

Math 20
Two-Person Zero Sum Games

1. In each round of the two-person game *rock-paper-scissors*, each player chooses one of rock, paper, or scissors. Rock beats scissors, scissors beats paper, and paper beats rock. If both players choose the same object, then the round is considered a tie.
 - (a) Give the payoff matrix for this game, assuming that an entry of 1 indicates a win for the row player, an entry of -1 indicates a loss for the row player, and an entry of 0 indicates a tie. Label the rows and columns of the matrix with the row and column player actions.
 - (b) If the row player chooses paper 50% of the time and scissors 50% of the time and if the column player chooses rock 75% of the time and scissors 25% of the time, which player will win more rounds of the game on average?
2. For the strictly determined game with the following payoff matrix, find optimal strategies for the two players and find the value of the game.

$$\begin{bmatrix} 2 & -2 & 0 \\ -6 & 0 & -5 \\ 5 & 2 & 3 \end{bmatrix}$$

3. Player R has two playing cards: a black ace and a red four. Player C also has two cards: a black two and a red three. Each player secretly selects one of his or her cards. If both selected cards are the same color, player C pays player R the sum of the face values in dollars. If the cards are different colors, player R pays player C the sum of the face values. What are optimal strategies for both players and what is the value of the game?