

1. In the following zero-sum game
  - (a) For each of the Row player's strategies, fix that strategy and find the corresponding strategy of the Column player that minimizes the Row player's payoff.
  - (b) Determine the Row player's maxmin strategy, i.e. that strategy of the Row player that maximizes her payoff if she expects that the Column player discovers her strategy and that the Column player's goal is to minimize the Row player's payoff.
  - (c) What is the highest payoff the Row player can guarantee for herself, i.e. the maxmin payoff?
  - (d) For each of the Column player's strategies, fix that strategy and find the corresponding strategy of the Row player that maximizes the Row player's payoff.
  - (e) Determine the Column player's minmax strategy, i.e. that strategy of the Column player that minimizes the Row player's payoff if the Column player expects that the Row player discovers her strategy and that the Row player's goal is to maximize the Row player's payoff.
  - (f) What is the lowest payoff of the Row player that the Column player can guarantee in the game, i.e. the minmax payoff?
  - (g) Do the minmax and the maxmin payoff coincide?
  - (h) Does the game have a minmax value?
  - (i) If the game has a minmax value, do the strategies that guarantee that value form a Nash equilibrium.
  - (j) Are there any dominated strategies in the game? Are they strictly or weakly dominated?

		Column		
		left	center	right
Row	up	10	5	1
	middle	11	8	9
	down	2	3	7

2. For the following game

- (a) Determine whether the game is a zero-sum game.
- (b) What are the Nash equilibria among the four strategy combinations (Top, West), (Top, East), (Bottom, West) and (Bottom, East)?
- (c) Suppose that the Row player fears that the Column player will discover the Row player's strategy. Can the Row player gain by adopting a randomized strategy? If not, why not? If so, why?
- (d) Suppose that the Column player fears that the Row player will discover the Column player's strategy. Can the Column player gain by adopting a randomized strategy? If not, why not? If so, why?

		Row	
		West	East
Column	Top	(23,-23)	(-11,11)
	Bottom	(-11,11)	(23,-23)

3. In Philip K. Dick's Novel *The Solar Lottery*

- (a) What device does the author use to implement the fear of an omniscient opponent that underlies maxmin reasoning?
- (b) Which player faces an omniscient opponent, and how does this player deal with his opponent's omniscience?
- (c) In what way is Philip K. Dick's literary treatment of zero-sum games an advance over Arthur Conan Doyle's treatment of such games?
- (d) Which game theorists informed Philip K. Dick's work and how do they appear in his novel?
- (e) Which physicist is mentioned in *The Solar Lottery* and what is the relation between his work and that of the game theorists mentioned in the novel?