You are not allowed to consult any notes or books. You have to write your answers in the blue book that the persons proctoring the exam give you. Your answers should reflect only your knowledge. Attempting to consult with others or to look at someone else's work constitutes academic misconduct.
Please return this page with your blue book.

Name:.....

Exam 1 (Total Points: 90)

(I) NE /SPNE
Suppose 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	
		U	D
Player 1	L	-2, -1	0, -3
	M	-3, 1	1, 2
	R	0, 5	0, 5

Suppose the game is played only once and that both players move simultaneously.
1) (4 pts) Does Player 1 have a dominant strategy? Justify.
2) (8 pts)What is/are the Nash equilibrium/a? Justify.

Suppose now that players move sequentially. Player 1 moves first and after his choice is observed by both players, Player 2 moves.
3) (6 pts) Draw the game tree.
4) (8 pts) What is the SPNE? Show your work.
5) (4 pts) Do you think that the SPNE will be different to the one you obtained in (4) if Player 2 is the one that moves first? Justify (a clear and precise explanation is sufficient; you do not need to draw the new game tree, etc).

(II) (14 pts)
Two firms that produce differentiated products compete by choosing quantities. Their demand functions are:

$$p_1 = 100 - q_1 + \tfrac{1}{2} q_2$$
$$p_2 = 100 - q_2 + \tfrac{1}{2} q_1,$$

where p_1 and p_2 are the prices charged by each firm, and q_1 and q_2 the resulting quantities demanded. Marginal Costs are equal to 10 ($MC_1 = MC_2 = 10$).

Suppose Firm 1 chooses its quantity first, and then Firm 2 chooses its quantity (i.e. Firm 1 is behaving as a Stackelberg leader). Calculate the Subgame Perfect Nash Equilibrium (you need to calculate quantities and prices).

Use Firm 2's reaction function that I calculated:

$$q_2 = (90 + \tfrac{1}{2} q_1) / 2$$

(III) Consider N identical firms with marginal costs equal to 30 and fixed costs equal to zero. The inverse demand is : $p = 90 - q$,
where q is total output ($q_1 + q_2 + \ldots + q_N$)
Marginal costs for any firm i are $MC_i = 30$

(1) (6 pts) What are the industry total output and price at the Nash Equilibrium when firms choose **prices** simultaneously? Justify.
(2) (6 pts) Under which circumstances will the Nash Equilibrium in **prices** calculated in (1) coincide with the Nash Equilibrium in **quantities**? Justify with a short explanation (no equations needed) .

(IV) (12 pts)
Consider the same example of question (III) but assume that there are only **two** firms with different marginal costs and fixed costs:

$p = 90 - q$

$MC_1 = 50 \quad F_1 = 0$
$MC_2 = 0 \quad F_2 = 50$

Assume the two firms compete only once and choose their prices simultaneously. What is the Nash equilibrium in **prices** (Bertrand equilibrium)? How many units is each firm producing? Justify your answers.

(V) Optimal Subsidy

Consider a homogeneous product market with two firms (firms 1 and 2) that have zero marginal and fixed costs and an inverse demand: $p = 90 - q$ (where q is the sum of the production of both firms).
Assume that firm 1 belongs to country 1, firm 2 to country 2 and that they export all their production to a third country. Country 1 maximizes social welfare and grants a subsidy of "s" dollars per unit of output to its firm (Firm 1). The subsidy level is chosen before the firms engage in Cournot competition (NE quantities). So in stage 1, country 1 chooses "s" and in stage 2 both firms choose their quantities simultaneously.

(1) (12 pts) Show that the NE in quantities in stage 2 is:

$q_1 = 1/3\ [90 + 2\ s]$, $q_2 = 1/3\ [90 - s]$

(2) (10 pts) Calculate the optimal value of "s"