Multiagent Systems

Course code : INFOMAS Date : 15 April 2021 Time : 19:00-22:00

Question 1

Consider the following game with players A and B. The outcome $X \backslash Y$ indicates that the A's payoff is X and the B's payoff is Y.

A\ B	β_1	β_2	β_3
α_1	5 \ 5	1 \ 4	3 \ 3
α_2	4 \ 1	3 \ 3	5 \ 1
α_3	2 \ 7	1 \ 7	2 \ 6

(a) What are the maxmin (security level) and minmax values for players A and B in this game?

(b) What are the Pareto efficient outcomes?

(c) What are the pure and mixed strategy (Nash) equilibria of this game? Provide the calculation of the mixed strategy.

(d) What is the expected utility for each player in the mixed strategy equilibrium?

(e) Is the declaration to play α_1 by player A a self-committed utterance? Is it a self-revealing utterance? Motivate your answer.

(f) Is the declaration to play β_3 by player B a self-committed utterance? Is it a self-revealing utterance? Motivate your answer.

Question 2

There are three parties a, b, and c with respectively 40, 25, and 35 votes. A majority vote is required to pass a €100 bill. A coalition of parties with a majority vote divides the €100 bill.

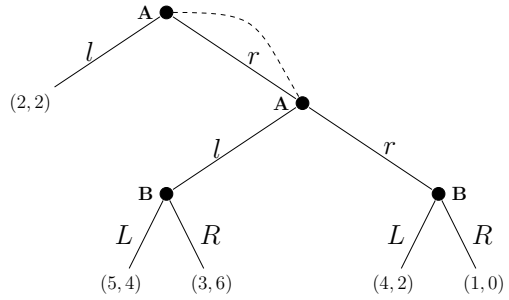
(a) Model this scenario as a cooperative game (N, v).

(b) Is the core of this game empty? If yes, explain why. If not, give an outcome that is in the core.

(c) Determine the Shapley value for each party. Provide the calculation of the Shapley values.

Question 3

Consider the following imperfect-information extensive game with players A and B. The outcome (X, Y) indicates that the payoff of player A is X and the payoff of player B is Y.



(a) What are the Nash equilibria of this extensive game?

(b) What are the subgame-perfect Nash equilibria of this extensive game?

(c) Transform this extensive game to a normal-form strategic game and determine the dominant strategies of players A and B.

Question 4

Consider the following voting scenario.

2	2	5	6
d	d	b	c
a	c	a	d
b	a	d	a
c	b	c	b

(a) Give the winners according to the plurality, majority, Condorcet, approval and Borda voting systems. For the approval voting assume that each voter gives one vote to his/her first two candidates.

(b) Which candidate is the winner according to the method of Plurality with Elimination? Explain why.

(c) Investigate whether different comparison orders of the candidates in this voting scenario result in different winners using the pairwise elimination method.

(d) Are these preferences single-peaked? If yes, show the order of the candidates.

(e) Which candidate is the winner of the median voting rule? Explain why.

Question 5

An indivisible object O should be assigned to one of the five rational players a, b, c, d, and e. The true independent private values of these players for O are respectively 20€, 30€, 15€, 35€, and 25€.

(a) How should these players bid in the Vickrey auction? Who is the winner in this auction and how much should the winner pay?

(b) What is the Nash equilibrium of the players in the first-price sealed-bid auction?