ECN 453: Mid-term Exam 1

Instructions:

- You have **60 minutes**

- Please write your final answer in the underlined section provided.

- You may bring a calculator and notes on a two-sided cheat-sheet on letter-size paper.

- Please be neat. If your work is too messy it will not be graded.

- Be sure to show your working.

- This is a long exam, so there are lots of ways to get points. If you get stuck, move on!

- Good luck!

Name: _____

Question:	1	2	3	4	Total
Points:	30	30	30	30	120
Score:					

Short Answer Questions (30 points)

1. Depending on the question, write either:

   - a number
   - one of: True, False, or NEI (Not Enough Information)
   - a definition (i.e. one or a few words)

   (a) (3 points) A monopolist faces a constant price elasticity demand curve, has a constant marginal cost of 2, and is optimally setting a price of 4. What is the price elasticity of demand?

   (a) _____

   (b) (3 points) A monopolist faces the constant elasticity demand curve $p = 5q^{1/-2}$ and has a constant marginal cost $= 2$. What is the optimal price?

   (b) _____

   (c) (3 points) In the case *FTC vs. Facebook* that we discussed in class, the FTC is seeking *what remedy* to Facebook's ownership of Instagram and Whatsapp?

   (c) _Divestment_

   (d) (3 points) True, False, or Not Enough Information: given two markets, a monopolist will charge a higher *price-cost margin* in a market with more inelastic demand.

   (d) _True_

   (e) (3 points) True, False, or Not Enough Information: consumer surplus is zero under perfect price discrimination.

   (e) _True_

   (f) (3 points) The *centipede game* that we discussed in class is often used as an example of a game that violates *which assumption* when played in real-world experimental settings?

   (f) _Rationality_

   (g) (3 points) Suppose that a monopolist has the cost $C(q) = 20 + 2q^2$ and the perfect competition price and quantity is at $p_{pc} = 8, q_{pc} = 2$. What subsidy will the regulator need to provide the monopolist to ensure it does not shutdown under *marginal cost pricing*?

   (g) _____

   (h) (3 points) True, False, or Not Enough Information: dead-weight-loss can be positive under average-cost pricing.

   (h) _True_

   (i) (3 points) True, False, or Not Enough Information: if there is a dominated strategy in a game with two players and three strategies per player, then there is *always* a dominant strategy.

   (i) _False_

   (j) (3 points) True, False, or Not Enough Information: consumer surplus can never increase when moving from uniform pricing to price discrimination.

   (j) _False_

2

Movie Theater Question (30 points)
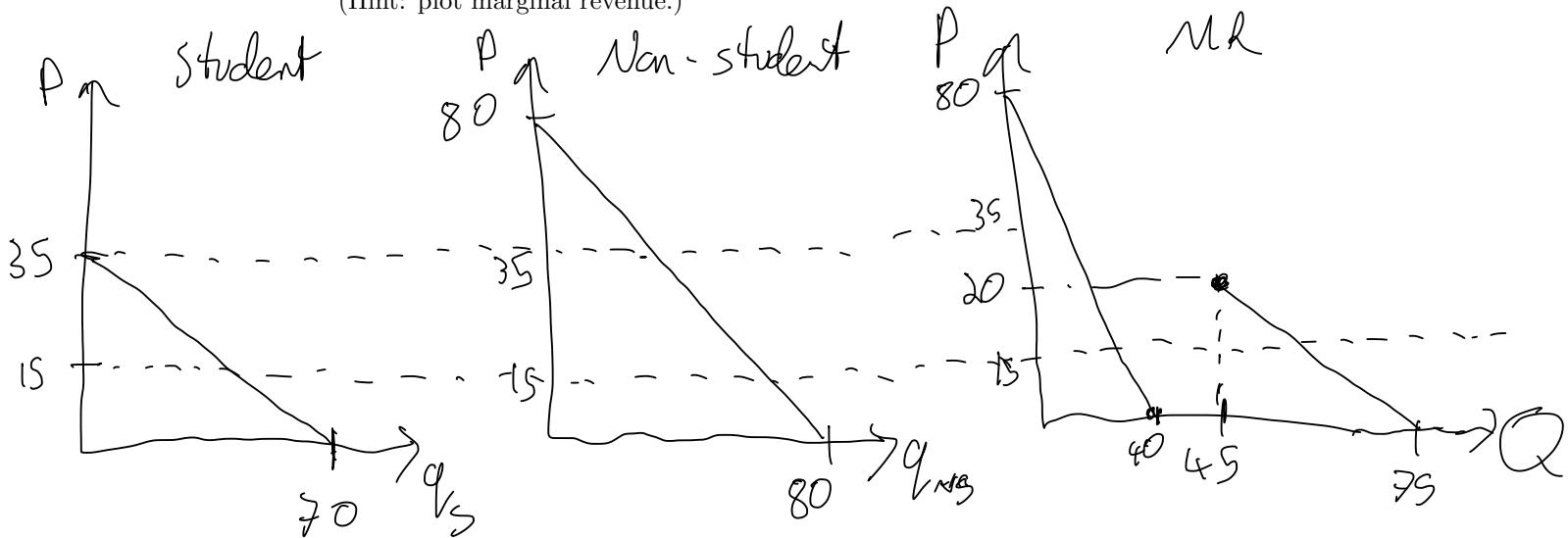
2. Suppose you are the owner of a movie theater. There are two types of customers: students (denoted 's') and non-students (denoted 'ns'). The demand for movie seats for each of these segments is:

