Instructions:
There are 7 questions worth a total of 100 points. Answer each question clearly and concisely. You must show your work to receive credit. You are allowed to work with others, but all work must be your own.

Clearly print your name above and in the space provided on the next page. You must turn in both sides of this cover sheet along with your responses. You do not need to turn in the questions, only your responses with the cover sheet. All pages must be stapled to be graded.
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Game Theory

1. Model the game of Rock-Paper-Scissors as a strategic form game. \( (10) \)
   (a) Explicitly list the strategic form structure of the game and the elements of the game along with a brief discussion.
   (b) Derive the best response functions.

2. Use the extensive form game in Figure 1 to answer the questions below. The payoffs listed at the bottom are given as (payoff to Player 1, payoff to Player 2), and the ellipse around Player 2’s decision indicates that Player 2 does not know Player 1’s choice.

Figure 1: An extensive form game for Question 2

(a) Rewrite the following extensive form game as a strategic form game.
(b) Derive the best response function for each player.
(c) Are there any Nash Equilibria of the game and if so what are they?

3. Consider the following strategic form game in Figure 2. The payoffs are listed as the payoff to the player on the left, payoff to the player on top. \( (15) \)
   (a) Derive the best response function for each player.
   (b) What is the Nash Equilibrium of this game and is it unique?
   (c) How does the outcome change if instead of simultaneous decisions, we model the game with sequential decisions and Player 1 chooses first?
Figure 2: A strategic form game for Question 3

\begin{tabular}{|c|c|c|}
\hline
Strategy & L  & R  \\
\hline
Player 2 & T  & (-1,2) & (-1,3) \\
\hline
 & B  & (-2,-2) & (0,1) \\
\hline
\end{tabular}

4. Types of games:
   (a) Provide an example of a zero sum game.
   (b) Provide an example of a coordination or prisoner’s dilemma game.
   (c) How do zero sum games differ from coordination or prisoner’s dilemma games?
   (d) How does repetition change the outcomes of zero sum games and coordination or prisoner’s dilemma games?
   (e) How does adding more players change the outcomes of zero sum games and coordination or prisoner’s dilemma games?

5. Consider the strategic form game of Figure 3. The payoffs are listed as the (payoff to the player on the left, payoff to the player on top).
   (a) Derive the best response functions.
   (b) Are there any dominant strategies?
   (c) Are there any dominated strategies?
   (d) Use the method of iterated elimination to try and find the outcome of the game.
6. Consider the following battle of the sexes game in Figure 4. The payoffs are listed as (payoff to the player on the left, payoff to the player on top). (15)

   (a) List all the Nash Equilibria of this game.
   (b) Now change the strategic form game into a sequential choice extensive form game.
   (c) Use backwards induction to find the Subgame Perfect Nash Equilibrium.
   (d) Are the Nash Equilibria you found in Part a still Nash Equilibria of the sequential game?
   (e) Are the Nash Equilibria you found in Part a Subgame Perfect Nash Equilibria?
   (f) What’s the difference between a Nash Equilibrium and a Subgame Perfect Nash Equilibrium?
7. Consider the following strategic form game in Figure 5. The payoffs are listed as the (payoff to the player on the left, payoff to the player on top).

(a) For $A \geq 0$ derive the best response functions conditional on the possible values of $A$.

(b) What is the outcome of the game conditional on the possible values of $A$?