Homework 1

CSCE631 Intelligent Agents

September 9, 2024
due: September 19, 2024. 11:10am.
May be submitted in class or via email.

1. (a) Consider the matching pennies game in Fig 1. Determine a mixed strategy Nash equilibrium following the method shown in class (by guessing that both players mix and calculating the probabilities).
   (b) Explain why the players cannot shift to a pure strategy despite it receiving the same expected reward.
2. Prove that every game must have at least one Pareto optimum with pure strategies.
3. Prove that every strategy is Pareto optimal in a zero-sum, two-player game.
4. Finish the proof of the Minimax theorem; that is, show that in any Nash equilibrium each player receives a payoff equal to her minmax value.
5. Consider the matching pennies game in Fig 1.

   Determine a mixed strategy Nash equilibrium by executing the Lemke-Howson algorithm. Graphically construct the strategy simplicies, and label each vertex. Then, show the path the algorithm takes.
6. Show that in two-player games the maxmin value of a player is equal to the player's minmax value.
7. Show that in n-player games the maxmin value of a player is at most the player's minmax value.

	Heads	Tails
Heads	$1, -1$	$-1, 1$
Tails	$-1, 1$	$1, -1$

Figure 3.6: Matching Pennies game.

Figure 1: