Econ 327: Game Theory
Midterm Exam

University of Oregon

October 30th, 2024

Version 1

- Complete *all* questions and parts. All questions will be graded.

- Carefully explain all your answers on short and long answer questions.

  An incorrect answer with clear explanation will earn partial credit, an incorrect answer with no work will get zero points.

- If you do not understand what a question is asking for, ask for clarification.

<u>Allowed Materials:</u>

- A single 5" by 3" note card

- A non-programmable calculator

- Pencils, color pens, eraser, ruler/straight-edge etc.

Name _____

> Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page or another sheet of paper.

Multiple Choice

Question 1. (4 P.)

If an outcome is _____, then it is _____

    a) never Pareto dominated, Pareto Optimal

    b) not a Nash equilibrium, not Pareto optimal

    c) Pareto dominated, a Nash equilibrium

    d) strictly dominated for everyone, Pareto optimal

Question 2. (4 P.)

Perform Iterative Deletion of Strictly Dominated Strategies for the strategic form game below all the way to completion.
 What does IDSDS tell you about the Nash equilibrium of this game?

		P_2		
		wide	narrow	thin
	tall	5,9	6,2	6,2
P_1	med	2,5	8,8	2,2
	short	6,4	2,3	5,9

    a) The NE is (tall,wide)

    b) IESDS by itself does not reveal the NE of this game.

    c) The NE is (med,narrow)

    d) The NE is (short,thin)

    e) The NE is (tall,narrow)

Question 3. (4 P.)

A choice that is the best for a player **no matter what everyone else is doing** is referred to as a:

    a) Nash strategy

    b) Pareto optimal strategy

    c) strictly dominant strategy

    d) strictly dominated strategy

Question 4. (4 P.)

Iterative Deletion of Strictly Dominated Strategies is useful because

    a) it will always find all Nash Equilibria of any strategic form game

    b) it removes non-credible threats

    c) it can remove strategies which will never be played in a Nash Equilibrium

    d) it's not useful because you will get different answers depending on which player you start with

		P_2		
		Left	Middle	Right
P_1	Up	0,1	9,0	2,3
	Straight	5,9	7,3	1,7
	Down	7,5	10,10	3,5

Question 5. (4 P.)

Consider the strategic form game below: What is the Nash Equilibrium?

a) Up, Left

b) Straight, Middle

c) Down, Left

d) Down, Middle

Question 6. (4 P.)

I make two bets on separate games. If the UO men's basketball team beats Washington, I win \$6, but if Washington wins I lose \$6. If the UO women's team beats Colorado, I win \$12, but if Colorado wins I lose \$12. Suppose that the probability of the UO men beating Washington is $\frac{1}{3}$ and the probability of the UO women beating Colorado is $\frac{1}{2}$.

What is my expected (dollar) payout across both games?

a) -\$2

b) -\$4

c) \$2

d) \$0

Question 7. (4 P.)

In a **sequential-move game**, the appropriate method of analysis is:

a) Iterated elimination of dominated strategies

b) backward induction (rollback analysis)

c) Cournot adjustment process

Question 8. (4 P.)

In the **Prisoner's Dilemma**, mutual cooperation:

a) is a dominant strategy equilibrium

b) Pareto dominates the outcome of mutual defection

c) is stable

d) is a credible threat

Question 9. (4 P.)

Which of the following do we assume when we solve sequential games using backwards induction?

a) All players believe that all other players are rational

b) All players have the same preferences

c) All playeres have perfect information

d) Some players have a first-move advantage

Question 10. (4 P.)

In a two player game in which both players have 2 elements in their strategy set, it is possible for there to be 4 pure strategy Nash equilibria.

    a) False, pure strategy Nash must be unique

    b) False, only mixed strategies can be used in a 2x2 game

    c) True, if all are weak Nash equilibria

    d) True, if all are Pareto dominated

Long Answer

Exercise 11.

Here's a little ditty, about Jack and Diane, two American kids growing up in the heartland. The game is below.

