Microeconomic Theory II — Spring 2022

Midterm Exam — Mikhael Shor

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

Question 1. Consider the following normal-form game:

		Player 2			
		W	X	Y	Z
Player 1	A	2, 6	8, 0	0, 1	4, 1
	B	6, 0	4, 6	6, 1	0, 0
	C	0, 10	0, 0	6, 6	0, 0
	D	2, 0	2, 10	$\boldsymbol{\alpha}$, 6	2, 10

(a) Assume $\boldsymbol{\alpha} = 5$. Which strategies are a best response for *some* beliefs (i.e., consistent with rationality)? For each, specify a belief or show that none exists.

(b) For what values of $\boldsymbol{\alpha}$ is D strictly dominated?

(c) Assume $\boldsymbol{\alpha}$ is a value for which D is strictly dominated. Which strategies survive the iterated deletion of strictly dominated strategies? Explain each step.

Question 2. Consider the two-firm Stackelberg model but with firms sequentially setting prices instead of quantities. First, firm 1 sets a price p_1. Next, after observing p_1, firm 2 sets a price, p_2. As in the Bertrand model, the firm with the lower price sells the entire market demand, $Q = Q(\min\{p_1, p_2\})$, while the other firm sells zero. If both prices are equal, market demand is split evenly between the two firms, $q_1 = q_2 = Q/2$. Assume constant marginal costs of c and assume $Q(c) > 0$.

(a) What are the (pure strategy) subgame-perfect Nash equilibria of the above game?

(b) Briefly describe and explain if this differs from the outcome of the simultaneous Bertrand game (in which firms set prices simultaneously).

Question 3. Two coworkers are competing for a promotion to be awarded on Wednesday (in two days). The boss wants to award the promotion to whichever worker works hardest the next two days. Each coworker must decide how many of the next two days they want to stay late at work and work through the night. Each worker decides to stay late 0 days, 1 day, or 2 days ($S_i = \{0, 1, 2\}$). Utility decreases by 1 for every day a worker stays late. Assume that the two workers decide on the number of days to stay late simultaneously.

If both workers stay late an equal number of days, the promotion is awarded to one of them at random, with equal probability. Otherwise, the worker who stayed late more days gets the promotion. The promotion provides a utility of 3 while no promotion provides a utility of 0.

For example, if one worker stays late 1 day and the other stays late 2 days, the worker who stayed late 1 day receives utility of $0 - 1 = -1$ while the worker who stayed late 2 days receives utility of $3 - 2 = 1$.

(a) Carefully write down the normal form (strategic form) of this game.

(b) Which strategies are consistent with rationality? Briefly explain.

(c) Which strategies survive the iterated deletion of dominated strategies? Briefly explain.

(d) Show that each player using each strategy with equal probability is a Nash equilibrium.

(e) Now imagine that the game is played sequentially. On the first day, each player decides whether to stay late or not. On the second day (after observing the outcome of day 1), each again decides whether to stay late or not. Like before, the worker who stays late more days receives the promotion (utility of 3) or, in case of a tie, the promotion is awarded randomly (utility to each of $1\frac{1}{2}$). What is/are the subgame perfect Nash equilibrium/equilibria?