

Econ 327: Game Theory

Homework #1

University of Oregon

Due: Oct. 11th

Question:	Question 1	Question 2	Question 3	Total
Points:	28	32	28	88
Score:				

For homework assignments:

- Complete *all* questions and parts.
- You will be graded on not only the content of your work but on how clearly you present your ideas. Make sure that your handwriting is legible. Please use extra pages if you run out of space but make sure that all parts of a question are in the correct order when you submit.
- 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.

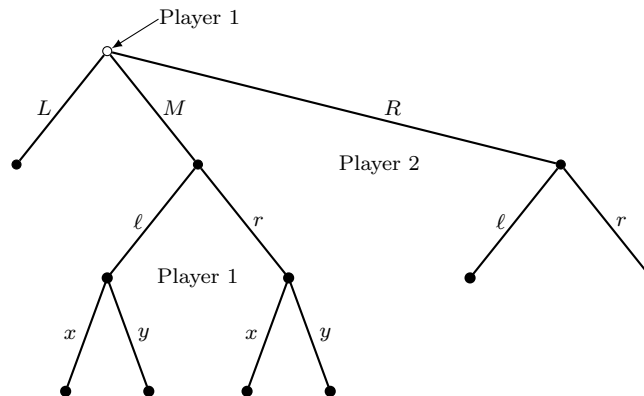
Name _____

Question 1. Multiple Choice

- (a) [4 points] Which of the following is **not** an example of **strategic behavior**?
- A. I always choose Chocolate over Vanilla ice cream because I like it better
 - B. More people bike on days with too much traffic
 - C. Apple markets *Pro* versions of their products to people with money and non-*Pro* versions to broke students
 - D. Best Buy offer to match any competitors price offer for their customers
- (b) [4 points] **Alice**, **Bob**, and **Confucious** each put one dollar in a pot and each toss a fair coin. **Alice** wins if the coins are *all heads* **or** *all tails*, **Bob** wins if there are *2 heads* and *1 tail*, and **Confucious** wins if there are *1 head* and *2 tails*.

What are the **expected payoffs** for each player? ¹

- A. $EU_A = \$0$, $EU_B = \$0$, $EU_C = \$0$
 - B. $EU_A = -\$0.25$, $EU_B = \$0.125$, $EU_C = \$0.125$
 - C. $EU_A = -\$0.50$, $EU_B = \$0.25$, $EU_C = \$0.25$
 - D. $EU_A = \$0.50$, $EU_B = -\$0.25$, $EU_C = -\$0.25$
- (c) [4 points] Consider the game tree below



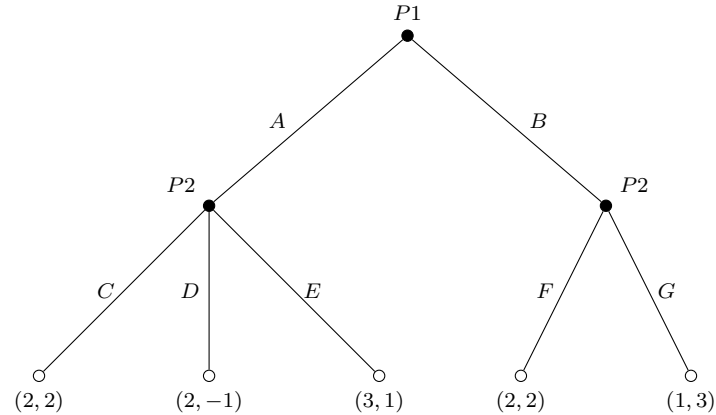
(recall that a strategy is a complete plan of action for *every* eventuality)

Which of the following is a **complete strategy for Player 1**?

- A. (L)
 - B. $(x \text{ if } \ell)$
 - C. $(L, x \text{ if } \ell, y \text{ if } r)$
 - D. (R)
- (d) [4 points] Consider the game tree from the previous question.
- Which of the following is a **complete strategy for Player 2**?
- A. $(\ell \text{ if } M)$
 - B. $(r \text{ if } M, \ell \text{ if } R)$
 - C. (ℓ)
 - D. $(\ell \text{ if } L, r \text{ if } M, r \text{ if } R)$

¹Adapted from Dixit, Skeath, & McAdams (2021)

(e) [4 points] Consider the game tree below Find the **rollback equilibrium**.



- A. **P1:** (A), **P2:** (C if A, F if B)
- B. **P1:** (A), **P2:** (C if A, G if B)
- C. **P1:** (B), **P2:** (C if A, F if B)
- D. **P1:** (B), **P2:** (D if A, G if B)

(f) [4 points] Consider the following variation to the Survivor Flags game:

There are 100 flags to start with, two teams who take turns taking flags, each team can take any number of flags between 1 and 10 on their turn, and the team to take the last flag wins.

How many flags should the first team take?

- A. 1
- B. 2
- C. 5
- D. 10

(g) [4 points] **Rationality** means that:

- A. Players have perfect information
- B. Players never make mistakes
- C. Players have perfect recall
- D. Preferences are complete and transitive

Question 2. Imagine a sequential moves version of rock-paper-scissors where player 2 gets to pick what they will do after player 1 picks. Please model the game in its extensive form (as a game tree). Assume both player 1 and player 2 only care about the result of the game and have the following preferences over the result of the game: win \succ tie \succ loss.²

(a) Answer the following questions:

- i. [4 points] How many nodes are there?
- ii. [4 points] How many branches are there?
- iii. [4 points] How many terminal nodes are there?

(b) [10 points] Prune the tree as much as possible. How many branches were you able to eliminate? (A complete answer should include your drawing(s) of the game tree)

(c) [10 points] Use the same setup, but now imagine player 1's preferences change because they want to be seen as a "tough guy". Given that what they want to play remains the same, they still have the following preferences over the result of the game: win \succ tie \succ loss. However, they now would prefer to lose playing rock than win playing paper or scissors. Please create a new game tree so the payoffs reflect these new preferences.

Prune the tree as much as possible.

How many branches were you able to eliminate? (Include your drawing(s))

²Ethan Holdahl, University of Oregon

Question 3. Read the 2022 Politico Opinion article, *How Game Theory Explains Why We Have to Sanction Putin : Even If It's Costly*.

<https://www.politico.com/news/magazine/2022/04/21/russia-sanctions-game-theory-00026566>

- (a) [8 points] List the tools from game theory that we've learned about in class which the authors use to argue their point.
- (b) [10 points] What assumptions do they make in their simplified model of international sanctions?
- (c) [10 points] Choose one assumption of the author's model to change and explain how it changes what the model predicts.