Question Paper

Exam Date & Time: 23-May-2022 (10:00 AM - 01:00 PM)

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH
END SEMESTER EXAMINATIONS
May 2022

GAME THEORY AND APPLICATIONS [ICT 4307]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates:
1. Provide clear stepwise solutions to numericals with interpretation of the result
2. Answer ALL questions
3. Missing data may be suitably assumed

1) Tom and Jerry are playing the matching pennies game with observation using a 5 rupee coin. Represent the game in extensive and normal forms. Assuming Tom plays first, represent each player's information set and find the Pure Strategy Nash Equilibrium. (4)

A)

B) Yoko and John are married. Yoko cares both about her income and John's income. Precisely, the value she attaches to each unit of her own income is the same as the value she attaches to any two units of John's income. (4)

How would Yoko order the outcomes (1, 4), (2, 1), and (3, 0) where the first component in each case is Yoko's income and the second component is John's income?

Give a payoff function consistent with these preferences.

C) What is the difference between mutual information and common knowledge? Give an example to illustrate your point. (2)

2) Consider the bimatrix game in Figure 1 with two types of Player 1. Compute the Bayesian Nash Equilibrium for both the players of this game. (5)

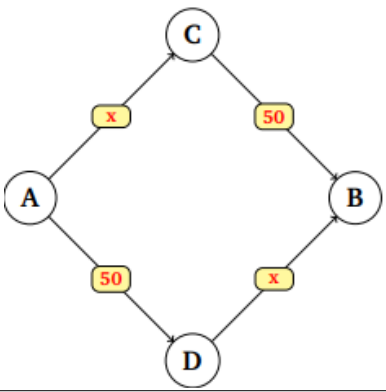
A)

	Left	Right
Up	3,4	1,0
Down	4,3	2,0

	Left	Right
Up	6,2	0,4
Down	5,1	-1,4

Figure 1

B) Consider a road network shown in Figure 2. The numbers on the edges indicate the time in minutes one requires to traverse the edges. The variable *x* denotes the number of commuters using that edge. Suppose there are 100 people who want to reach the vertex B from vertex A. Write the strategic form games corresponding to each of the networks in Figure 2 and find the PSNEs for both the games. (3)



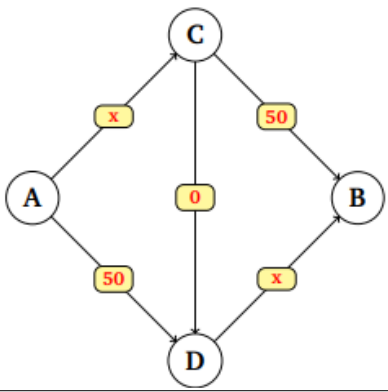


Figure 2

C) What is a maximin strategy? Identify the maximin strategy of Player 1 for the bimatrix given in Figure 3. (2)

	2	
1	A	B
A	$4, 1$	$0, 4$
B	$1, 5$	$1, 1$

Figure 3

3) A parent with two children is going to buy fruit. The children's preferences change depending on their mood. The parent does not know which state of mind the children are in but does not want the fruit to go waste. Figure 4 illustrates the children's fruit preference in each mood from most to least favourite. (5)

A)

The parent decides to come to you, a game theory analyst to design a simultaneous game. This game should successfully get the parent to identify the mood of the children.

Using mechanism design concepts, where the objective of the game is to not let any fruit go waste, design the simultaneous move game for the parent. Solve the game for Mood 1 and Mood 2 to reveal the Nash equilibrium in each case.

What would happen if the parent decided to use the survey method for revealing the children's true preferences?

Mood 1

Child A	Child B
Apple	Strawberry
Mango	Mango
Banana	Banana
Strawberry	Apple

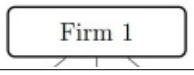
Mood 2

Child A	Child B
Strawberry	Mango
Apple	Apple
Banana	Banana
Mango	Strawberry

Figure 4

B) How will you know a market is monopolised by a single player? Write down the characteristics of monopolistic competition. (3)

C) Consider the Event Flow Graph given in Figure 5. Using backward induction, compute the subgame perfect equilibrium of the game. (2)



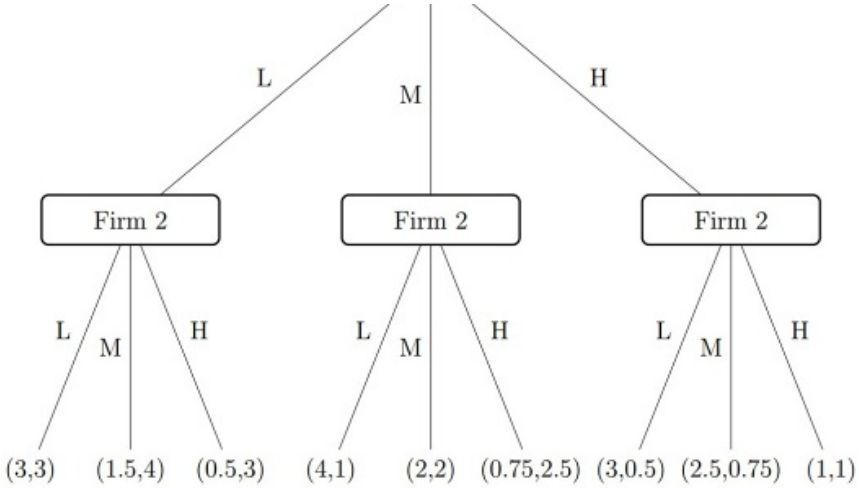


Figure 5

4) Using pseudocode, write down the Gate-Shapley algorithm. Explain the characteristics that make a matching algorithm "well-defined". (5)

A)

B) Alice has a house which she values at Rs 1 crore. She wishes to sell the house. There are two potential buyers, Bella and Claire. Both of them value Alice's house at Rs 2 crore each and who also have with them Rs 2 crore each. Suppose Alice sells the house to Bella at a price *p* crore where *1 < = p < = 2*. Find the utilities of the three players. What is the price Alice will ultimately sell her house for? (3)

C) Briefly explain *Super Additivity* property in the context of coalitions. (2)

5) Given below are the values of a restaurant bill if all permutations of coalitions of three friends went to a restaurant. What would be the fairest way to split the bill? (4)

A)

Value of coalition {1}: 16

Value of coalition {2}: 32

Value of coalition {1,2}: 30

Value of coalition {3}: 44

Value of coalition {1, 3}: 40

Value of coalition {2, 3}: 50

Value of coalition {1, 2, 3}: 100

B) What are the canonical mechanisms for auctioning a single indivisible item? (4)

C) With an example write down the rationale behind revealing a player's information in second-price auctions. Identify a real-world application on the internet where these auctions are common. (2)

-----End-----