
INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR
Algorithmic Game Theory 2021-22: Sample Solution Sketch of Third Class Test

Part 1

Prove or disprove the following with explanation.

- (i) An exact (not approximate) correlated equilibrium of a bimatrix game can be computed in polynomial time.

The statement is correct. Follows from the fact that a correlated equilibrium for a strategic form game can be computed by solving an appropriate linear program.

- (ii) Conclude from (i) that an MSNE of a bimatrix game can be computed in polynomial time.

The statement is incorrect since a probability distribution over the strategy profiles in a correlated equilibrium does not need to be a product distribution over the strategy sets of individual players.

[5+5 Marks]

Part 2

- (i) Consider a Bayesian game with 2 players; the cardinality of the type set of the first player is $d + 5$ and the cardinality of the type set of the second player is $d + 7$. The cardinality of the strategy set of the first player is $10 * (d + 1)$ and the cardinality of the second player is $10 * (d + 2)$. Write the corresponding Selten game. Explain your answer.

There will be $2d + 12$ players, the first $d + 5$ players have $10 * (d + 1)$ strategies each and the remaining $d + 7$ players have $10 * (d + 2)$ strategies each. The utility values will be computed as the expected utility of the two players of the Bayesian game when they have the corresponding types.

- (ii) Consider an extensive form game with 2 players. Player 1 plays her action first, then the player 2 plays her action, and then both the players receive their utilities. Suppose player 1 has $d + 5$ actions and player 2 has $d + 10$ actions. Also, each information set is singleton. Write down the corresponding strategic form game. Explain your answer.

There will be 2 players in the corresponding strategic form game. The first player will have $d + 5$ strategies and the second player will have $(d + 10)^{(d+5)}$ strategies. The utility values of the players for each strategy profile will correspond to the utilities of the players in the extensive form game if the game was played in the corresponding path.

[5+5 Marks]