Homework 1 – Part 1

CSCE689 Algorithmic Game Theory

August 28, 2023

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.

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

Figure 3.6: Matching Pennies game.

Figure 1: