

Econ 327: Game Theory

Homework #3

University of Oregon

Due: Nov. 15th

Question:	Question 1	Question 2	Question 3	Question 4	Total
Points:	20	40	20	20	100
Score:					

For homework assignments:

- Complete *all* questions and parts.
- You may choose to work with others, but everyone must submit to Canvas individually. Please include the names of everyone who you worked with below your own name.

Name _____

Note: All parts of Questions 1 and 2 are either directly from or adapted from problems in Dixit, Skeath and Reiley, <i>Games of Strategy</i> , Fourth Edition.

Question 1. [20 points] **Multiple Choice**

(a) Consider the game of Rock, Paper, Scissors:

		Lisa		
		Rock	Scissors	Paper
Bart	Rock	0, 0	10, -10	-10, 10
	Scissors	-10, 10	0, 0	10, -10
	Paper	10, -10	-10, 10	0 0

Suppose that Lisa announced she would use a mixture in which she chooses Rock with 40% probability, Scissors with 30% probability, and Paper with 30% probability. What is Bart's best response to this strategy choice?

- A. Rock
- B. Paper
- C. Scissors
- D. Mixed strategy of Rock with $1/3$, Scissors with $1/3$, and Paper with $1/3$.

(b) Consider the following game:

		Colin	
		<i>DL</i>	<i>CC</i>
Rowena	<i>DL</i>	4, 4	4, 1
	<i>CC</i>	1, 1	6, 6

How many Nash Equilibria are there *including mixed strategies*?

- A. one equilibrium
- B. two equilibria
- C. three equilibria
- D. an infinite number of equilibria

(c) Consider the strategic form game below:

		Column	
		Left	Right
Row	Up	4,1	2,2
	Down	1,1	3,0

How many Nash Equilibria are there *including mixed strategies*?

- A. one equilibrium
- B. two equilibria
- C. three equilibria
- D. an infinite number of equilibria

- (d) Find the mixed-strategy Nash equilibrium for the simultaneous game below:

		Pitcher	
		Throw fastball	Throw curve
Batter	Anticipate fastball	0.30, 0.70	0.20, 0.80
	Anticipate curve	0.15, 0.85	0.35, 0.65

where a represents the probability of Batter playing Anticipate fastball and t represents the probability of Pitcher playing Throw fastball.

- A. $(t = 1/3, a = 2/3)$
 - B. $(t = 1/4, a = 1/4)$
 - C. $(t = 1/2, a = 2/3)$
 - D. $(t = 1/6, a = 3/4)$
- (e) For this simplified version of the Cold War:

		Soviet Union	
		Restrained	Aggressive
United States	Restrained	4,3	1,4
	Aggressive	3,1	2,2

If one player could make a *strategic move* in a first stage of this game, which of the following would be a strategic move which would be *credible* and would improve the payoff of the player who made the strategic move?

- A. The Soviet Union commits to only playing Aggressive
- B. The Soviet Union promises to play Restrained if the US does too
- C. The United States develops a reputation of always playing restrained
- D. The United States threatens to play Aggressive unless the Soviet Union plays Restrained

Question 2. Consider the following game: ¹

		Colin	
		Yes	No
Rowena	Yes	x, x	$0, 1$
	No	$1, 0$	$1, 1$

- [10 points] Let $x = 1$. Graph the best-response curves of Rowena and Colin on a $p - q$ coordinate plane. Label all Nash equilibria in *pure* and *mixed* strategies.
- [10 points] Let $x = 3$. Graph the best-response curves of Rowena and Colin on a $p - q$ coordinate plane. Label all Nash equilibria in *pure* and *mixed* strategies.
- [4 points] For what values of x does this game have a unique Nash equilibrium? What is that equilibrium?
- [10 points] For what values of x does this game have a mixed-strategy Nash equilibrium? With what probability, expressed in terms of x , does each player play Yes in this mixed-strategy equilibrium?
- [6 points] For the values of x you found in part (d), is the game an example of an *assurance* game, a *game of chicken*, or a game similar to *tennis*? Explain.

¹Dixit, Skeath, and McAdams, pg 250

Question 3. Take a look at the data collected in class from **Activity 5 - Social Media Adspace**.

- (a) [6 points] Find the Nash equilibrium quantity strategies for firms in terms of a and b .
- (b) [8 points] Compare your firms actual quantities produced to the equilibrium strategy function in part (a). Also compare the theoretical profit in equilibrium to the profits which you earned during the activity. Did the production behavior of firms in class match the theoretical equilibrium? Why or why not?
- (c) [6 points] What would a monopolist firm do in this market if it didn't any competitors? Compare the monopolist's profit to the profits earned by firms in the activity. What obstacles prevented the firms from behaving like monopolists?

Question 4. Take a look at the data collected in class from **Activity 6 - Penalty Shootout**.

- (a) [6 points] Generate a testable hypothesis using mixed-strategy Nash equilibria to compare against the data from our in-class activity. Your hypothesis should include a specific numerical value or values. For example, you could find the probability of a goal being scored in equilibrium, or the overall distribution of strategies by kickers and goalies playing equilibrium strategy profiles.
- (b) [8 points] Now compare your theoretical prediction to some statistic or set of values from class. Do you *reject* or *fail to reject* the null hypothesis that the class data were significantly different from the theoretical distribution? Feel free to use any graphical, statistical, or computational tools to help your analysis.
- (c) [6 points] Evaluate the predictions generated by the theory.
If students' behavior in class resembled equilibrium behavior, under what circumstances might you expect the predictions to break down?
If students' behavior didn't fit with the predictions, what assumptions in the theory do you think failed to hold up in real life?