**Econ 467** **M. Muniagurria**
**Summer 2008**

**Midterm 1 (Total Points: 100)**

**(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 | | |
|---|---|---|---|---|
| | | L | M | R |
| | U | 5, 4 | 0, 1 | 0, 6 |
| Player 1 | M | 4, 1 | 1, 2 | 1, 1 |
| | D | 5, 6 | 0, 3 | 4, 4 |

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) (3 pts) Define Nash Equilibrium.
(3) (6 pts) Calculate the Best Response Functions for both players. What is/are the Nash equilibrium/a?

Suppose now that players move sequentially. Player 2 moves first and after his choice is observed by both players, Player 1 moves.
(4) (4 pts) Draw the game tree.
(5) (3 pts) Define Subgame Perfect Nash Equilibrium (SPNE).
(6) (6 pts) Find the SPNE? Justify.
(7) (4 pts) Do you think that the SPNE will be different to the one you obtained in (5) if Player 1 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)**

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

$p = 80 - q$, where q is the sum of $q_1$ and $q_2$ .

Total costs for firms 1 and 2 are:

$TC_1(q_1) = c_1 q_1$ , $TC_2(q_2) = c_2 q_2$

where the marginal costs ($c_1$ and $c_2$) are constants bigger or equal to zero.

(1) (10 pts) Suppose the two firms compete only once and choose their quantities simultaneously. Calculate the NE in quantities for any $c_1$, $c_2$.

(2) (4 pts) Suppose $c_1 = c_2 = 20$ . What are the quantities, price and profits at the NE in quantities?

(3) (6 pts) Suppose now that Firm 1 has no fixed costs but Firm 2 has a fixed cost of $F_2 = 10$ . The two firms still compete only once, choose their quantities simultaneously and $c_1 = c_2 = 20$. Do you think that your answer to (2) will still be the same?
What if instead $F_2 = 425$ ?
Justify (no calculations needed).

**(III)**
Consider the same example of question (II):
$p = 80 - q$,
and $c_1 = c_2 = 20$

(1) (6 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.

(2) (6 pts) Suppose Firm 2 is producing at the cooperative output level. Use your results in question (II) (1) to calculate the output level that Firm 1 will choose if it wants to maximize profits. What are the implications of this for the collusive agreement?

**(IV)** (12 pts) Consider a market with two firms (firms 1 and 2). The (inverse) demand curve is:

$p = 80 - q$,
where q is the sum of $q_1$ and $q_2$ .

Suppose Firm 1 has a marginal cost equal to zero and Firm 2 a marginal cost equal to 45. Both firms choose prices simultaneously and they compete only once. Calculate the Nash Equilibrium in prices (i.e. Bertrand equilibrium). **Show your work.**

**(V)** Two firms that produce differentiated products compete by choosing price. Their demand functions are:

$$q_1 = 10 - p_1 + p_2$$
$$q_2 = 10 - p_2 + p_1,$$

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 zero.

(1) (11 pts) Suppose the two firms set their prices at the same time. Calculate the reaction functions. Find the resulting Nash Equilibrium in prices. Calculate the profits for each firm at the equilibrium.

(2) (12 pts) Suppose Firm 1 sets its price first, and then Firm 2 sets its price (i.e. Firm 1 is behaving as a Stackelberg leader). Calculate prices, quantities and profits for each firm at the SPNE.

(3) (3 pts) If you were a firm's manager would you rather be the leader (i.e. the firm that chooses price first) or the follower? Justify.