Question Paper

Exam Date & Time: 18-Jul-2022 (09:00 AM - 12:00 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

VI Semester End Semester Makeup Examination

Game Theory and Applications ICT 4307 Open Elective

July 2022

GAME THEORY AND APPLICATIONS [ICT 4307]

Marks: 50

1)

Duration: 180 mins.

Section Duration: 180 mins

Descriptive Questions

Answer all the questions.

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The answer must be arrived at with legible reasoning and stepwise iterations.

A) Three friends Xavier, Yasher, and Zoe are considering taking one of the classes of a different style (5) of yoga: Ashtanga (A) and Bikram (B). But they each have different preferences or valuations for the classes. All of them sign up for the classes A or B classes in sequence. Once one person signs up for a class, they tweet their choice, so that the remaining friends are informed of this choice before they make their own choices. Their choices are in the following order: first Xavier chooses a class, then Yasher chooses, then Zoe chooses. This is represented in the extensive form game tree shown in Figure 1.

Solve the game using backward induction, and write down the Subgame Perfect equilibrium strategies. Your reasoning at each step of the solution must be clearly stated.





of this recognizing this phenomenon. .

C)

What is a saddle point in a game? Compute the saddle point for the bimatrix given in Figure 2. (2)



Figure 2

2)

In the game shown in figure 3, compute the Pure and Mixed strategy Nash equilibria if they exists. (5) Also, state the interpretation of PSNE and MSNE for Rose and Colin.

A)

| | | Colin | | |
|------|------|--------|--------|--|
| | | Left | Right | |
| Rose | Up | 12 , 4 | 8,5 | |
| | Down | 6,8 | 12 , 5 | |

Figure 3

B)

For the non -ymmetric company's dilemma game shown in Figure 4, compute the maxmin and (3) minmax values and strategies for each firm.

| | 2 | | |
|---|------|-----|--|
| 1 | A | B | |
| A | 4,1 | 0,4 | |
| B | 1, 5 | 1,1 | |

Figure 4

C)

What are games with perfect and imperfect information? Explain with examples. .

A state wants to build one of two power plants for the two cities A and B but is unsure of the preference possibilities of the cities. As a mechanism designer, design a simultaneous move game for the state. The objective of the game is to build a single power plant for both cities based on two preference possibilities in Table 1. Ensure that the game is designed in such a way that the cities reveal their true preferences. Also, compute the Nash Equilibria for the designed game for each of the preference possibilities.

| Preference | Possibility 1 | Preference Possibility 2 States care about sustainability | | |
|------------|----------------------|--|---------|--|
| Don't care | about sustainability | | | |
| City A | City B | City A | City B | |
| Gas | Nuclear | Nuclear | Oil | |
| Oil | Oil | Gas | Gas | |
| Coal | Coal | Coal | Coal | |
| Nuclear | Gas | Oil | Nuclear | |

Table 1

- B) Why does a perfectly competitive market considered an ideal construct? With an example, identify (3) a market scenario in real life that comes close to perfect competition.
- C) How are mutual information and common knowledge different? Give an example to illustrate your (2) point. .
- Using the Gate-Shapley algorithm, find a man-optimal stable matching for the two sets of Men and Women (5) given in Figure 5. Clearly state the intermediate matches produced by the algorithm after each iteration of the algorithm in a table.





Figure 5

- B)
- There are 5 suppliers of watch parts. Of these the first two players can each supply a watch dial (3) and the other three players can supply a watch strap. The worth of each coalition is the number of matched pairs of watch dials and watch straps that can be assembled. Find the core of the game for each of the cases below.

4)

A)

(5)

- 1. $ND = \{1, 2\}$ and $NS = \{3, 4\}$
- 2. ND = {1, 2} and NS = {3, 4, 5}

(where ND is the set of watch dial suppliers and NS is the set of watch strap suppliers) .

C) What is effective mechanism design? Why is it necessary? .

(2)

5)

A)

The Generalized Vickrey Auction mechanism is used by a buyer for procuring a bundle {A,B,C,D,E}. (5) The following are the bids received from 5 sellers.

- Seller 1: (A, 20), (B, 30), (AB, 45)
 - Seller 2: (B, 25), (C, 35), (BC, 50)
 - Seller 3: (C, 30), (D, 40), (CD, 60)
 - Seller 4: (D, 35), (E, 45), (DE, 70)
 - Seller 5: (E, 40), (A, 15), (EA, 50)

Assume XOR bids (that is, at most one bid will be selected from any seller). Compute the allocation and the payments that the winning bidders will receive. Is this mechanism individually rational? .

- B) Three schools decide to contribute to hosting a football match for their students. The values of their (3) contributions separately and together are as follows.
 - v {1}:12
 - v {2}:22
 - v {1,2}:20
 - v {3}:33
 - v {1,3}:28
 - v {2,3}:44
 - v {1,2,3}:60

What is the fairest way for each of them to contribute to the total cost of hosting the match? Perform a stepwise computation with reasoning and interpretation of the result .

C) The nucleolus is a game theoretical solution concept based on bargaining considerations. Identify a (2) few defining characteristics of the nucleolus.

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