$$\text{Student: } q_s = 70 - 2p_s$$
$$\text{Non-student: } q_{ns} = 80 - p_{ns}$$

(a) Assume that you cannot distinguish between students and non-students, and so you can only set a single *uniform price* for all consumers.

    i. (20 points) Assume that the marginal cost of a seat is \$15. What is the optimal uniform price? (Hint: plot marginal revenue.)

Demand:

$$Q = 80 - p \quad \text{if } p \geq 35$$
$$Q = 150 - 3p \quad \text{if } p < 35$$

Marginal Revenue:

IF $Q < 45$:

$$MR = 80 - 2Q$$

If $Q > 45$:

$$MR = 50 - \tfrac{2}{3}Q$$
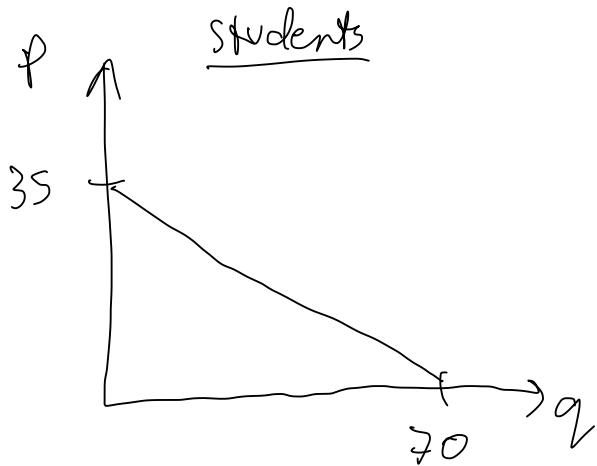
• Plot MR; MC intersects at two points

If $Q < 45$:

$$MR = MC \Rightarrow 15 = 80 - 2Q$$
$$\Rightarrow Q = \tfrac{65}{2}, \; P = 47.5$$
$$\pi = 1056.25$$

If $Q > 45$:

$$MR = MC \Rightarrow 15 = 50 - \tfrac{2}{3}Q$$
$$\Rightarrow Q = 52.5, \; P = 32.5$$
$$\pi = 918.75$$

i. $\underline{\quad 47.5 \quad}$

(b) Suppose that there are only (identical) students in the market, and that the interpretation of the demand curve for students is now *how many* tickets each student demands. Assume that the marginal cost of a seat is $5.

   i. (10 points) You would like to offer a 'movie-pass' plan where each customer pays a fixed fee and then can watch as many movies as they want (i.e. at a variable price = 0). What is the optimal fixed fee for the movie-pass plan?

P

Students

35

70

q

$$f = CS(p=0) = \frac{1}{2} \times 35 \times 70 = 1225$$

i. $\underline{1225}$

Price Discrimination By Self-Selection (30 points)

3. Suppose you are the CEO of an airline and there are two segments of airline ticket consumers: business and tourists. <u>Marginal cost = $20 per seat.</u>

   There are two types of tickets: standard and restricted, where a restricted ticket has limitations about when/where it can be used (and so we can think of it as a 'damaged' good). The number of consumers and willingness-to-pay for each consumer is given in the following table:

Consumer type	Number of consumers	Willingness to pay ($)	
		Standard	Restricted
Business	10	130	70
Tourist	40	50	40

   (a) (5 points) What is the profit under perfect price discrimination?

   $$\text{Profit} = (130-20) \times 10 + (50-20) \times 40$$

   $$= 2300$$

   (a) __2300__

   (b) Assume that you <u>cannot</u> distinguish between business and tourist consumers.

       i. (10 points) If you can only offer the standard ticket, what is the optimal uniform price?

