Eco 171 - Industrial Organization
First Midterm Exam

Name:

Section:

Instructions

There are 5 short questions and 2 problems, each worth 1/3 of the total points. Answer in the space provided (no need to use it all.) If necessary use the back of the page. For the short questions, don't forget to explain your answer.DONT FORGET TO WRITE DOWN YOUR NAME.

Part I. Short questions

1. A monopolist faces two markets. Market A has lower elasticity of demand than market B. Marginal cost is zero. Thre is no possibility of arbitrage. Which of the following is true about third degree price discrimination? Explain.

   (a) Output will be higher in the market with higher elasticity.

   (b) Price will be lower in the market with higher elasticity.

   (c) Sometimes, the monopolist may be better off setting the same price in both markets.

   (d) The monopolist may choose not to serve one of the markets.

(a) Is not true. In all examples given in class the more elastic group is the one with lower demand — price is lower (so demand is more elastic) but quantity is also lower

(b) is true : $MR_i = P_i \left(1 - \frac{1}{\varepsilon_i}\right) = c$. The market i with higher elasticity must have lower price.

(c) Cannot be true: as seen in (b) if elasticities are different, prices must be different

(d) Given the assumption that $c <$ highest willingness to pay in both markets, they will be served.

2. There are two groups of firms in a competitive market. Each firm in the first group has constant marginal cost $10 up to 10 units and constant marginal cost $30 from 10 to 20 units. Each firm in the second group has constant marginal cost $20 and can produce up to a capacity of 20 units. In addition to this marginal cost, all firms -in both groups- have the same fixed cost F. Which of the following is true? Explain.

(a) In the long run equilibrium, the first group will not enter the industry.

either

(b) In the long run equilibrium, the second group will not enter the industry.

or
(not both)

(c) In the long run equilibrium price will be greater than $20.

(d) In the short urn equilibrium price can never be lower than $10+F/10$.

As seen in the following page, there are 2 possible cases : ① $F < 200$ and min average cost < 20 occurring at $q=10$ ② $F>200$ and min avg. cost $= 20 + \frac{F}{20}$ occurring at $q=20$. In case ① in the long run equil there will only be firms of group 1 but $p<20$, making ⓑ correct. In case ② $p>20$ and both groups enter so ⓒ is correct. For both cases the lowest mg. cost $=10$ so short run equilibrium price could go down to 10, so (d) is FALSE.

3. Which of the following is true? *Explain.* In a competitive market, price in the long run will be equal to:

or

(a) Average cost of the most efficient firm that is active (i.e. has entered and produces)

(b) Average cost of the least efficient firm that is active.

(c) Somewhere in between.

If both types of firms are active, $p \ge$ AC of the least efficient group, so (a) would be correct. If only the more efficient group enters then $p \ge$ AC of that group and $\le$ AC of the least efficient one. In this case either (b) or (c) could be true

I will derive the average cost function for a firm in the first group.

