		B_1	B_2
	A_1	a_{11}	a_{12}
	A_2	a_{21}	a_{22}

b) Find the solution of the game whose payoff matrix is as follows:

Player A	**Player B**		
		B_1	B_2
	A_1	1	-3
	A_2	3	5
	A_3	-1	6
	A_4	4	1
	A_5	2	2
	A_6	-5	0

c) Consider the information about the cost of performing different jobs by different persons. Using this information, state the optimal assignment of job and the total cost of assignment.

	Job 1	job 2	Job 3	Job 4	Job 4
Person A	27	18	-	20	21
Person B	31	24	21	12	17
Person C	20	17	20	-	16
Person D	22	28	20	16	27

d) Determine an initial basic feasible solution of the following transportation problem by Vogel's approximation method. Test the optimality of the solution by using UV method and find the optimal solution.

	Destination				
	P	Q	R	S	Availability $\downarrow$
Source A	21	16	25	13	11
Source B	17	18	14	23	13
Source C	32	27	18	41	19
Requirements $\rightarrow$	6	10	12	15	

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