   <u>Check p = 130:</u>

   $$\text{Profit} = 10 \times (130 - 20) = 1100$$

   <u>Check p = 50:</u>

   $$\text{Profit} = 40 \times (50 - 20) = 1200$$

   i. __50__

5

ii. (10 points) Suppose that you offer both tickets and charge \$40 for the restricted ticket. What is the optimal price for the standard ticket?

	S	R
B	$130-p$	30
T	$50-p$	0

- B buys standard ticket if $130-p \geq 30 \Rightarrow p \leq 100$
- So, charge $p = 100$

ii. $\underline{100}$

iii. (5 points) Suppose that you offer both tickets and charge \$80 for the restricted ticket. What is the optimal price for the standard ticket?

- Neither B or T buy restricted ticket.
- So, we are back in part (i)
- Charge $p = 50$
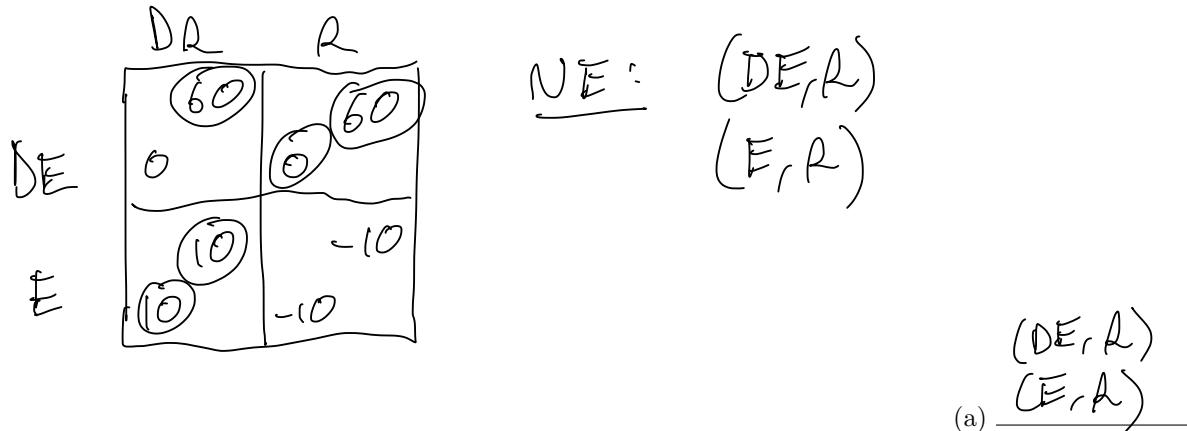
iii. $\underline{50}$

6

Game Theory: Entry Deterrence (30 points)

4. Consider the following game with two players: an Entrant and an Incumbent. The strategies of the Entrant are to enter 'E' or don't enter 'DE'. The strategies of the Incumbent are to retaliate 'R' or don't retaliate 'DR'. In the payoffs, 'x' represents a number.

Incumbent

		DR	R
Entrant	DE	60 0	60 0
	E	10 - x 10	-10 -10

(a) (5 points) Assume that $x = 0$. What are all the Nash equilibria?

NE: (DE, R)
(E, R)

(a) $\underline{\quad (DE, R) \quad (E, R) \quad}$

(b) (5 points) Assume that $x = 0$ and that the players play (E, DR) in the simultaneous game. How much would the players pay to merge and become one firm? (Hint: the merged firm receives a payoff equal to the sum of the individual payoffs.)
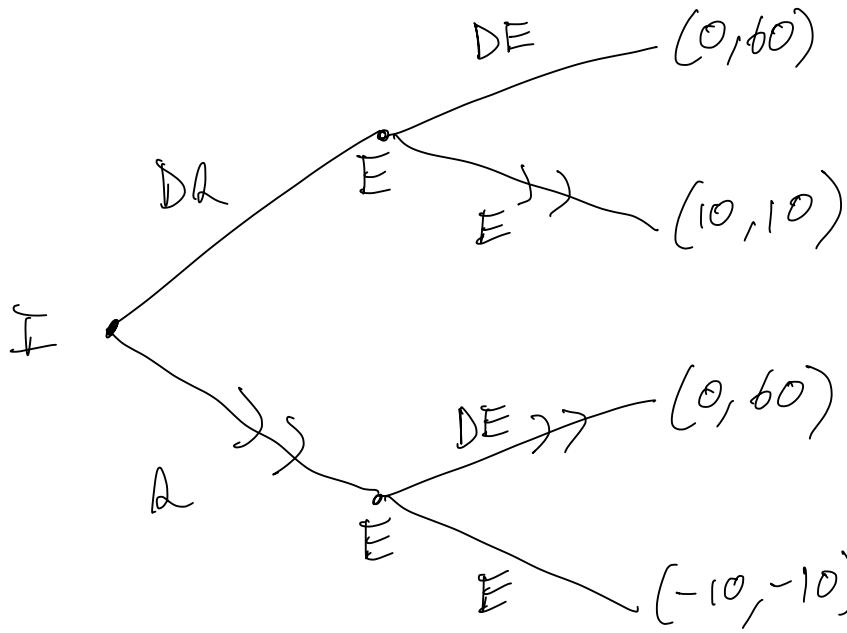
Merged: get 60 by jointly choosing (DE, DR)