$mc = 10$ for $0 \leq q \leq 10$

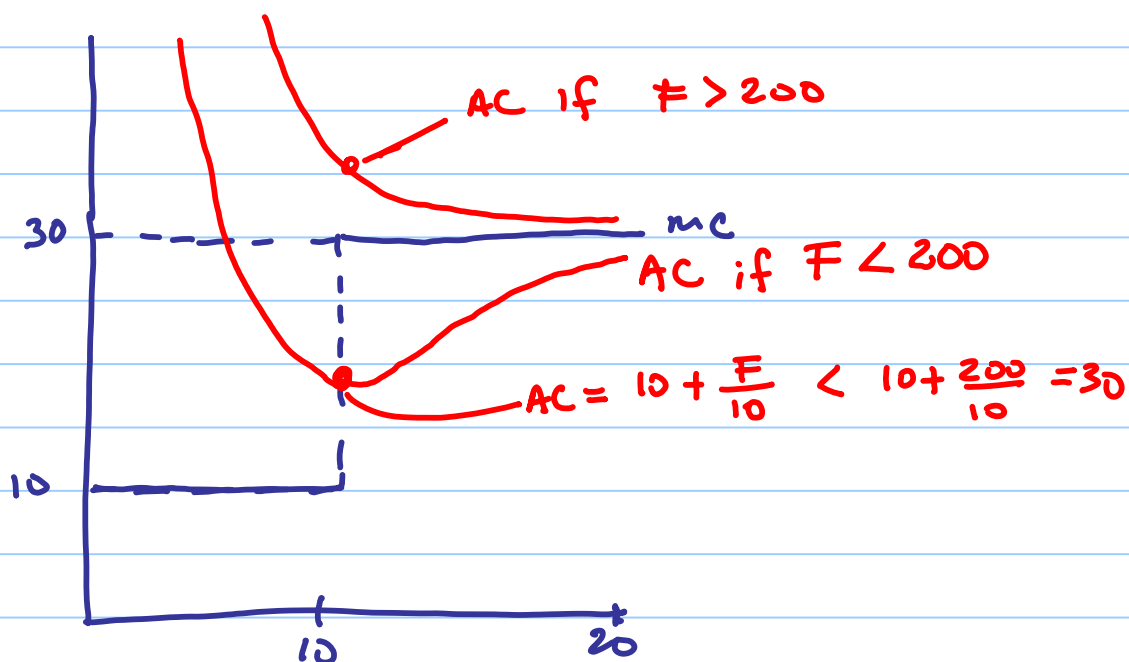$mc = 30$ for $10 < q \leq 20$

Fixed cost F

$$TC = \begin{cases} 10q + F & \text{for } 0 \leq q \leq 10 \\ 100 + (q-10)30 + F & \text{for } 10 \leq q \leq 20 \end{cases}$$

$$AC = \begin{cases} 10 + \dfrac{F}{q} & \text{for } 0 \leq q \leq 10 \\ 30 - \dfrac{200}{q} + \dfrac{F}{q} & \text{for } 10 \leq q \leq 20 \end{cases}$$

<u>Remark</u> (i) AC decreases for $0 \leq q \leq 10$

(ii) For $10 \leq q \leq 20$ AC decreases if $F > 200$ but it increases if $F < 200$.

<u>Graphically</u>

AC if $F > 200$

mc

AC if $F < 200$

$AC = 10 + \dfrac{F}{10} < 10 + \dfrac{200}{10} = 30$

4. A monopolist can sell in two markets (one with a higher demand function than the other) and is able to price discriminate fully in each of them (first degree price discrimination.) Which of the following statements is true? *Explain.*

   (a) Only consumers in the high demand market will have positive surplus.

   (b) The low demand market may not be served.

or (c) Quantity in the low demand market will be such that demand price for the last unit equals marginal cost.

   (d) It is possible that the monopolist chooses not to discriminate between the two markets.

(a) is false. With first degree Price disc. (fdpd) all CS is extracted from all consumers.

(b) If $mc > P_L(0)$ this group will not be served. So it may happen.

(c) True in both markets

(d) False. As demands are different and captures all CS, it will set different prices.

5. There are two types of consumers, H and L and a number N_H and N_L of each. Both consumers are willing to pay \$5 for the first unit of consumption but differ in how much they value the second unit (consumers in the H group value it more.) Marginal cost is zero. The monopolist is doing second degree price discrimination (nonlinear prices). Which of the following is/are true? *Explain.*

   (a) The monopolist will sell at least one unit in each market.

   (b) If N_H/N_L is large, the low types will be excluded.

   (c) If N_L/N_H is high, the high types will be excluded.

(a) is true. By selling the first unit at \$5 to the L group, no surplus is given to the other group. So the net gain is $N_L \cdot 5$.
(b) is false, since it contradicts (a)
(c) is false : H types are never excluded.

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Part II. Problems.

1. A monopolist sells to consumers in two different markets. The demand functions in these markets are given by:

$$p_1 = 12 - q_1$$
$$p_2 = 8 - q_2$$

(a) Suppose marginal cost is zero.

   i. If the monopolist cannot discriminate prices between the two markets, what price will it charge? Will both markets be served?

Add demand functions:
$$q_1 = 12 - P$$
$$q_2 = 8 - P$$
$$\Rightarrow Q = 20 - 2p$$

So $p = 10 - \dfrac{Q}{2}$

$MR = 10 - Q = MC = 0 \Rightarrow Q = 10, \ P = 5$

$\pi = 50$

Alternative: exclude group 2. Then optimal price $= 6$, $q_1 = 6$ and $\pi = 36 < 50$

$\Rightarrow$ Include both groups

   ii. Suppose it can discriminate prices between the two markets. What prices will it charge?

$MR_1 = 12 - 2q_1 = 0 \rightarrow q_1 = 6, \ P_1 = 6$

$MR_2 = 8 - 2q_2 = 0 \rightarrow q_2 = 4, \ P_2 = 4$

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iii. Answer the following question without making any calculations:
Has welfare -measured by total surplus- increased with price discrimination? Explain.

Total welfare decreases since total quantity does not increase.

(b) Answer the previous three questions assuming marginal cost $c = 6$.

