Introductory Microeconomics
Homework 7: Introduction to Game Theory

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1. T/F. All simultaneous move games have an unique Nash equilibrium.

2. T/F. In a zero-sum game, one player's gain is always another player's loss.

3. T/F. In the Prisoner's Dilemma, both players choosing to cooperate is a Nash equilibrium.

4. T/F. In a game with multiple Nash equilibria, players are guaranteed to reach one of them.

5. T/F. All Nash equilibria must be Pareto efficient.

6. Consider the classic game Rock-Paper-Scissors between two players. If a player wins, he gets 1. If he loses, he gets -1. If there's a draw, both players get 0.

   (a) Write down the game in normal form.
   (b) Find $BR_1(s_2)$ the best response of player 1 to player's 2 strategies.
   (c) Argue there's not a pure strategy Nash Equilibrium in this game.
   (d) What would be your strategy if you were to play this game?

7. (Mankiw 18.8) Two athletes of equal ability are competing for a prize of \$10,000. Each is deciding whether to take a dangerous performance-enhancing drug. If one athlete takes the drug and the other does not, the one who takes the drug wins the prize. If both or neither take the drug, they tie and split the prize. Taking the drug imposes health risks that are equivalent to a loss of X dollars.

   (a) Draw a 2×2 payoff matrix.
   (b) For what values of X is the situation that both take the drug the Nash equilibrium?
   (c) Does making the drug safer (that is, lowering X) make the athletes better of? Explain.

8. Two animals compete over a resource valued in 4. They can either behave aggressively (hawk) or peacefully (dove). If both behave peacefully, they share the resource $(2, 2)$. If both behave aggressively, they fight, fighting is costly and they end up with $(-1, -1)$. If one of them behave aggressively and the other peacefully, the hawk gets the full resource 4 and the dove 0.

   (a) Write the payoff matrix.
   (b) Find $BR_1(s_2)$ and $BR_2(s_1)$.
   (c) Find the Nash equilibria.

9. Using iterated elimination of strictly dominated strategies find the prediction of the following game.

	Left	Center	Right
Top	10,4	5,3	3,2
Mid	0,1	4,6	6,0
Bottom	2,1	3,5	2,8

10. (Mankiw 18.9) Little Kona is a small coffee company that is considering entering a market dominated by Big Brew. Each company's profit depends on whether Little Kona enters and whether Big Brew sets a high price or a low price.

   (a) Does either play have a dominant strategy?

   (b) Does your previous answer help you figure out what the other player should do? What's the Nash equilibrium?

   (c) Big Brew threatens Little Kona by saying, *If you enter, we're going to set a low price, so you had better stay out.* Do you think Little Kona should believe the threat? Why or why not?

	High Price	Low Price
Enter	2,3	1,1
Don't Enter	0,7	0,2