Not merged: get 20

Payment: $60 - 20 = 40$
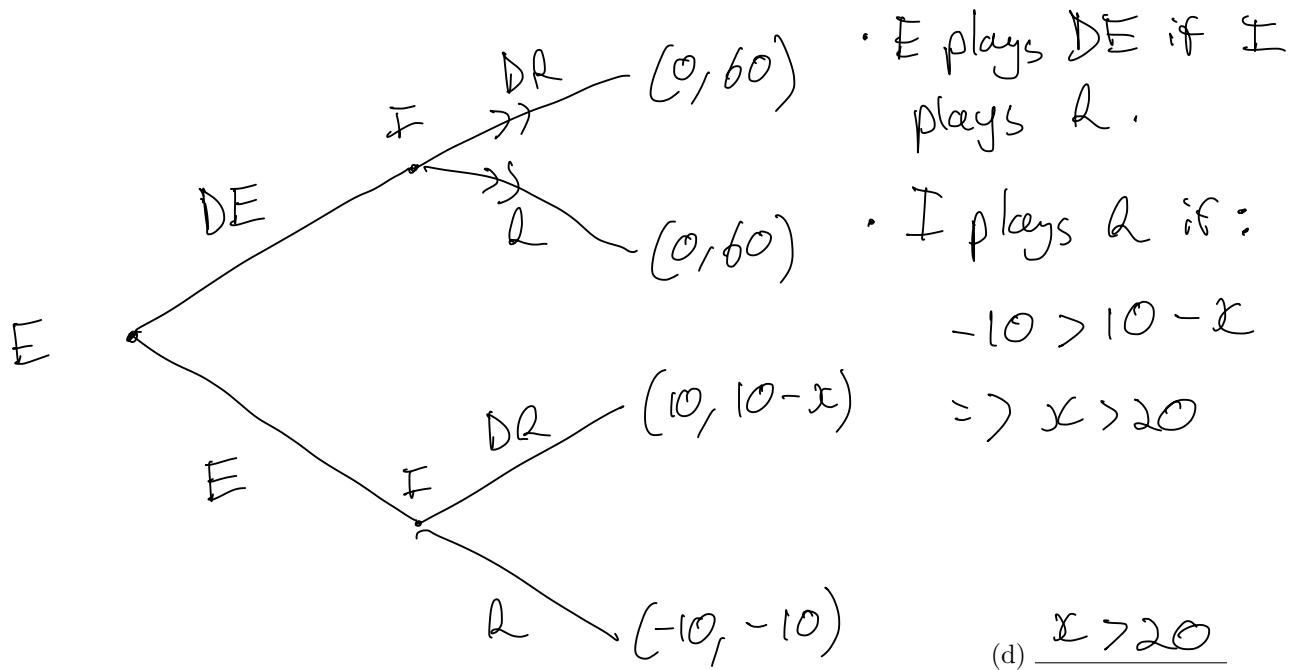
(b) $\underline{\quad 40 \quad}$

(c) (10 points) Assume that $x = 0$ and that the players play (E, DR) in the simultaneous game. What is the maximum value that the Incumbent would pay to commit to moving first?

DE — $(0, 60)$

DR   E

E — $(10, 10)$

I

R

DE — $(0, 60)$

E

E — $(-10, -10)$

- where payoffs:
  (Entrant, Incumbent)

- I gets 60 if first mover
- I gets 10 if (E, DR)
- Pay $60 - 10 = 50$

(c) $\underline{50}$

(d) (10 points) Assume that the Entrant moves first. What values of x successfully deter entry (i.e. ensure that in the subgame-perfect equilibrium, the Entrant plays DE)?

