

**Microeconomics III**  
**Midterm Exam**

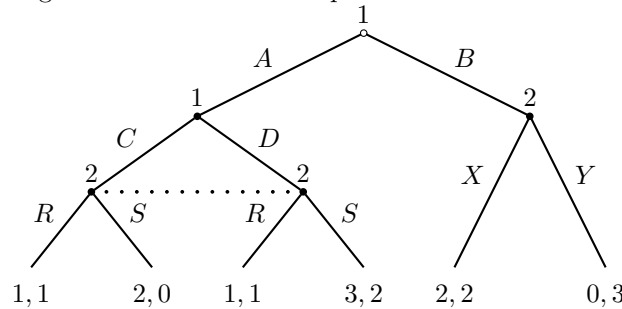
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**Question 1.** Consider the following game.

		Player 2			
		<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Player 1	<i>M</i>	3, 2	2, 0	2, 3	2, 6
	<i>N</i>	2, 2	1, 4	3, 3	4, 2
	<i>O</i>	3, 3	4, 1	2, 4	1, 3
	<i>P</i>	1, 5	0, 4	2, 3	3, 5

- (a) What strategies survive the iterated deletion of strictly dominated strategies? For each iteration, specify the dominated strategy and the strategy that dominates it.
- (b) What is the unique Nash equilibrium of this game?

**Question 2.** Consider the game below. Both the extensive form and the normal form are given. The dotted line represents an information set.



		Player 2			
		<i>R, X</i>	<i>R, Y</i>	<i>S, X</i>	<i>S, Y</i>
Player 1	<i>A, C</i>	1, 1	1, 1	2, 0	2, 0
	<i>A, D</i>	1, 1	1, 1	3, 2	3, 2
	<i>B, C</i>	2, 2	0, 3	2, 2	0, 3
	<i>B, D</i>	2, 2	0, 3	2, 2	0, 3

- (a) List all pure-strategy Nash equilibria.
- (b) List all pure-strategy trembling-hand perfect equilibria.
- (c) List all pure-strategy subgame-perfect equilibria.
- (d) List all pure-strategy sequential equilibria.

**Question 3.** Three students ( $i = 1, 2, 3$ ) are working on a joint project. Each student selects the amount of time to work on the project,  $x_i \geq 0$ . The quality of the project,  $q$ , depends on  $x_1, x_2$ , and  $x_3$ :

$$q(x_1, x_2, x_3) = 3x_1 + 2x_2 + 2x_3 - x_1x_2 - x_1x_3$$

Each student also has a cost function given by

$$c_i(x_i) = (x_i)^2$$

The utility for student  $i$  is given by:

$$u_i(x_1, x_2, x_3) = q(x_1, x_2, x_3) - c_i(x_i)$$

- (a) Suppose that the students simultaneously and independently decide how much time to spend on the project. Show each student's best response function and determine the pure-strategy Nash equilibrium of this game.
- (b) Consider the following two-period game. First, student 1 decides how much time to spend on the project. Second, after observing the choice of student 1, students 2 and 3 simultaneously and independently decide how much time to spend. Determine the pure-strategy subgame-perfect Nash equilibrium of this game.

**Question 4 (If time, save for last).** Two firms are deciding on which technology to adopt,  $A$  or  $B$ . Technology  $A$  is only profitable if adopted by both firms. The payoffs based on their decisions are given by

		Firm 2	
		$A$	$B$
Firm 1	$A$	$3, 3$	$0, 2$
	$B$	$4, 0$	$1, 1$

The game is played over two periods. Each firm may make an adoption decision only once, but may do so in either period 1 or period 2. Players move simultaneously in each period (though may select no action,  $N$ , in period 1), and first period choices are observed before a second-period action is chosen (if  $N$  were chosen in period 1). Payoffs are received after the second period.

- (a) Is there a subgame-perfect equilibrium in which  $(A, A)$  is ultimately chosen? If yes, what is it? If no, why not?
- (b) Find all subgame-perfect equilibria of this game. [ Hint: there are nine possible combinations of first-period actions. What are the payoffs from each of these when second-period actions are taken into account? ]