Questions on Competitive market and Monopoly

1. In the long run equilibrium, all firms in the industry earn zero economic profit. Why is this true?

2. Suppose that a competitive firm's marginal cost of producing output q is given by $MC = 3 + 2q$. Assume that the market price of the firm's product is Rs 9.

    (a) What level of output will the firm produce?

    (b) Suppose that the average variable cost of the firm is given by $AVC(q) = 3 + q$. Suppose that the firm's fixed costs are known to be Rs 3. Will the firm be earning a positive, negative, or zero profit in the short run?

3. Suppose you are given the following information about a particular industry:
    $Q^D = 6500 - 100p$, market demand
    $Q^S = 1200p$, market supply
    $C(q) = 722 + \frac{q^2}{200}$, total cost function of a firm.
    $MC(q) = \frac{2q}{200}$, Marginal cost of a firm.
    Assume that all firms are identical and that market is characterized by perfect competition.

    (a) Find the equilibrium price, the equilibrium quantity, output supplied by a firm and the profit of each firm.

    (b) Will there be entry or exit in the industry in the long run? Explain. What effect will entry or exit have on market equilibrium?

    (c) What is the lowest price at which each firm would sell its output in the long run?

    (d) What is the lowest price at which each firm would sell its output in the short run?

4. A monopolist is producing at a point at which marginal cost exceeds marginal revenue. How should it adjust its output to increase profit?

5. A firm faces the following average revenue (demand) curve:
    $p = 120 - .02q$, where q is the output, and p is the price. The firm's cost function is given by $C(q) = 25,000 + 60q$. Assume that firm maximize profit.

    (a) What is the level of production, price and total profit?

    (b) If the government wants to levy a tax of Rs 14 per unit of this product, what will be the new level of production, price and profit?

6. Suppose the market demand function is $A - bq = p$, where $A > 0, b > 0$ q is output, p is price. The cost of production is zero. Suppose a firm can do first degree price discrimination. what is the lowest price it will charge, what will its total output be?

7. Can third degree price discrimination be effective if the different groups of consumers have different level of demand but the same price elasticities?

Answer Hints

1. Suppose firms are earning positive in the short run and there are N identical firms. This industry will attract new firms since existing firms are earning positive profit. So new firms will enter the market. Suppose for simplicity new firms are identical. It will result in rightward shift of market supply function. Given the same market demand function, the equilibrium price will fall due to rightward shift of market supply function. The profit of the firms will fall due to fall in the market price. If the profits are still positive, there will be further entry of new firms. again, the market supply curve will shift rightward. So price will fall further. The entry of new firms will continue if profits are positive.
Suppose firms are earning negative in the short run. Some of firms will exit the market. The market supply will shift leftward as some of the firms will leave the market. Given the same market demand curve, the leftward shift of supply curve will result in increase in equilibrium price. So the existing firms will either have lower loss or start earning profit or zero profit. If zero profit there will be neither entry or exit of firms in the market.

2. (a) The firms will choose the output that maximize its profit. The first order condition gives, $MC = price$. $3 + 2q = 9, q = 3$.

    (b) The optimum output is $q = 3$. The total revenue is $p.q = 27$. The total cost is $(3 + q)q + 3$. For $q = 3$, total cost is 21. The firms are earning positive profit in the short run, $27 - 21 = 6$.

3. (a) The equilibrium price is given by quantity demanded equal to quantity supplied in the market. $Q^D = Q^S$, $6500 - 100p = 1200p$, $p = 5$. The equilibrium quantity is $6500 - 100 \times 5 = 6000$, . The optimum amount supplied by a firm is $p = MC$, so $5 = \frac{2q}{200}$, $q = 500$. The profit of each firm is total revenue minus total cost, $2500 - (722 + \frac{2500}{200})$, profit is 1036.

(b) There will entry of firms in the long run. Because firms are making positive profit in the short run. The market supply will shift rightward and equilibrium price will fall and equilibrium quantity in the market increases.

(c) The optimum amount of output produced by each firm taking a price as given is $p = MC = \frac{2q}{200}$. $100p = q$., optimum amount of output produced by each firm. In the long run profit earned by firm is zero. So the lowest price in the long run is the price at which profit is zero. $pq - 722 - \frac{q^2}{200} = 0$, $100p^2 - 722 - \frac{10000p^2}{200} = 0$, $p = \frac{\sqrt{722}}{10}$.

(d) The lowest price at which firms will produce in the short run is zero in this case. The minimum average variable cost is zero.

4. A monopolist is producing at a point at which marginal cost is higher than marginal revenue. This implies that at the margin the monopolist is incurring more cost than the revenue. The monopolist should not produce at this level because for the production of an extra unit of output the cost is more than the revenue earned. The monopolist should reduce the level of output.

5. (a) The market demand is $p = 120 - 0.02q$. The total cost of the monopoly is $C(q) = 25000 + 60q$. The profit function of the monopoly is $\pi = (120 - 0.02q)q - 25000 - 60q$. $\frac{d\pi}{dq} = 120 - 0.04q - 60 = 0$ at optimum point. $q = 1500$. The monopoly price is $p = 120 - 0.02 \times 1500$, $p = 90$. The profit, $\pi = 90 \times 1500 - 25,000 - 60 \times 1500$.

(b) Government levy a tax of Rs 14 per unit on this product. The cost of production increases and it becomes $C(q) = 25000 + 60q + 14q$. The new profit maximizing output is given by $\frac{d\pi}{dq} = \frac{d((120-0.02q)q - 2500 - 60q - 14q)}{dq} = 0$. $q = 1250$. The profit maximizing price is $p = 95$. We get the profit by plugging in these two values in the profit function.

6. The lowest price the monopolist will set is zero in the first degree price discrimination, since cost of production is zero. The total output produced at zero price is $q = \frac{A}{b}$.

7. Suppose there are two groups of people. The inverse demand function of group one is $p_1 = f_1(q_1)$ and the inverse demand function of group two is $p_2 = f_2(q_2)$. The cost function is given by $c(q_1 + q_2)$. Suppose the monopoly does third degree price discrimination between these two groups. We are given that demand elasticity of group one is same as the demand elasticity of group two but the level of demands are different.

The profit maximization problem of the monopolist is:

$\pi = p_1 q_1 + p_2 q_2 - c(q_1 + q_2)$. $\pi = f_1(q_1)q_1 + f_2(q_2)q_2 - c(q_1 + q_2)$. At the optimum point, we have,

$\frac{d\pi}{dq_1} = f_1'(q_1)q_1 + f_1(q_1) - c'(q_1 + q_2) = 0$

$\frac{d\pi}{dq_2} = f_2'(q_2)q_2 + f_2(q_2) - c'(q_1 + q_2) = 0$

From the above two equations we get,

$f_1'(q_1)q_1 + f_1(q_1) = f_2'(q_2)q_2 + f_2(q_2)$.

$f_1(q_1)[1 + f_1'(q_1)\frac{q_1}{f_1(q_1)}] = f_2(q_2)[1 + f_2'(q_2)\frac{q_2}{f_2(q_2)}]$, $f_1(q_1) = p_1$, $f_2(q_2) = p_2$. So, $p_1[1 + \frac{1}{E_1}] = p_2[1 + \frac{1}{E_2}]$, where $E_1 = \frac{1}{f_1'(q_1)\frac{q_1}{f_1(q_1)}}$ elasticity of demand of group one. $E_2 = \frac{1}{f_2'(q_2)\frac{q_2}{f_2(q_2)}}$, elasticity of demand of group two. We have $E_1 = E_2$, therefore, $p_1 = P_2$.

Third degree price discrimination in not possible.