DR — $(0, 60)$

I

DE   R — $(0, 60)$

E

DR — $(10, 10-x)$

E   I

R — $(-10, -10)$

- E plays DE if I plays R.
- I plays R if:

$$-10 > 10 - x$$
$$\Rightarrow x > 20$$

(d) $\underline{x > 20}$

8

ECN 453: Mid-term Exam 1

Instructions:

- You have **60 minutes**

- Please write your final answer in the underlined section provided.

- You may bring a calculator and notes on a two-sided cheat-sheet on letter-size paper.

- Please be neat. If your work is too messy it will not be graded.

- Be sure to show your working.

- This is a long exam, so there are lots of ways to get points. If you get stuck, move on!

- Good luck!

Name: _____

Question:	1	2	3	4	Total
Points:	30	30	30	30	120
Score:					

Short Answer Questions (30 points)

1. Depending on the question, write either:

   - a number
   - one of: True, False, or NEI (Not Enough Information)
   - a definition (i.e. one or a few words)

   (a) (3 points) A monopolist faces a constant price elasticity demand curve, has a constant marginal cost of 2, and is optimally setting a price of 4. What is the price elasticity of demand?

   (a) _____ −2 _____

   (b) (3 points) A monopolist faces the constant elasticity demand curve $p = 5q^{1/-2}$ and has a constant marginal cost $= 2$. What is the optimal price?

   (b) _____ 4 _____

   (c) (3 points) In the case *FTC vs. Facebook* that we discussed in class, the FTC is seeking *what remedy* to Facebook's ownership of Instagram and Whatsapp?

   (c) _divestment_

   (d) (3 points) True, False, or Not Enough Information: given two markets, a monopolist will charge a higher *price-cost margin* in a market with more inelastic demand.

   (d) _True_

   (e) (3 points) True, False, or Not Enough Information: consumer surplus is zero under perfect price discrimination.

   (e) _True_

   (f) (3 points) The *centipede game* that we discussed in class is often used as an example of a game that violates *which assumption* when played in real-world experimental settings?

   (f) _rationality_

   (g) (3 points) Suppose that a monopolist has the cost $C(q) = 20 + 2q^2$ and the perfect competition price and quantity is at $p_{pc} = 8, q_{pc} = 2$. What subsidy will the regulator need to provide the monopolist to ensure it does not shutdown under *marginal cost pricing*?

   (g) _12_

   (h) (3 points) True, False, or Not Enough Information: dead-weight-loss can be positive under average-cost pricing.

   (h) _True_

   (i) (3 points) True, False, or Not Enough Information: if there is a dominated strategy in a game with two players and three strategies per player, then there is *always* a dominant strategy.

   (i) _True_

   (j) (3 points) True, False, or Not Enough Information: consumer surplus can never increase when moving from uniform pricing to price discrimination.

   (j) _False_
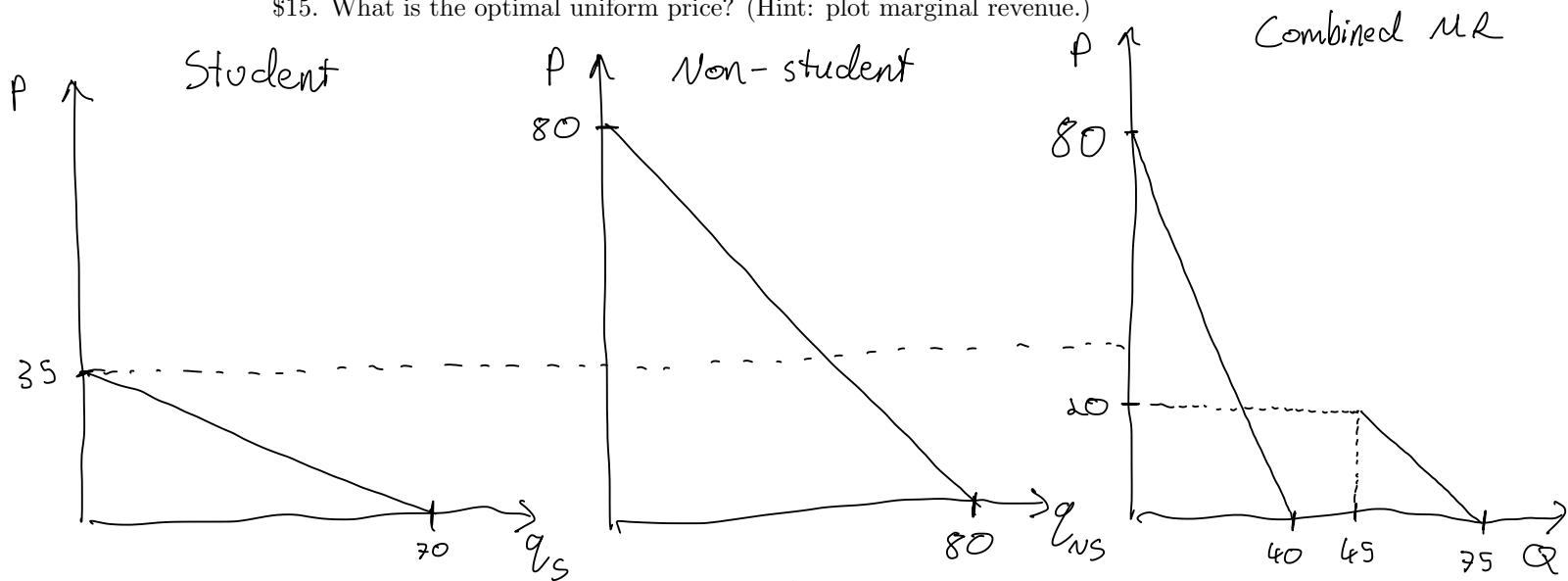
Movie Theater Question (30 points)

