Sr. No. of Question Paper:

Unique Paper Code: 12277504

Name of the Paper: Topics in Microeconomics - I

Name of the Course: CBCS DSE

Semester: V

Maximum Marks: 75

Instructions for Candidates

There are *six* questions in all. Answer any *four* questions. All questions carry equal marks.

1. Consider the two stage game in which firm 1 chooses output Q_1 first. Firm 2 observes it and then decides to enter, incurring a cost E, or stay away. Firm 2's output is given by Q_2 if it enters. The firms' preferences are represented by the following profit functions.

$$\pi_1 = Q_1(1 - Q_1 - Q_2)$$
$$\pi_2 = Q_2(1 - Q_1 - Q_2) - E, \text{ if firm 2 enters.}$$

If firm 2 stays out it's profit is zero.

(a) Find the values of E which will deter the entry of firm 2 if Firm 1 chooses the monopoly level of output.

(b) Find the value of E which would make Firm 1 indifferent between choosing entry deterring output level and accommodating entry.

2. There are three bidders named Bidder 1, Bidder 2 and Bidder 3 with valuations equal to 30, 20 and 10 respectively in a second - price sealed-bid auction for a single object. Assume that valuations of bidders are common knowledge. Bids can be any non-negative real numbers and each bidder submits a sealed bid without knowing the bids submitted by the other players. The bidder who submits a bid higher than the bids submitted by the other two bidders gets the object at a price equal to the highest bid submitted by the other bidders and gets a payoff equal to her/his valuation minus the price paid. The unsuccessful bidders don't pay anything and each one of them gets a payoff of zero. Assume that if more than one player submits the highest bid , the player with the highest valuation amongst those who submitted the highest bids gets the object. Give necessary and sufficient conditions for an action profile to be a Nash equilibrium of this game. Is there any Nash equilibrium in which no player uses a weakly dominated action?

3. Consider the following version of Hotelling's model of electoral competition. There are three potential political candidates. Each one of them has to simultaneously decide whether or not to enter a political contest. If a candidate decides to contest, she/he also has to simultaneously choose a policy position, which is modeled as choosing a number in some interval $[a, b]$, without knowing what the other candidates have decided. There is a continuum of voters, each of whom has a favorite position; the distribution of favorite positions is given by cumulative probability distribution function F . Interpret $F(x)$ as the proportion of voters whose favorite policy position is less than or equal to x . Assume that F is strictly increasing and continuous. A candidate attracts the votes of citizens whose favorite positions are closer to her/his position than to the position of any other candidate. If two or more candidates take the same position, they equally split the votes that the position attracts. Each potential candidate prefers to be the sole winning candidate than to tie for first place with others, prefers to tie for first place than to stay out of the electoral race, and prefers to stay out of the race the to enter and lose. Formulate this situation as a strategic game and show that there is no Nash equilibrium in pure strategies when there are three potential candidates and F is continuous.

4. (a) Consider the Cournot oligopoly model where there are n firms that choose outputs simultaneously. The inverse demand function is given below:

$$P(Q) = 5 - Q \quad if \quad Q \leq 5$$
$$= 0 \quad if \quad Q > 5$$

where Q is the firms' total output. The cost function of each firm i is $C_i(q_i) = 2q_i$ for all $q_i(i = 1,2........n)$, and is common knowledge. Assume that each firm maximizes its profit. Solve for the pure strategy Nash equilibrium. (Consider only the case where all firms are producing a positive amount of output in the equilibrium.)

(b) The members of a hierarchical group of hungry lions face a piece of prey. If lion 1 does not eat the prey, the prey escapes and the game ends. If it eats the prey, it becomes fat and slow and lion 2 can eat it. If lion 2 does not eat lion 1, the game ends. If it eats lion 1, then it may be eaten by lion 3, and so on. Each lion prefers to eat than to be hungry but prefers to be hungry than to be eaten. Find the subgame perfect equilibrium/equilibria of the extensive game that models this situation for any number n of lions.

5. (a) Consider an industry with n firms. The n firms individually could lobby for a subsidy which will be equally divided between them. Firm i's cost of lobbying for h_i hours is ωh_i^2 where ω is a positive constant. For effort level $(h_1, h_2, \ldots.. h_n)$ of n firms the value of subsidy to the industry will be

$$\alpha \sum h_i + \beta(h_1 h_2 h_3 \ldots.. h_n) \text{ for positive constants } \alpha \text{ and } \beta.$$

Firms decide simultaneously and independently.

(i) Show that the necessary and sufficient condition for each firm to have a strictly dominant action is $\beta = 0$.
(ii) Find the Nash equilibrium for $n = 2$. (Make necessary assumptions about the parameters.)

(b) Two people use the following procedure to split Rs. 1000 : Person 1 first proposes an amount $x(0 \leq x \leq 1000)$ which he would like to keep for himself. If person 2 accepts, person 1 gets to keep Rs. x and person 2 receives Rs. 1000 - x. If person 2 rejects the allocation then person 2 gets 0 but player 1 gets what he proposed (Rs. x). Find the subgame perfect equilibrium/equilibria of this game.

6. (a) Consider the following agenda setting game. The set of possible policies is an interval $X = [0,5]$. An agenda setter (player 1) proposes an alternative $x \in X$ against the status quo $q = 4$. After player 1 proposes x, the legislator (player 2) observes the proposal and selects between the proposal x and the status quo q. Player 1's most preferred policy is 1 and for any final policy $y \in X$ his payoff is given by

$$v_1(y) = 10 - |y - 1|.$$

Player 2's most preferred policy is 3, and for any final policy $y \in X$ his payoff is given by

$$v_2(y) = 10 - |y - 3|.$$

(i) Model this as an extensive game with perfect information and draw the game tree.
(ii) Find the subgame perfect equilibrium/equilibria.

(b) Consider the following n - player game. Simultaneously and independently the players each select either X, Y or Z. The payoffs are given as follows. Each player who selects X obtains a payoff equal to γ where γ is the number of players who select Z. Each player who selects Y obtains a payoff of 2α, where α is the number of players who select X. Each player who selects Z obtains a payoff of 3β, where β is the number of players who select Y. And $\alpha + \beta + \gamma = n$.

(i) Suppose $n = 2$. Give the payoff matrix and check if the game has a pure strategy Nash equilibrium/equilibria. If so describe the equilibria.
(ii) Suppose $n = 11$. Does the game any pure strategy Nash equilibrium/equilibria? If so how many are there? Describe those?