		Diane		
		x	y	z
	a	1,1	2,1	2,0
Jack	b	2,3	0,2	2,1
	c	2,1	1,2	3,0

a) (6 P.) Find all pure Nash strategy profiles and outcomes *if Jack moves first*. Carefully detail and explain your strategy profiles.
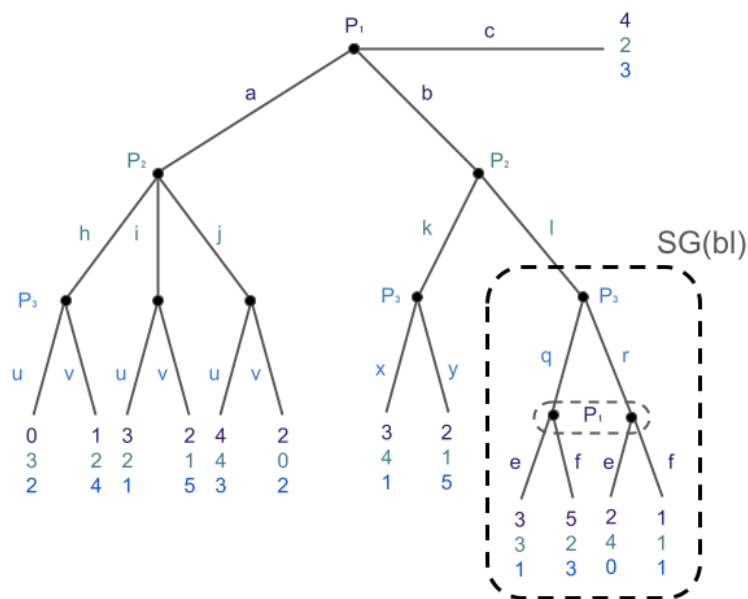
Question 12.

Consider the strategic form game below:

		P_2			
		W	X	Y	Z
	A	9, 5	6, 8	10, 5	6, 7
	B	9, 0	4, 3	11, 5	2, 7
P_1	C	10, 7	2, 8	9, 9	6, 11
	D	1, 2	5, 3	12, 4	9, 12
	E	10, 2	4, 3	7, 4	4, 14

a) (4 P.) Does either player have any strategies they would never play if they are rational? State any strictly dominated strategies and explain why they would not be played.

b) (4 P.) Use Iterated Deletion of Strictly Dominated Strategies and write out a simplified game table with any remaining cells.

c) (4 P.) Find all Nash equilibria in pure strategies. Explain why you know that these strategy profiles are Nash, or if you cannot find any explain why not.

Question 13.

Consider the extensive form game below:

a) (4 P.) First, focus on the subgame outlined in the dashed box and labelled SG$(b\ell)^1$.
   Write out this sequential subgame as a normal form table.

b) (4 P.) Solve for all Nash equilibria in SG$(b\ell)$.

c) (4 P.) Now based on your answer above, what can you say about any subgame perfect Nash equilibria in the whole game?

d) (4 P.) Solve for all subgame perfect Nash in the entire game. Outline your work to justify your answer. If you cannot find any Nash, explain why not.

Question 14.

Crude oil is transported across the globe in enormous tanker ships called Very Large Crude Carriers (VLCCs). Assume that the price of new VLCCs (in millions of dollars) is determined by the function $P = 166 - Q$, where $Q = q_{Korea} + q_{Japan}$. (That is, assume that only Japan and Korea produce VLCCs, so they are a duopoly.) Assume that the cost of building each ship is \$7 million in both Korea and \$10 million in Japan. That is, $c_{Korea} = 7$, $c_{Japan} = 10$, where the per-ship cost is measured in millions of dollars.

a) (4 P.) Solve for *Korea*'s best response rule to Japan's price.

b) (4 P.) Solve for *Japan*'s best response rule to Korea's price.

c) (4 P.) Graph the best-responses with the x-axis as Korea's price and the y-axis as Japan's price.

d) (4 P.) Solve for all Nash Equilibria. Explain why they are stable.

Extra Credit

Pick a bid of any number between 0 and 2 bonus points which will be matched with another random student's bid. Whoever has the **lowest** bid will be awarded their bonus points, the other student will earn zero points. A tie will result in no bonus points being given.

Your Bid: _____