Algorithmic Game Theory
Assignment 8

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1. Which of the following games may not have any PSNE?

   (a) Selfish load balancing game.

   (b) Network congestion game.

   (c) Congestion game.

   (d) First price auction.

   The correct answer is (d). Refer to Lecture 8.1.

2. Consider a Bayesian game with 3 players having $7, 9$, and 3 types and $2, 3$, and 5 strategies respectively. How many players will be there in the corresponding Selten game?

   (a) 10

   (b) 19

   (c) 189

   (d) 30

   The correct answer is (b). Refer to Lecture 8.2.

3. Consider a Bayesian game with 3 players having $7, 9$, and 3 types and $2, 3$, and 5 strategies respectively. Compute the number of strategy profiles in the corresponding Selten game?

   Answer range: 314927000 to 314929000. Refer to Lecture 8.2.

4. Consider a Bayesian game with 3 players having $7, 9$, and 3 types and $2, 3$, and 5 strategies respectively. How many numbers are needed to write down a pure strategy Bayesian Nash equilibrium?

   Answer range: 17 to 21. Refer to Lecture 8.2.

5. Consider a Bayesian game with 3 players having $7, 9$, and 3 types and $2, 3$, and 5 strategies respectively. How many numbers are needed to write down a mixed strategy Bayesian Nash equilibrium?

   Answer range: 52 to 60. Refer to Lecture 8.2.

6. What is the type of equilibrium that exists in the first price auction where there are 7 buyers, 1 seller, the type set of each buyer player is the set of real numbers from 13 to 19, and the common prior is the product of uniform distributions over individual type sets of the players?

   (a) Bayesian strongly dominant strategy equilibrium

   (b) Bayesian weakly dominant strategy equilibrium which is not a Bayesian strongly dominant strategy equilibrium

   (c) Bayesian very weakly dominant strategy equilibrium which is not a Bayesian weakly dominant strategy equilibrium

   (d) Bayesian mixed strategy Nash strategy equilibrium which is not a Bayesian very weakly dominant strategy equilibrium

   The correct answer is (d). Refer to Lecture 8.3.

7. 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 5 actions and player 2 has 10 actions. Also, suppose player 2 gets to oberve the strategy player by player 1 before playing her strategy. Compute the number of strategies of the second player in the corresponding strategic form game.

   Answer range: 45 to 55. Refer to Lecture 8.4.

8. 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 5 actions and player 2 has 10 actions. Also, suppose player 2 does not get to oberve the strategy player by player 1 before playing her strategy. Compute the number of strategies of the second player in the corresponding strategic form game.

   Answer range: 8 to 12. Refer to Lecture 8.4.

9. 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 5 actions and player 2 has 10 actions. Also, it is a perfect information game. Compute the number of histories of the game.

   Answer range: 45 to 55. Refer to Lecture 8.4.

10. 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 5 actions and player 2 has 10 actions. Also, suppose player 2 does not get to oberve the strategy player by player 1 before playing her strategy. Compute the information sets of player 2 this game.

    Answer range: 0 to 2. Refer to Lecture 8.4.