Microeconomic Theory II — Spring 2021

Midterm Exam — Mikhael Shor

Read all questions carefully and work carefully.
Show all work and provide brief explanations.
Be explicit about any assumptions that you are making.

Question 1. Consider the following normal-form game:

		Player 2		
		X	Y	Z
Player 1	A	α, β	$10, 10$	$30, 10$
	B	$5, 3$	$25, 20$	$40, 10$
	C	$8, 8$	$15, 16$	$25, 18$

(a) For what values of α is the strategy A strictly dominated?

For the rest of the question, imagine that the stage game above is repeated twice, with the outcome of the first period observed by both players before the second period, and with payoffs equal to the sum of the two periods (i.e., no discounting).

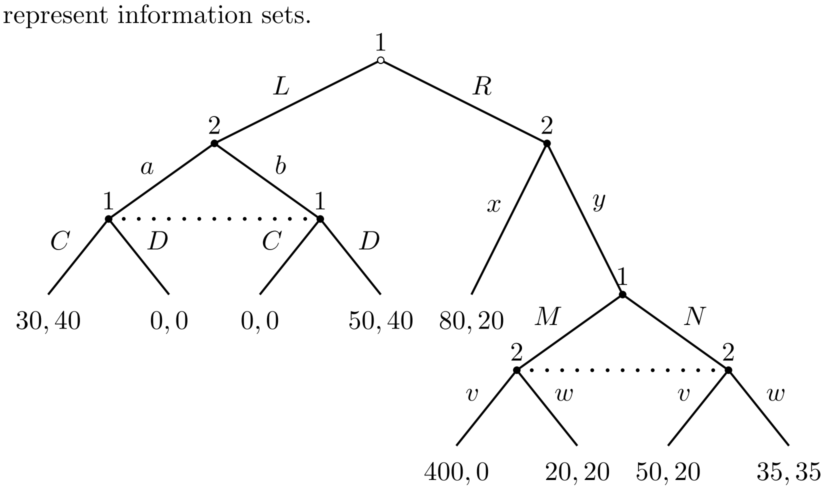
(b) For what values of α and β does the game have a pure-strategy subgame-perfect Nash equilibrium in which players play {B,Y} in the first period? Explain.

(c) For what values of α and β does the game have a pure-strategy subgame-perfect Nash equilibrium in which players play {A,X} in the first period? Explain.

(d) For what values of α and β does the game have a pure-strategy subgame-perfect Nash equilibrium in which players play {A,X} in the *second* period? Explain.

(e) For what values of α and β does the game have a pure-strategy subgame-perfect Nash equilibrium in which players play {C,Z} in the first period? Explain.

Question 2. Consider the game below. Player 1's actions are denoted by uppercase letters and Player 2's actions by lowercase letters. The dotted lines represent information sets.



(a) Describe the strategy space (or provide an example of a pure strategy) for each player.

(b) Find <u>*all*</u> subgame-perfect Nash equilibria. For each equilibrium, also write down each player's equilibrium payoffs.

Question 3. Consider two firms (Firm 1 and Firm 2) who are Cournot competitors (compete in quantities). Inverse demand is given by $p = 100 - q_1 - q_2$. Each firm has costs given by $c(q_i) = 10q_i$, $i \in \{1, 2\}$ (i.e., a marginal cost of 10).

Before the two firms play the Cournot game, Firm 1 can invest in a cost-eliminating technology. If it invests, its costs become $c(q_1) = 0$. The cost of this investment is F.

The timing of the game is:

- In the first period, Firm 1 chooses to invest (at a cost of F) or to not invest. Firm 2 observes Firm 1's choice.
- In the second period, Both firms simultaneously select a quantity, q_i. Firm 2's cost is given by $c(q_2) = 10q_2$. Firm 1's cost is given by $c(q_1) = 10q_1$ if it chose not to invest and by $c(q_1) = 0$ if it chose to invest.

Profits for each firm are given by $pq_i - c(q_i)$ minus the cost of the investment for Firm 1, F, if Firm 1 chooses to invest.

(a) Carefully identify the subgame-perfect Nash equilibrium of this game (this will depend on F).

(b) What is the maximum value of F for which it is subgame-perfect for Firm 1 to invest in the technology?

(c) ** Describe a Nash equilibrium with an F greater than that identified in (b) for which investing is not part of a subgame-perfect Nash Equilibrium but is part of a Nash equilibrium.