Intermediate Microeconomic Theory
ECN 100B (Section B), Fall 2019

Professor Brendan Price

Midterm Exam #1

Name: _____

ID number: _____

- Write your answers on the exam itself, using only the space provided for each question.
  - If you run out of space for a given question, write "see extra space" in the space provided for that question, then finish your answer on the extra graded pages. Make sure to write the problem number. You may lose credit if we can't tell which question you're answering.
  - We've also included ungraded scrap pages for pure scrap work. Answers written on these ungraded pages will not be graded under any circumstances.
- You must show your work on every question that requires a calculation. We will award partial credit as appropriate. Correct results without adequate work will receive little or no credit.
- Simplify all mathematical expressions as much as possible.
- The exam is graded out of 50 points. Each question is worth the indicated number of points.
- You will have 80 minutes. You must drop your pen/pencil immediately when time is up.
- As a reminder: UC Davis has a strict code of Academic Conduct. Any violations, including copying or attempting to copy from another student, will result in a score of 0.
- Good luck!

Do not turn this page until I tell you to start.

1. **True or false (10 points total)**

   Indicate whether each of the following statements is true or false. Provide a brief explanation (1–3 sentences) justifying your answer.

   a. (2 pts.) A firm will always stay in the market if its revenues exceed its variable costs.

   b. (2 pts.) A uniform-pricing monopolist will never choose a price at which demand is relatively inelastic ($-1 < \varepsilon < 0$).

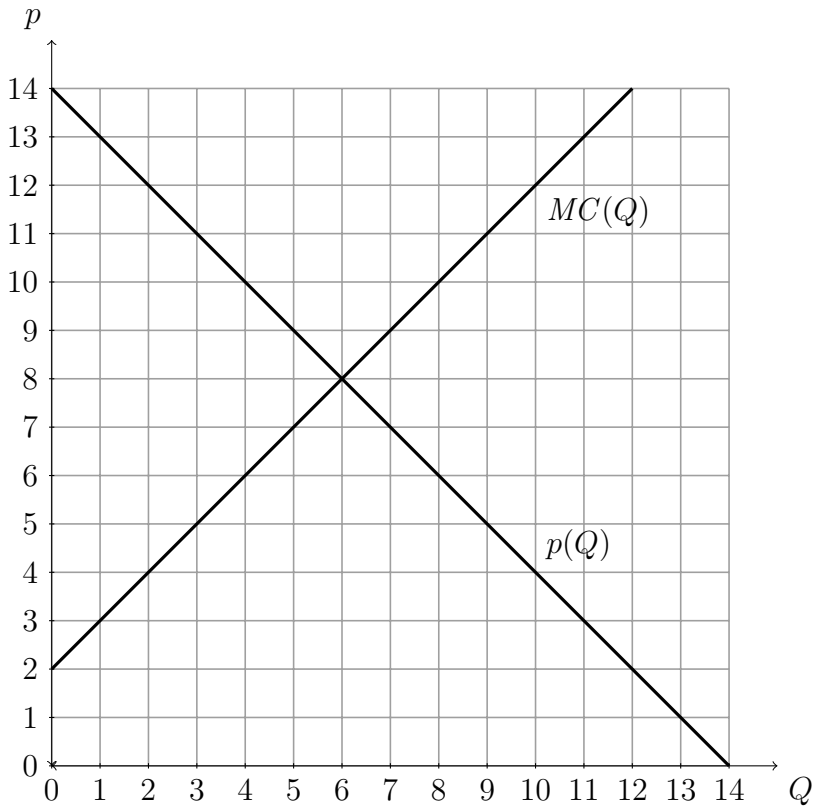
   c. (2 pts.) Lenovo produces laptops using a combination of labor (L) and capital (K). If wages go up ($w \uparrow$), Lenovo might increase its demand for capital ($K^* \uparrow$).

   d. (2 pts.) Under group price discrimination, consumer surplus is sometimes positive.

   e. (2 pts.) Imposing a price cap on a monopolist can sometimes increase its profits.