(i) If both served: $MR = 10 - Q = 6$
$$\rightarrow Q = 4 \qquad p = 8$$
But then $q_2 = 0$ ➜ group 2 excluded.
Then π all max by setting $MR_1 = MC = 6$
$$12 - 2q_1 = 6 \qquad \rightarrow q_1 = 3, \quad p = 9.$$

(ii)   Market 1 $P_1 = 9 \qquad q_1 = 6$
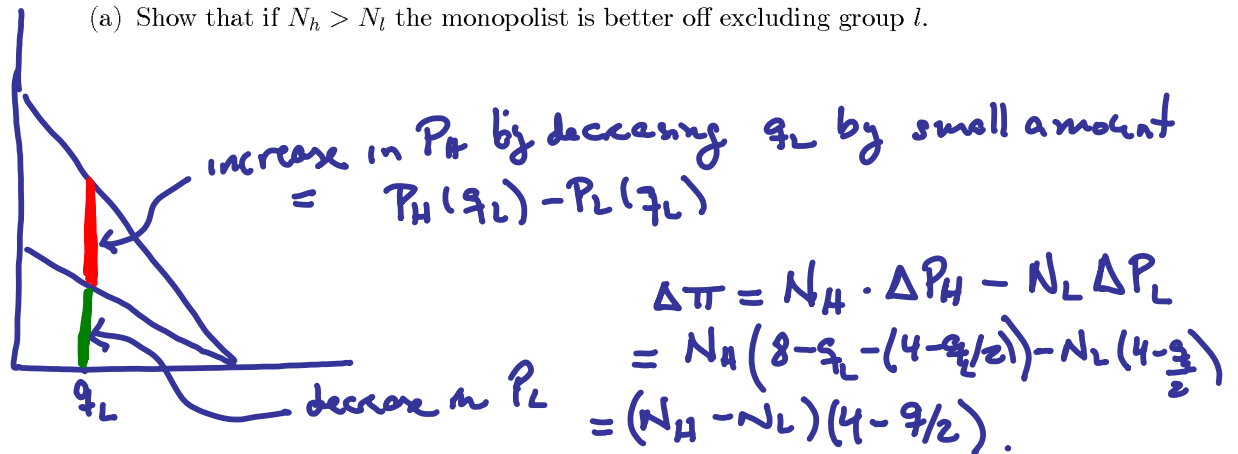Market 2 $8 - 2q_2 = 6, \quad q_2 = 1, \quad P_2 = 7$

(iii)   Consumer welfare goes up: No change in market 1 and surplus created in market 2 (or, as seen in class, when there are 2 markets and the 2 market is not served under uniform pricing but is served with price discrimination, welfare must increase)

2. A monopolist faces two types of consumers, with the following demand functions:

$$p_h = 8 - q$$
$$p_l = 4 - q/2$$

Suppose there are N_h and N_l consumers of each group, respectively. Suppose marginal cost is zero. The monopolist is deciding the best second-degree price discrimination (nonlinear pricing) scheme.

(a) Show that if $N_h > N_l$ the monopolist is better off excluding group l.

increase in P_H by decreasing q_L by small amount
$$= P_H(q_L) - P_L(q_L)$$

decrease in P_L

$$\Delta \pi = N_H \cdot \Delta P_H - N_L \Delta P_L$$
$$= N_H \left(8 - q_L - (4 - q_L/2)\right) - N_L(4 - \tfrac{q}{2})$$
$$= (N_H - N_L)(4 - q/2).$$

(b) Show that if $N_l > N_h$ the monopolist is better off not discriminating and offering only one package.

(a) If $N_H > N_L$ profits increase by decreasing q_L. So optimal $q_L = 0$

(b) If $N_L > N_H$ the opposite occurs. So optimal $q_L = q_H = 8$.

(c) Now suppose marginal cost $c = 2$ and $N_l = 3N_h$.

   i. Derive the optimal nonlinear pricing scheme.

Use formula $\quad N_h \left(4 - \frac{q_L}{2}\right) = N_L \left(4 - \frac{q_L}{2} - 2\right)$

$\Rightarrow \left(4 - \frac{q_L}{2}\right) = \frac{N_L}{N_h}\left(2 - \frac{q_L}{2}\right) = 3\left(2 - \frac{q_L}{2}\right)$

$4 - \frac{q_L}{2} = 6 - \frac{3}{2} q_L \qquad \Rightarrow q_L = 2, \quad q_h = 6$

$P_L = 7, \quad P_h = 23 \quad (\text{see below})$

   ii. Explain graphically how the prices for the two groups are determined.

$U_{HL} = \frac{8+6}{2} \times 2 - P_L = 14 - P_L$

$\boxed{P_L = \frac{4+3}{2} \times 2 = 7} \Rightarrow U_{HL} = 7$

$q_H = 6, \quad CS_h = \frac{8+2}{2} \times 6 - P_H = 7$

$\rightarrow 30 - P_H = 7$

$P_h = 23$

8, 6, 4, 3, 2 (axis), 2, $6 = q_h$