

ECON 203.01/02 - Problem Set 5

Spring 2024

1. Suppose you know the following about an industry that is a monopoly. Market demand is $P = 200 - 0.5Q$. Marginal cost is 40 and there are no fixed costs.

- (a) What is the marginal revenue curve for this monopoly?
- (b) Find the profit maximizing quantity and price for this monopolist if it charges a single price for the good.
- (c) What do profits equal for this single price monopolist?

2. A monopoly faces market demand $Q = 30 - P$ and has a cost function $C(Q) = \frac{1}{2}Q^2$.

- (a) Find the profit maximizing price and quantity and the resulting profit to the monopoly.
- (b) What is the socially optimal price? Calculate the deadweight loss due to the monopolist behavior of this firm. Calculate consumer surplus and producer surplus.
- (c) Assume that the government put a price ceiling on the monopolist in order to maximize the total (i.e. consumer plus producer) surplus. What price ceiling should it choose? How much output will the monopolist produce at this price ceiling? What will the profit of the monopolist be?

3. A monopolist firm faces a demand with constant elasticity of -2 . It has a constant marginal cost of \$20 per unit and sets a price to maximize profit. If marginal cost should increase by 25%, would the price charged also rise by 25%?

4. Suppose a profit-maximizing monopolist is producing 800 units of output and is charging a price of \$40 per unit.

- (a) If the elasticity of demand for the product is -2 , find the marginal cost of the last unit produced.
- (b) What is the firm's percentage markup of price over marginal cost?
- (c) Suppose that the average cost of the last unit produced is \$15 and the firm's fixed cost is \$2000. Find the firm's profit.

5. Ash's Watches (AW) is a monopolist in the watch industry. Its cost is $C = 100 - 5Q + Q^2$, and demand is $P = 55 - 2Q$

- (a) What price should AW set to maximize profit? What output does the firm produce? How much profit and consumer surplus does AW generate?
- (b) What would output be if AW acted like a perfect competitor and set $MC = P$? What profit and consumer surplus would then be generated?
- (c) What is the deadweight loss from monopoly power in part (a)?
- (d) Suppose the government, concerned about the high price of watches, sets a maximum price at \$27. How does this affect price, quantity, consumer surplus, and AW's profit? What is the resulting deadweight loss?
- (e) Now suppose the government sets the maximum price at \$23. How does this decision affect price, quantity, consumer surplus, AW's profit, and deadweight loss?
- (f) Finally, consider a maximum price of \$12. What will this do to quantity, consumer surplus, profit, and deadweight loss?

6. A monopolist faces the following demand curve: $Q = 144/P^2$, where Q is the quantity demanded and P is price. Its average variable cost is $AVC = Q^{\frac{1}{2}}$; and its fixed cost is 5.

- (a) What are its profit-maximizing price and quantity? What is the resulting profit?
- (b) Suppose the government regulates the price to be no greater than \$4 per unit. How much will the monopolist produce? What will its profit be?
- (c) Suppose the government wants to set a ceiling price that induces the monopolist to produce the largest possible output. What price will accomplish this goal?

7. A monopolist sells in two markets. The inverse demand curve in market 1 is

$$p_1 = 200 - q_1$$

while the inverse demand curve in market 2 is

$$p_2 = 300 - q_2$$

The firm's total cost function is

$$c(q_1 + q_2) = (q_1 + q_2)^2$$

The firm is able to price discriminate between the two markets.

- (a) What quantities will the monopolist sell in the two markets?
- (b) What price will it charge in each market?

8. Suppose you know the following about an industry that is a monopoly. Market demand is $P = 200 - 0.5Q$. Marginal cost is \$40 and there are no fixed costs. Suppose that this monopoly can perfectly price discriminate (1st degree price discrimination).

- (a) What is the profit maximizing level of output for this monopolist if they practice first degree price discrimination?
- (b) When this firm practices first degree price discrimination, what is the value of its profits?
- (c) Suppose now that the monopolist cannot perfectly price discriminate, and instead decides to be a second degree price discriminator. If the monopolist can set two different prices, what will the prices to be set?

9. Consider a monopolist local movie theater which has two distinct client groups, adults and seniors. The inverse demands for the two group are given by:

$$p(q_A) = a - b \cdot q_A$$

$$p(q_B) = \frac{a}{3} - \frac{b}{3} \cdot q_B$$

- (a) Describe the demand function in the two markets graphically and then compute the demand elasticity in each market.
- (b) Compute the demand function q_P under the assumption that the movie theater can only offer a single price to both segments of the market. (Hint: at a given price add the demand of the adults and senior market. You need to go from the inverse demand function to the demand function.) Illustrate the aggregate demand function in contrast to the demand functions in each segment. Now compute the optimal price of the movie theater when it can only offer a single and common price to the market segments. Who goes to the movies and who does not?
- (c) Next allow the movie theater to offer different prices in each segment and customers cannot misrepresent their identity. What is the optimal price in each one of the markets?

10. You own a bar. For any given night you will have fixed cost of \$1000 plus a variable cost of \$0.50 per drink (drinks are the only thing you sell at the bar). You look to the market and find a set of party animals. There are 500 of these customers in a given night. They each have the same demand curve for drinks:

$$Q_{PA} = 10 - 2P$$

- (a) How you should price the drinks?
- (b) You did well with this strategy but there is some consumer surplus that is slipping through your hands. So you decide to add a cover charge at the door while setting a new price for each drink. What is the optimal price for the cover charge and the drinks? What does the profit equal?

- (c) You decide that you could do better! You notice that there are also some Latin folks who like to dance. They are currently not coming because the cover charge is too high. You want to get this customer to come to your bar also. There are 500 dancers each with the exact same demand curve for drinks:

$$Q^D = 5 - P$$

(Remember that there are still 500 Party Animals) You want to maximize profit and thus you must decide what the cover charge and price per drink should be.

- 11.** You own a tennis club in an isolated wealthy community, you must decide on membership dues and fees for court time. There are two types of tennis players. "Serious" players have demand

$$Q_1 = 10 - P$$

where Q_1 is court hours per week and P is the fee per hour for each individual player. There are also "occasional" players with demand

$$Q_2 = 4 - 0.25P$$

Assume that there are 1000 players of each type. Because you have plenty of courts, the marginal cost of court time is zero. You have fixed costs of \$10,000 per week. Serious and occasional players look alike, so you must charge them the same prices.

- (a) Suppose that to maintain a "professional" atmosphere, you want to limit membership to serious players. How should you set the annual membership dues and court fees (assume 52 weeks per year) to maximize profits, keeping in mind the constraint that only serious players choose to join? What would profits be (per week)?
- (b) A friend tells you that you could make greater profits by encouraging both types of players to join. Is your friend right? What annual dues and court fees would maximize weekly profits? What would these profits be?
- (c) Suppose that over the years young, upwardly mobile professionals move to your community, all of whom are serious players. You believe there are now 3000 serious players and 1000 occasional players. Would it still be profitable to cater to the occasional player? What would be the profit-maximizing annual dues and court fees? What would profits be per week?