2. **Graphical questions (10 points total)**

Fill in the blanks using the graph below. (You do not need to show your work here.)



a. Suppose that the market shown above is perfectly competitive.

   i. (2 pts.) The equilibrium quantity is _____. The consumer surplus is _____.

   ii. (1 pt.) If producers have to pay an \$8 tax for each unit sold, total tax revenue is _____.

b. Now suppose that the market shown above represents a uniform-pricing monopoly.

   i. (2 pts.) The monopoly price is _____. The monopoly profit is _____.

   ii. (1 pt.) At the monopoly's optimal price, the markup equals _____.

   iii. (1 pt.) We can get the monopoly to produce the competitive quantity by setting a price $\underbrace{\text{\_\_\_\_\_}}_{\text{(floor or ceiling)}}$ equal to _____.

   iv. (1 pt.) Marginal revenue equals zero at the point where $Q =$ _____ units.

c. Now suppose that the market shown above represents perfect price discrimination.

   i. (1 pt.) The consumer surplus equals _____ and the deadweight loss equals _____.

   ii. (1 pt.) The total variable cost equals _____.

3. **Staying afloat (10 points total)**

Jing faces demand for haircuts given by $p(Q) = 24 - 2Q$. Her variable costs are $VC(Q) = 8Q$. She has already paid a fixed cost $FC = 80$ to enter the market.

a. (3 pts.) Compute the elasticity of demand as a function of Q. For what value of Q are consumers most price-sensitive? For what value of Q is demand unit elastic?

b. (5 pts.) Suppose that Jing is a uniform-pricing monopolist.

i. Write Jing's profits as a function of Q. (Include the fixed cost.)

ii. Assuming she stays in business, how many haircuts will she sell (Q_m)? How does your answer to this question depend on the value of FC?

iii. If her fixed cost is (100%) sunk, will she stay in business or exit?

iv. If her fixed cost is (100%) recoverable, will she stay in business or exit?

c. (2 pts.) Now suppose Jing knows her clients so well that she can perfectly price discriminate.

i. Assuming she stays in business, how many haircuts will she sell (Q^*)?

ii. If she can recover 50% of her fixed costs, will she stay in business or exit?

4. **In it to win it (10 points total)**

Jie runs a small coaching company that offers tennis lessons in both Davis and Sacramento.

In Davis, she faces downward-sloping demand for tennis lessons given by $p_D(Q_D) = 60 - Q_D$. In Sacramento, she faces perfectly elastic demand given by $p_S = 48$.

She can provide Q_D lessons in Davis and Q_S lessons in Sacramento, in whatever combination she wants, at a total cost $C(Q_D, Q_S) = 2(Q_D + Q_S)^2$.

a. (3 pts.) Write profits as a function of Q_D and Q_S. What is $MR_D(Q_D)$? What is $MR_S(Q_S)$?

b. (3 pts.) Find Q_D^*, Q_S^*, and p_D^*.

c. (2 pts.) Jie chooses $Q_D^* = 0$ if $p_S \geq x$, and she chooses $Q_D^* > 0$ if $p_S < x$. Find x.

d. (2 pts.) Now suppose Jie has to charge Davis and Sacramento customers the same price p. Will she charge $p = 48$ in both markets, or will she charge $p > 48$ and only sell in Davis?

5. **Cost-minimization (4 points total)**

In each of the following cases, find the cheapest combination of labor and capital needed to produce 1 unit of output. (L and K don't have to be integers: for example, L^* could equal $\frac{3}{2}$.) Also state whether labor and capital are perfect substitutes, perfect complements, or neither.

a. (2 pts.) $q(L, K) = 5L + 6K$, with $w = 10$, $r = 13$

b. (2 pts.) $q(L, K) = \sqrt{LK}$, with $w = 2$, $r = 8$

6. **Wheelers and dealers (6 points total)**

A bike shop hires workers to "produce" bicycle repairs, with output given by the production function $q(L) = 6\sqrt{L + 4}$. It's both a price-taker ($p = 20$) and a wage-taker ($w = 15$).

a. (3 pts.) Compute the marginal physical product of labor in terms of L. Then compute the marginal revenue product of labor. What is the bike shop's marginal revenue?

b. (3 pts.) Write the shop's profits as a function of L. Then find the profit-maximizing choice of labor L^*. How many bike repairs are made (q^*), and what is the total revenue?

EXTRA GRADED PAGE #1: DO NOT TEAR OFF

If you need to use this extra space:

- On the exam itself, write "see extra space" next to the relevant question(s).
- On this page, clearly indicate which question(s) you are answering.

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