

Midterm 1 (Total Points: 90)

(I) (6 pts) Define Nash Equilibrium and Subgame Perfect Nash Equilibrium (SPNE).

(II) Consider a game with 2 players that make their moves simultaneously and can choose between 2 actions : c and n . Their payoffs are given in the matrix below (the first number in each cell corresponds to player 1's payoffs and the second one to those of player 2).

		Player 2	
		c	n
Player 1	c	0 , 0	7, - 2
	n	-2 , 7	5, 5

(1) (7 pts) Suppose the game is played twice. What is the SPNE? Justify.

(2) (8 pts) Suppose the game is played for an infinite number of periods , that the players have a discount factor δ (between zero and one) and that they are using trigger strategies.

What condition needs to be satisfied for the trigger strategy to be a SPNE? For what values of δ is the trigger strategy equilibrium a SPNE?

(III) Consider the following game.

Players 1 and 2 can use the strategies specified below and their payoffs are as shown (the first number in each cell corresponds to Player 1's payoff, the second one to Player 2's payoff).

		Player 2		
		L	M	H
Player 1	L	-13, -8	-1, - 4	7, - 4
	M	- 4, -1	4, - 1	4, - 4
	H	1, 2	1, - 1	1, - 4

(1) (10 pts) Suppose the game is played only once and that both players move simultaneously. Find the Nash Equilibrium/a. Justify.

(2) (12 pts) Suppose now that players move sequentially. Player 2 moves first and after his choice is observed by both players, Player 1 moves.

Draw the game tree and find the SPNE.

(IV) Consider a market with FIVE identical firms that have zero marginal costs . The (inverse) demand curve is:

$$p = 6 - q, \quad \text{where } q \text{ is the sum of } q_1, q_2, q_3, q_4 \text{ and } q_5 .$$

(1) (12 pts) Calculate the Nash equilibrium in quantities.

(2) (5 pts) What will happen to the market price if more firms enter the market? What will the price be when the number of firms is approaching infinite?

(V)

Consider a market with two firms (firms 1 and 2). The (inverse) demand curve is:

$$p = 65 - (1/3) q, \quad \text{where } q \text{ is the sum of } q_1 \text{ and } q_2 .$$

Total costs for firms 1 and 2 are:

$$TC_1(q_1) = c q_1 = TC_2(q_2) = c q_2$$

where the marginal cost c is a positive constant equal to 5 ($c=5$).

(1) (**8 pts**) Suppose the two firms compete only once and choose their quantities simultaneously. The reaction functions for each firm are:

$$q_1 = (180 - q_2) / 2$$

$$q_2 = (180 - q_1) / 2$$

Calculate the Cournot equilibrium (NE in quantities) for each firm, the market price and profits.

(2) (**8 pts**) Calculate the market price and the quantity that each firm will produce if the two firms cooperate (i.e. collude). Calculate the profits for each firm.

(3) (**5 pts**) Suppose Firm 2 is producing at the cooperative output level. Calculate the output level that Firm 1 will choose if it wants to maximize current period profits. Calculate the market price and the profits for Firm 1.

(4) (**9 pts**) Suppose now that the two firms compete for an infinite number of periods and use trigger strategies to choose their quantities. In addition, they discount future profits using the discount factor δ (between zero and one).

Write down the condition that needs to be satisfied for Firm 1 if the trigger strategy equilibrium is a SPNE.