Indian Institute of Technology Kharagpur
Department of Computer Science and Engineering

CS60025 Algorithmic Game Theory **Autumn 2026**

Quiz 1 **14 August 2026, 2:40 PM – 3:00 PM** **Marks: 10 × 1.5 = 15**

Name: _____ **Roll No.:** _____

Please write your answers in the space provided. Do not mark on the questions.

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1. The conditions on a, b, c, d so that (S, S) is a weakly dominant strategy are

	S	T
S	(a, a)	(d, c)
T	(c, d)	(b, b)

   A. $a \geq c, d > b$ **or** $a > c, d \geq b$
   B. $a > b \geq c > d$
   C. $a \geq b, c > d$ or $a > b, c \geq d$
   D. $a \geq b > c \geq d$

2. Which of the following is true?
   A. Every MSNE is a PSNE.
   B. Every PSNE is a strong DSE.
   C. Every PSNE is a weak DSE.
   D. Every strong DSE is an MSNE.

3. Consider a matrix game A. Which of the following is incorrect?
   A. A saddle point is simultaneously a row minimum and a column maximum.
   B. If a_{ij} and a_{kl} are saddle points, then so are a_{il} and a_{kj}.
   C. A can have multiple saddle points.
   D. If a_{ij} is a saddle point, then so is a_{ji}.

4. Consider a 2-person zero-sum game with each player having four strategies each. Which of the following cannot be the total number of PSNEs in the matrix game?
   A. 10
   B. 0
   C. 9
   D. 6

5. How many MSNEs does the following game have?

	S	T
S	$(3,3)$	$(0,0)$
T	$(0,0)$	$(2,2)$

A. 2

B. 1

C. 0

D. 3

6. Consider a matrix game $A \in \mathbb{R}^{n\times n}$. For $i \in \{1,2\}$, let S_i and $\Delta(S_i)$ denote the strategy set and set of all mixed strategy profiles of player i, respectively. Which one of the following is true?

A. $\max\limits_{\vec{y}\in\Delta(S_2)} \min\limits_{\vec{x}\in\Delta(S_1)} \vec{x}^T A\vec{y} \leq \min\limits_{\vec{x}\in\Delta(S_1)} \max\limits_{\vec{y}\in\Delta(S_2)} \vec{x}^T A\vec{y}$

B. $\max\limits_{\vec{x}\in\Delta(S_1)} \min\limits_{\vec{y}\in\Delta(S_2)} \vec{x}^T A\vec{y} \geq \min\limits_{\vec{y}\in\Delta(S_2)} \max\limits_{\vec{x}\in\Delta(S_1)} \vec{x}^T A\vec{y}$

C. $\max\limits_{\vec{x}\in\Delta(S_1)} \min\limits_{\vec{y}\in\Delta(S_2)} \vec{x}^T A\vec{y} \leq \min\limits_{\vec{y}\in\Delta(S_2)} \max\limits_{\vec{x}\in\Delta(S_1)} \vec{x}^T A\vec{y}$

D. $\max\limits_{\vec{y}\in\Delta(S_2)} \min\limits_{\vec{x}\in\Delta(S_1)} \vec{x}^T A\vec{y} \geq \min\limits_{\vec{x}\in\Delta(S_1)} \max\limits_{\vec{y}\in\Delta(S_2)} \vec{x}^T A\vec{y}$

7. Minimax theorem guarantees the existence of stochastic vectors $\vec{x}^*$, $\vec{y}^*$ such that

A. $\max\limits_{\vec{y}\in\Delta(S_2)} (\vec{x}^*)^T A\vec{y} = \min\limits_{x\in\Delta(S_1)} \vec{x}^T A\vec{y}^*$

B. $\min\limits_{\vec{y}\in\Delta(S_2)} (\vec{x}^*)^T A\vec{y} = \max\limits_{x\in\Delta(S_1)} \vec{x}^T A\vec{y}^*$

C. $\min\limits_{\vec{y}\in\Delta(S_2)} (\vec{x}^*)^T A\vec{y} \leq \max\limits_{x\in\Delta(S_1)} \vec{x}^T A\vec{y}^*$

D. $\max\limits_{\vec{y}\in\Delta(S_2)} (\vec{x}^*)^T A\vec{y} \geq \min\limits_{x\in\Delta(S_1)} \vec{x}^T A\vec{y}^*$

8. Here is a variant of the matching pennies game.

	H	T
H	$(5,-1)$	$(-1,1)$
T	$(-1,1)$	$(1,-1)$

Which of the following is an MSNE for the game?

A. $\left(\frac{1}{5},\frac{4}{5}\right), \left(\frac{1}{2},\frac{1}{2}\right)$

B. $\left(\frac{5}{6},\frac{1}{6}\right), \left(\frac{1}{6},\frac{5}{6}\right)$

C. $\left(\frac{1}{2},\frac{1}{2}\right), \left(\frac{1}{4},\frac{3}{4}\right)$

D. $\left(\frac{1}{4},\frac{3}{4}\right), \left(\frac{1}{2},\frac{1}{2}\right)$

9. Which of the following games has an MSNE but not a PSNE?

A.

	A	B
A	$(5,3)$	$(0,0)$
B	$(0,0)$	$(3,5)$

B.

	A	B
A	$(2,2)$	$(0,3)$
B	$(3,0)$	$(1,1)$

C.

	A	**B**
A	$(2,-2)$	$(-3,3)$
B	$(-3,3)$	$(4,-4)$

D.

	A	B
A	$(10,10)$	$(1,5)$
B	$(1,20)$	$(10,1)$

10. In a single-item Second-Price Sealed-Bid Auction where players have private valuations for the item, bidding one's true valuation constitutes

A. Weak Dominant Strategy Equilibrium

B. Very Weak Dominant Strategy Equilibrium

C. No Equilibrium

D. Strong Dominant Strategy Equilibrium