2. Suppose you are the owner of a movie theater. There are two types of customers: students (denoted 's') and non-students (denoted 'ns'). The demand for movie seats for each of these segments is:

$$\text{Student: } q_s = 70 - 2p_s$$
$$\text{Non-student: } q_{ns} = 80 - p_{ns}$$

(a) (20 points) Assume that you cannot distinguish between students and non-students, and so you can only set a single *uniform price* for all consumers. Assume that the marginal cost of a seat is \$15. What is the optimal uniform price? (Hint: plot marginal revenue.)

Demand:

$$Q = 80 - p \quad \text{if} \quad p \geqslant 35$$
$$Q = 150 - 3p \quad \text{if} \quad p < 35$$

Marginal Revenue:

$$MR = 80 - 2Q \quad \text{if} \quad Q < 45$$
$$MR = 50 - \tfrac{2}{3}Q \quad \text{if} \quad Q > 45$$

• Plotting MR, note that MC intersects at two points.

If $Q < 45$:

$$MR = MC \implies 15 = 80 - 2Q$$
$$\implies Q = \tfrac{65}{2} \text{ and } P = 47.5$$
$$\implies \text{Profit} = 1056.25$$

If $Q > 45$:

$$MR = MC \implies 15 = 50 - \tfrac{2}{3}Q$$
$$\implies Q = 52.5, \ p = 32.5$$
$$\implies \text{Profit} = 918.75$$

• Choose $P = 47.5$

[Note: half points awarded if you answered $p = 32.5$]

(a) ___47.5___

3

(b) (10 points) Suppose that there are only (identical) students in the market, and that the interpretation of the demand curve for students is now *how many* tickets each student demands. Assume that the marginal cost of a seat is $5.

You would like to offer a 'movie-pass' plan where each customer pays a fixed fee and then can watch as many movies as they want (i.e. at a variable price = 0). What is the optimal fixed fee for the movie-pass plan?

P

Students

35

70   q_s

$$\text{Fixed fee} = CS (\text{price} = 0)$$
$$= \frac{1}{2} \times 70 \times 35$$
$$= 1225$$

(b) $\underline{1225}$

4

Price Discrimination By Self-Selection (30 points)

3. Suppose you are the CEO of an airline and there are two segments of airline ticket consumers: business and tourists. <u>Marginal cost = \$20 per seat.</u>

There are two types of tickets: standard and restricted, where a restricted ticket has limitations about when/where it can be used (and so we can think of it as a 'damaged' good). The number of consumers and willingness-to-pay for each consumer is given in the following table:

Consumer type	Number of consumers	Willingness to pay (\$)	
		Standard	Restricted
Business	10	130	70
Tourist	40	50	40

(a) (5 points) What is the profit under perfect price discrimination?

$$Profit = (130 - 20) \times 10 \quad + \quad (50 - 20) \times 40$$

$$= 2300$$

(a) __2300__

(b) Assume that you <u>cannot</u> distinguish between business and tourist consumers.

    i. (10 points) If you can only offer the standard ticket, what is the optimal uniform price?

