

Question 1: Consider the normal form game in the following table:

		Player 2	
		L (Left)	R (Right)
Player 1	T (Top)	(a,b)	(c,d)
	B (Bottom)	(e,f)	(g,h)

Find the conditions on the parameters that would ensure that

- The outcome (T,L) is a Nash Equilibrium
- The outcome (T,L) is an equilibrium in dominant actions
- The outcome (T,L) Pareto-dominates all other outcomes
- The outcome (T,L) is Pareto noncomparable to outcome (B,R).

Question 2: Find all the pure and mixed-strategy equilibria of the following game:

		Player 2	
		X	Y
Player 1	X	(3,1)	(2,4)
	Y	(1,6)	(5,2)

Question 3: Ali and Leyla are working on the same project as a team. If both devote more “effort” to the project, the project will be more successful, and they will both be better off professionally. An effort level is a positive number, and Ali’s payoff function is  $(1 + e_L - e_A) e_A$ ; where  $e_A$  is Ali’s effort level and  $e_L$  is Leyla’s effort level. For Leyla the cost of effort is either the same as that of Ali, and hence her payoff function is given by  $(1 + e_A - e_L) e_L$ ; or effort is very costly for her in which case her payoff function is given by  $(1 + e_A - 2e_L) e_L$ : Leyla knows Ali’s payoff function and if the cost of effort is high for herself or not. Ali, however, is uncertain about Leyla’s cost of effort. He believes that the cost of effort is low with probability  $p$ , and high with probability  $1-p$ , where  $0 < p < 1$ . Find the Bayesian equilibrium of this game as a function of  $p$ .

Question 4: Consider the Bertrand model with differentiated products. Two competing firms, selling two differentiated products. The marginal cost of producing each unit of a product is zero. The market demand,  $q_i$ , for firm  $i$  is determined by  $q_i = (\alpha - \beta P_i + \gamma P_j)$ , where  $P_i$  and  $P_j$  are the prices set by firms  $i$  and  $j$ , respectively. ( $P_i$  and  $P_j$  are the decision variables of the firms.) Both firms seek to maximize profits.

- Given a price  $P_j$  set by firm  $j$ , find the best response for firm  $i$ .
- Find the firms’ prices and quantities in equilibrium (*simultaneous* competition).
- Now suppose the firms engage in a *sequential* competition, i.e., Firm 1 makes its pricing decision first, and after seeing Firm 1’s price, firm 2 moves next and chooses its price. Find the equilibrium prices and quantities under the *sequential* model.
- Suppose  $\beta=2$ ,  $\gamma=1$  and  $\alpha=200$ . How do the firms’ profits compare under the *simultaneous* and *sequential* models? If firm 1 could choose between a *simultaneous* and a *sequential* model, which one would it prefer? What about firm 2?
- How are your observations in part (d) similar to or different from the observations we made about the profits of quantity-setting firms under Cournot and Stackelberg competition?