Algorithmic Game Theory

Algorithmische Spieltheorie

Pingo

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Website

https://pingo.coactum.de/

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Question 1

In a 2-player normal-form game, you have marked in the table

- player 1's maximum gain in each column and
- player 2's maximum gain in each row.

Which of the following statements is true?

A Every double-marked entry is a Pareto-optimal strategy profile.

B Every double-marked entry corresponds to a Nash equilibrium in pure strategies.

C Every double-unmarked entry is a Pareto-optimal strategy profile.

D Every double-unmarked entry corresponds to a Nash equilibrium in pure strategies.

Question 2

In a 2-player normal-form game, you have marked in the table

- player 1's maximum gain in each column and
- player 2's maximum gain in each row.

Suppose the second components in one complete column have been marked. Does this mean that ...

A ... this strategy belongs to a Pareto-optimal strategy profile?

B ... this corresponds to a dominating strategy of player 1?

C ... this corresponds to a dominating strategy of player 2?

D ... there cannot exist a Nash equilibrium in pure strategies?

Question 3

		Belle	
		Nailing	Sailing
Anna	Nailing	$(7, 3)$	$(1, 1)$
	Sailing	$(4, 2)$	$(2, 4)$

A Exactly one strategy profile is Pareto-optimal.

B Exactly two strategy profiles are Pareto-optimal.

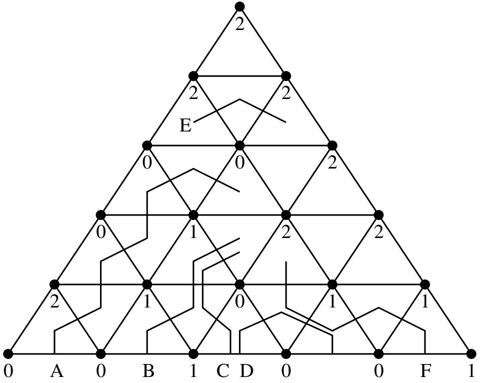
C Exactly three strategy profiles are Pareto-optimal.

D All four strategy profiles are Pareto-optimal.

Question 4

Which of the following walks are correct according to the proof of Sperner's lemma?

- A
- B
- C
- D
- E
- F



Question 5

Which of the following statements are true for finite, two-player, zero-sum games in normal form?

A Every Nash equilibrium in mixed strategies is a profile of maxmin strategies.

B The set of maxmin strategies can be different from the set of minmax strategies for some of the two players.

C Every profile of maxmin strategies is a Nash equilibrium in mixed strategies.

Question 6

Let's play NIM by the following rules:

- Both players can take one or two plush bunnies (they have to take at least one).
- Whoever takes the last plush bunny loses.
- The other player wins.

Does player 1 have a winning strategy if we start with five plush bunnies?

A Yes.

B No.

Question 7

Consider the game $G = (P, v)$ with three players whose characteristic function is defined by

$$v(C) = \begin{cases} 1 & \text{if } \|C\| \text{ is odd} \\ 0 & \text{if } \|C\| \text{ is even.} \end{cases}$$

Which of the following statements are true?

A G is anonymous.

B G is simple.

C G is superadditive.

D G is convex.

Question 8

Consider the game $G = (P, v)$ with five players whose characteristic function is defined by

$$v(C) = \begin{cases} 1 & \text{if } \|C\| \geq 2 \\ 0 & \text{if } \|C\| \text{ otherwise.} \end{cases}$$

Which of the following statements are true?

A G is anonymous.

B G is simple.

C G is superadditive.

D G is convex.

Question 9

Which of the following statements are true for simple games?

A A veto player is necessary (but not always sufficient) to form a winning coalition.

B There always exists a veto player.

C Veto players are unique.

D It is possible that all players are veto players.

E A superadditive simple game has an empty core exactly if it has a veto player.

Question 10

Let $G = (P, v)$ be a nonmonotonic cooperative game with n players. Consider the payoff vector $(\varphi_1(G), \ldots, \varphi_n(G))$. Which of the following statements are true?

A $\sum_{i=1}^{n} \varphi_i(G) = v(P)$.

B If $\varphi_i(G) = 0$ then $i \in P$ is a dummy player.

C $\varphi_i(G) = \varphi_j(G)$ for symmetric players i and j.

D $\varphi_i(G + G) = 2\varphi_i(G)$.

Question 11

Consider the weighted voting game $G = (4, 4, 1; q)$.
How would you choose the quota q to make sure that the weight-1 player has the same total power (in terms of the Shapley–Shubik index) as any of the weight-4 players?

A $q = 4$.

B $q = 5$.

C $q = 8$.

D $q = 9$.

Question 12

Consider the weighted voting game $G = (5, 10, 2; 12)$.

Which of the following weighted voting games are equivalent to G?

A $(1, 1, 1; 3)$

B $(1, 1, 1; 2)$

C $(1, 2, 1; 3)$

D $(1, 2, 1; 2)$

Question 13

To show that a cooperative game $G = (P, v)$ is convex, we have to show that ...

A ... $v(C) \leq v(D)$ for all coalitions C and D with $C \subseteq D$.

B ... $v(C \cup \{i\}) - v(C) \leq v(D \cup \{i\}) - v(D)$ for all subsets $C, D \subseteq P$ with $C \subseteq D \subseteq P$ and all $i \in P \smallsetminus D$.

C ... $v(C \cup D) \geq v(C) + v(D)$ for any two disjoint coalitions C and D.

D ... $v(C \cup D) + v(C \cap D) \geq v(C) + v(D)$ for all coalitions C and D.

Question 14

Consider the weighted voting game $G = (2, 2, 2; 6)$.
In terms of the probabilistic Banzhaf index, is splitting the last player into two weight-1 players (yielding $G' = (2, 2, 1, 1; 6)$) ...

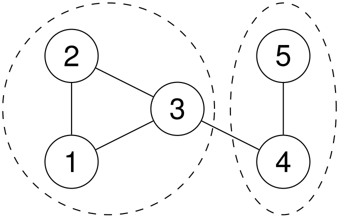
A ... beneficial?

B ... neutral?

C ... disadvantageous?

Question 15

Consider the enemy-oriented hedonic game



with a partition Π into cliques. Is Π ...

A ... core stable?

B ... strictly core stable?

C ... wonderfully stable?