<u>Check p = 130:</u>

$$Profit = 10 \times (130 - 20) = 1100$$

<u>Check p = 50:</u>

$$Profit = 40 \times (50 - 20) = 1200$$

i. __50__

5

ii. (10 points) Suppose that you offer both tickets and charge $40 for the restricted ticket. What is the optimal price for the standard ticket?

	S	R
B	130-p	30
T	50-p	0

- B buys standard ticket if $130 - p \geq 30 \Rightarrow p \leq 100$

- So, charge highest price possible where $p \leq 100$

- i.e. charge $p = 100$

ii. $\underline{100}$

iii. (5 points) Suppose that you offer both tickets and charge $80 for the restricted ticket. What is the optimal price for the standard ticket?

- Neither B or T buy standard ticket.

- So, we are back in part (i)

- Charge $p = 50$
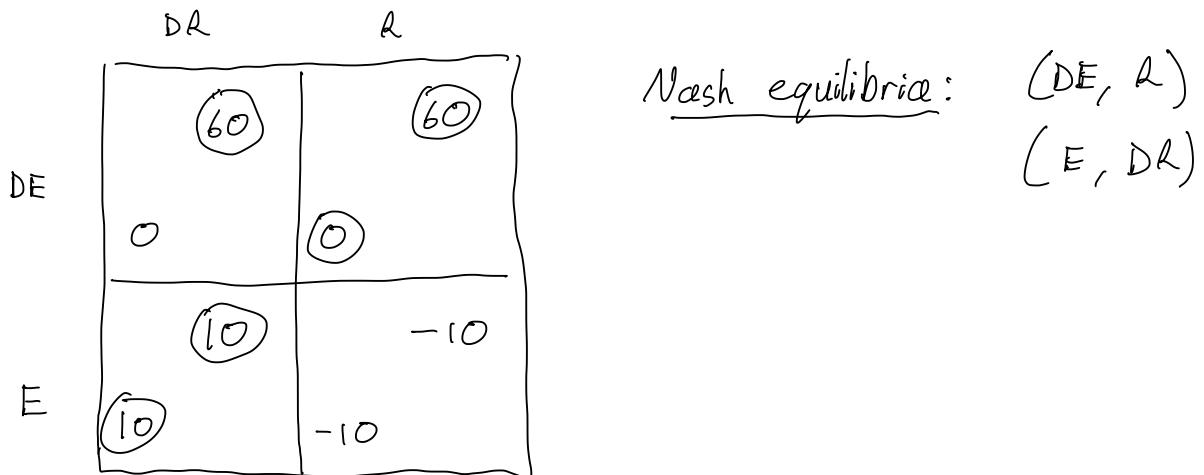
iii. $\underline{50}$

Game Theory: Entry Deterrence (30 points)

4. Consider the following game with two players: an Entrant and an Incumbent. The strategies of the Entrant are to enter 'E' or don't enter 'DE'. The strategies of the Incumbent are to retaliate 'R' or don't retaliate 'DR'. In the payoffs, 'x' represents a number.

Incumbent

		DR	R
Entrant	DE	60 0	60 0
	E	10 - x 10	-10 -10

(a) (5 points) Assume that $x = 0$. What are all the Nash equilibria?

Nash equilibria: (DE, R)
                  (E, DR)

(a) (DE, R)
     (E, DR)

7

(b) (10 points) Assume that $x = 0$ and that the players play (E, DR) in the simultaneous game. What is the maximum value that the Incumbent would pay to commit to moving first?

DE — (0, 60)

E

DR

E ⟶ (10, 10)

I

R ⟶

E

DE ⟶ (0, 60)

