EC 327 Spring 2023, Midterm Exam, 1A

Exam Grading Policy:

- If you don't know the answer, please write “I don't know” or leave it blank, and you will receive partial credit. 25%
- If you choose to attempt a question, you will be graded on the merit of your answer.
- An answer that shows understanding with some mistakes will be given partial credit, decided by the grader. A well-written response should receive more than 25%.
- Show all your work. Answers without work are not guaranteed credit.

Name_____ ID number:_____

Problem #1: Expected Payout, 16 pts

Suppose you roll a fair die, and your opponent flips an unfair coin simultaneously (independent events). The die has a ¼ chance of coming up Heads and a ¾ chance of coming up Tails. The die places a ⅛ chance on all values.

You win $3 whenever a Tail appears, and the number of dots on the top face of the dice is either one or six. For all other outcomes, you lose $1. (Dr. Rui Zhao, University at Albany)

a. What is your expected payoff?
b. What is your opponent's expected payoff? Is the game in your favor?

Problem #2: Construct Game Matrix, 20 pts

(18pts)Two fishing firms, “Seafood Unlimited” and “Critter Catchers,” catch Dungeness Crab off the Oregon coast. Each chooses between using a large vessel or a small one. It costs $10,000 and $20,000 to run a small and large vessel, respectively, for a fishing season. If both run small vessels, they will each catch 2,500 pounds of crab per season, and the market price will be $10 a pound. If one uses a small vessel and the other a large one, the market price will be $8, and the large vessel will catch 4,000 pounds of crab and the small vessel 2,500 pounds of crab (because they fish at different distances offshore). If both choose large vessels, they will both catch 3,500 pounds of crab, and the market price of crab will be $2. The fishing firms must make their vessel size choices simultaneously. Firms measure their utility in profit. Recall profit = revenue - cost. (Dr. Ellis, University of Oregon)

a. Specify: players, strategies
b. Construct a payoff matrix for this game
c. Find pure strategy Nash equilibrium
d. Give both definitions of a Nash equilibrium

Problem #3: Verify Nash Equilibrium, 16pts

		Player 2	
		T	Q
Player 1	T	(4,3)	(1,3)
	Q	(2,4)	(4,0)

I. Verify if the following strategy profile is Nash equilibrium or not using Theorem 1. (A, ⅘ C+ ⅕ D)
II. Clearly explain your findings.

Problem #4: Graphing Payouts When Strategies are Mixed, 16 pts

		Player 2	
		T	Q
Player 1	T	(4,3)	(1,3)
	Q	(2,4)	(4,0)

I. Graph both players' pure strategy payouts if the other uses a mixed strategy.
II. Define a strictly dominated strategy and explain why we can eliminate these strategies when we are looking for a Nash equilibrium.

Problem #5: Mixed-Strategy Nash Equilibrium, 24 points

		Player 2	
		T	Q
Player 1	T	(4,3)	(1,3)
	Q	(2,4)	(4,0)

a. Find all Nash equilibria.
b. Explain how you know what you just found is a Nash equilibrium

Problem #6: States of Nature, 16 points

Good (p)

Player 1 \ Player 2	T	Q
T	(2,2)	(0,0)
Q	(0,0)	(3,3)

Bad (1-p)

Player 1 \ Player 2	T	Q
T	(2,2)	(4,0)
Q	(0,4)	(3,3)

a) Assume that *p* is unknown. Combine the two-game tables into one table containing player 1's and player 2's expected payoffs.

b) Based on your answer to b), for what values of *p* is (Quiet, Quiet) a Nash equilibrium?

Problem #7: Pure Strategy Bayesian Nash Equilibrium, 16pts

Suppose player 1 knows there exists a probability distribution over states with some unknown value p, and player 2 knows which state is going to be realized.

Good (p)

Player 1 \ Player 2	C	D
A	(2,1)	(0,0)
B	(0,0)	(1,2)

Bad (1-p)

Player 1 \ Player 2	C	D
A	(2,0)	(0,2)
B	(0,1)	(1,0)

a. What are the possible pure strategy BNEs?
b. Define a Bayesian Nash equilibrium and explain why what you just found qualifies.