

Problem Set # 8
Econ 2106H, J. L. Turner

1. At which output level does a monopolist produce to maximize profit?
2. In a **well labeled** graph show:
 - a) A linear Demand Curve (i.e., straight line)
 - b) The corresponding Marginal Revenue Curve
 - c) A Marginal Cost Curve (you may use any curve you wish)

In the graph, show the optimal output and price, and the resulting consumer surplus if:

- d) The marginal cost curve is for a monopolist
- e) The marginal cost curve is for a single firm that behaves as though it were in perfect competition.

In problems 3 - 5 show well labeled graphs.

3. Consider the following market demand curve: $P = 24 - Q$. The cost of production is $C = Q^2 + 4$, and thus, $MC = 2Q$. Calculate output, price, consumer surplus, and profit, if:

- a) The market is supplied by a monopolist with $MR = 24 - 2Q$.
- b) The market is supplied by a single firm which acts perfectly competitive.
- c) How high is average cost for the two output levels calculated in a) and b)?

Now, suppose more firms enter the market and each individual firm i has the same cost of production $C_i = Q_i^2 + 4$, and thus, $MC_i = 2Q_i$.

- d) If there are 6 of these firms, then the market output is given by:
$$Q = Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_6$$
Calculate:
 - (i) Each firm's output
 - (ii) The market output
 - (iii) The equilibrium price
 - (iv) Consumer surplus
 - (v) Each firm's profit
 - (vi) Total profits in the market (assume perfect competition)
- e) Is average cost above, below or equal to the equilibrium price?
- f) Will firms continue to enter the market?
- g) Repeat parts d) through f) if there are a total of 10 firms in the market.

4. Using your calculations from problem 3, show what happens to consumer surplus, individual firms' profits and total societal welfare (consumer surplus + total of profits), as the market changes from monopoly to perfect competition.

5. Suppose the market demand curve is $P = 20 - Q$, and each firm in this industry has the same total cost function $C = 2 + 2Q^2$, and therefore $MC = 4Q$. Suppose the industry is perfectly competitive.

- a) What is Average Cost for each firm in this industry?
- b) What is the long run equilibrium price in this industry?
- c) What are economic profits at this price?
- d) How many firms will be in this industry in the long run?
- e) Suppose there are 20 firms in this industry. What are profits of each firm in the short run?
- f) Suppose there are 10 firms in this industry. What are profits of each firm in the short run?

6. The *Mall Street Journal* is considering offering a new service which will send news articles to consumers by email. Their market research indicates that there are two types of potential users, impecunious undergraduates studying microeconomics and high-level executives. Let x be the number of articles that a user requests per year. The executives have an inverse demand function of

$$P_E(x) = 100 - x ,$$

while the undergraduates have inverse demand function

$$P_U(x) = 80 - x ,$$

where prices are measured in cents. The Journal has a zero marginal cost of sending articles via email.

- a. Draw these demand functions in a diagram.
- b. Suppose that the Journal can identify which of the users are undergraduates and which are executives. It offers each type an all-or-nothing deal. A student can either buy access to 80 articles per year or to none at all. What is the maximum price a student will be willing to pay for access to 80 articles? An executive can either buy access to 100 articles per year or to none at all. What is the maximum price an executive would be willing to pay for access to 100 articles? (Hint: think of willingness to pay as the area under the demand curve, conditional on quantity)
- c. Suppose now that the Journal cannot identify which users are executives and which are undergraduates. Thus it can't be sure that executives wouldn't buy the student package if they found it to be a better deal for them. In this case, it simply offers two packages, and lets the users self-select the one that is optimal for them. Suppose that it offers two packages: one that allows up to 80 articles per year, and one that allows up to 100 articles per year. What's the total value to executives of reading 80 articles per year?
- d. What is the maximum price the Journal can charge to executives for the 100-article package if it wants executives to prefer it to the 80-article package at the highest price the undergraduates are willing to pay for 80 articles?
- e. Suppose the Journal decides to offer only 60 articles in the student package. What is the most a student would pay for this? How much net consumer surplus would executives get for buying the student package? What is the most the Journal could charge for the executive package such that executives would be willing to buy it?
- f. If there are equal numbers of executives and students, does the Journal earn higher profits selling an 80-article student package, or a 60-article student package?

7. The diagram below depicts a market demand curve and the cost structure of a single firm -- a natural monopoly.

- What distinguishes a natural monopoly from other firms?
- For a given level of output, explain why society is better off with 1 firm producing this output compared to two firms each producing half of the total output.
- Given the marginal revenue function, identify quantity and price if the firm is left unregulated. Show consumer surplus and profit for this case.
- Suppose a regulator suggests that the firm produce the perfectly competitive output given by the rule marginal cost equals price. Identify this price/output combination in the diagram. Depict any profit or loss the firm incurs at this price/output combination.
- As an alternative point of regulation find the price/output combination on the demand curve where profit is exactly equal to zero.