E
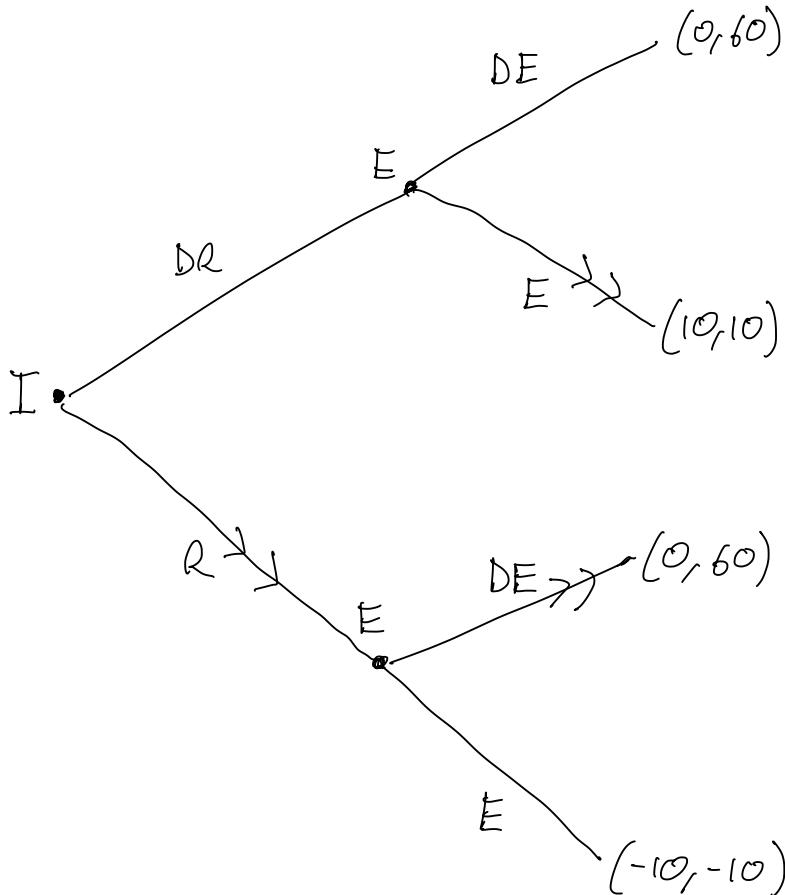
(-10, -10)
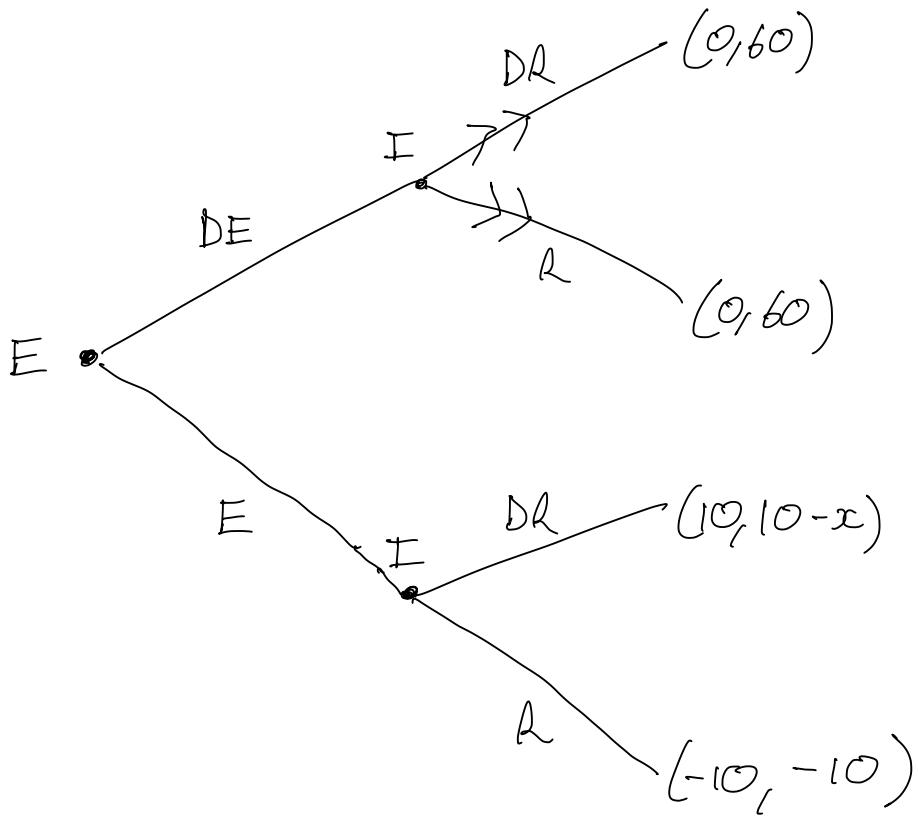
- Payoffs in the figure on the left are written in the form (Entrant, Incumbent)

- I gets 60 if first mover.
- I gets 10 if (E, DR) is played.
- So, I would pay 60 - 10 = 50.

(b) _____50_____

8

(c) (15 points) Assume that the Entrant moves first. What values of x successfully deter entry (i.e. ensure that in the subgame-perfect equilibrium, the Entrant plays DE)?

DR — (0,60)

I

DE

E

E

I

DR — (10, 10−x)

R

(0, 60)

R

(−10, −10)

- E plays DE if I plays R

- I plays R if : −10 > 10 − x

  ⟹ x > 20

(c) ____ $x > 20$ ____

9