

Massachusetts Institute of Technology

Department of Economics

14.01 Principles of Microeconomics

Exam 2

Last Name (Please print): \_\_\_\_\_

First Name: \_\_\_\_\_

**Instructions. Please read carefully.**

The exam has a total of 100 points. Answers should be as concise as possible. This is a closed book exam. You are not allowed to use notes, equation sheets, books or any other aids. You are not allowed to use calculators. You must write your answers in the space provided between questions. Fractional answers are permissible in any part of this exam. DO NOT attach additional sheets of paper. This exam has 18 pages (13 pages + 5 blank pages for scratch work)

DO NOT WRITE IN THE AREA BELOW:

Question 1    \_\_/16

Question 2    \_\_/22

Question 3    \_\_/27

Question 4    \_\_/35

Total    \_\_/100

**1. True/False/Uncertain Questions (16 points)**

In this section, write whether each statement is True, False or Uncertain. You should fully explain your answer, including diagrams where appropriate. Points will be given based on your explanation.

- (a) (4 points) Two firms are producing similar goods, but one enjoys economies of scale and one has diseconomies of scale. Claim: both firms can have an identical long-run linear expansion path.

- (b) (4 points) A firm is currently earning negative profit on each good it produces. Claim: it is always optimal for this firm to shut down in the short run.

(c) (4 points) The market for drug production is characterized by both lengthy periods of patent protection and the need for FDA permission to market products. Claim: this market will be characterized by production at the minimum level of average cost in the long run.

(d) (4 points) Cooperative behavior between two oligopolists is impossible if they know that they will be competing for a limited number of years.

**2. Costs and profit maximization** (22 points)

A profit-maximizing, price-taking firm produces output  $Y$  using a single input  $X$ . The firm can produce 0, 8, 9, or 15 units of  $Y$  by using 0, 4, 7, or 9 units of  $X$ , respectively. There are no other possible input-output combinations. The firm's production function is therefore given by:

$$Y = f(X) = \begin{cases} 0 & \text{if } X = 0 \\ 8 & \text{if } X = 4 \\ 9 & \text{if } X = 7 \\ 16 & \text{if } X = 12 \end{cases}$$

The price of input  $X$  is 1 dollar per unit.

(a) (4 points) Write the firm's total cost as a function of output.

(b) (6 points) Find the firm's supply function  $y(p)$ . Explain your answer.

- (c) (5 points) Suppose that there are 5 such price-taking firms in the market, and that there is no entry. Market demand is given by  $Q_D = 100 - 10p$ . What is the equilibrium price and quantity in this market?

- (d) (7 points) Suppose now that instead of the 5 firms in part (c) there is actually a single monopolist that is five times as large as one of these individual firms. The monopolist's production function is therefore:

$$Y_M = 5 \cdot f(X_M) = \begin{cases} 0 & \text{if } X_M = 0 \\ 40 & \text{if } X_M = 20 \\ 45 & \text{if } X_M = 35 \\ 80 & \text{if } X_M = 60 \end{cases}$$

Demand is given by  $Q_D = 100 - 10p$  as before. Assume now that entry is once again impossible. What is the equilibrium price and quantity in this market? Compare this outcome with the equilibrium in (c) and explain why they are the same / differ.

**3. Monopoly and oligopoly** (27 points)

A uniform pricing monopolist has the following cost function and faces the following demand curve for its product:

$$\begin{aligned}C(Q) &= 20Q \\ P &= 100 - Q\end{aligned}$$

- (a) (3 points) Find the monopolist quantity ( $Q_m$ ), price ( $P_m$ ), and deadweight loss relative to the perfectly competitive outcome. Draw a diagram labeling the perfectly competitive outcome as A, and the monopolist outcome as B. Be sure to include the marginal cost and marginal revenue curves in your diagram.

- (b) (6 points) There are two possible scenarios for the monopolist:
- i. The government set a price ceiling of \$40/unit in which case the monopolist does not invest in any R & D because it is wary of future government regulation.
  - ii. There is no government regulation, so then the monopolist invests in R & D which then changes the cost function so that  $MC = 0$ .

Which scenario has higher welfare (ignore the cost of R & D for producer surplus)? Which scenario do the consumers prefer? Explain.

- (c) (6 points) For plan (i), the MR curve features a discontinuity at some  $Q'$ . Explain intuitively why the MR curve has this discontinuity.

(d) (6 points) In scenario (ii), when  $MC = 0$ , the monopolist chooses  $(Q_m, P_m)$  such that  $|\epsilon^D| = 1$ . Will an unregulated uniform pricing monopolist ever choose  $(Q_m, P_m)$  such that  $|\epsilon^D| < 1$ ? Explain intuitively.

(e) (6 points) Go back to your solution in (a). Suppose now the government allows one other identical firm to enter this market and firms compete on quantity. Let  $x$  equal the value of the MR at the monopolist output when there's only one firm. Claim: If the two firms each produce half the monopoly quantity, then  $MR = x$  for both firms at current levels of output. Is this claim true, false, or uncertain? Please explain your reasoning.



**4. Trade in sweat-trapping headbands (35 points)**

The U.S. demand for sweat-trapping headbands is summarized by the function  $q_d = 1200 - p$ , where  $p$  is the market price of a headband. There are currently 49 identical, profit-maximizing domestic headband producers in the U.S., each with the cost function  $TC(q) = 72 + 0.5q^2$ . U.S. consumers consider domestically produced headbands to be identical to foreign-produced headbands, and currently have access to a huge supply of foreign-made handbands at a constant price of \$10 per band (that is, we can think of the worldwide supply of sweat-trapping headbands as a horizontal curve at  $p = 10$ ).

- (a) (5 points) Write down an expression for the supply curve for an individual domestic headband producer. If there is perfectly free international trade in sweat-trapping headbands, what will be the market price of a headband in the U.S.? How many headbands will be purchased in the U.S.? How many of those will be imported from abroad?

(b) (5 points) What will be the profits of each domestic headband producer? What will be the total profits earned by firms in the U.S. domestic headband industry? Assume, for now, that the number of domestic producers remains fixed at 49. Illustrate your answer with two diagrams: one showing the profit-maximization decision of an individual domestic firm, the other showing the entire U.S. headband industry.

(c) (2 points) What do you predict would happen to the U.S. domestic headband industry in the long run?

(d) (3 points) Suppose the U.S. government passes a dramatic new trade bill, the Sweat-Trapping Headbands Industry Protection Act of 2009, outlawing all imports of foreign-made head-bands. If the number of domestic headband producers remains fixed at 49, what will be the new market price of a headband? How many headbands will be purchased in the U.S.?

(e) (6 points) What will be the profits of each domestic producer after the new law is passed? What is the total increase in profits in the domestic headband industry as a result of this new trade law? Depict graphically the change in consumer surplus for headband buyers in the United States as a result of this policy as compared to your answers in (a). Under which scenario will consumer surplus be larger?

(f) (6 points) Assuming that the law described in (d) remains in force, but that there is free entry and exit in the domestic headband industry over time, what do you predict will be the long-run market equilibrium price? How many sweat-trapping headbands will be sold in the U.S.? How many headband-producing firms will there be in the U.S. in the long run?

(g) (8 points) Suppose that instead of the bill described in (d), the U.S. government decides to pass a less extreme law, assessing a  $t\%$  tax on all imports of foreign headbands. How large must  $t$  be (5%? 10%? etc.) in order to ensure that the 49 existing domestic producers can remain in business in the long run?

END OF EXAM

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