# Mathematics of Games Homework Assignment 4

REMINDER: here are the assumptions/definitions that we made about Final Jeopardy! wagering in class.

• There are only two players remaining, Rose and Colin, and Rose's amount of money before Final Jeopardy!, which we call $r$, is greater than or equal to Colin's amount of money before Final Jeopardy, which we call $c$.
• Each player can wager any amount of money from \$0 up to the amount of money they have going into Final Jeopardy!
• Players either win or lose their wager depending on their answer to a randomly chosen question, which we assume the players each get right or wrong with 50% probability.
• For simplicity, we don't worry about the players' money when calculating payoffs, we just say that the person with more money gets a payoff of $+1$ and the person with less gets a payoff of $-1$. In the case of a tie, both players receive a payoff of 0.

1. Under the assumptions we made in class, solve the Jeopardy! game where Rose starts with \$3 and Colin starts with \$2. (This means find optimal mixed strategies for both players, and the value of the game!) You can use whatever shorthand notation you like to find the entries in the payoff matrix, but I do want to see your work. This means that if you turn in a payoff matrix with no explanation, it won't receive full credit.

2. In all of the examples we did in class, the first column of the payoff matrix (this is the column where Colin wagers \$0) consists of some 1s at the top, followed by a single $\frac{1}{2}$ in the row where Rose wagers $r - c$, followed by all 0s. Try to explain why this is always true, no matter what amounts Rose and Colin start with. (Hint: set Rose's starting amount to be $r$ and Colin's to be $c$, set a variable $w$ for the wager, and break down into the cases $w < r - c$, $w = r - c$, and $w > r - c$.