

**University of Notre Dame  
Department of Finance  
Economics of the Firm  
Fall 2011  
Practice Final Exam**

- 1) Suppose that you are a monopoly facing the following regional demand curve. Q represents total sales for a region, P is the price you are charging, and I represents average income in the region in thousands.

$$Q = 20 - 4P + .1I$$

You are considering selling to two regions. You have a fixed cost of \$5 and then a constant marginal cost of \$4.

Region A: Average Income = \$40,000

Region B: Average Income = \$80,000

- a) Suppose that you could prevent resale across the two regions and, hence could set different prices across the regions. What prices would you charge in the two regions?

We can treat each demand curve separately here...first, region A.

$$Q = 20 - 4P + .1(40) = 24 - 4P$$

This will be easier if we solve this for price:

$P = 6 - .25Q$  Now we can set up a table. We want to locate where marginal revenue equals marginal cost.

Quantity	Price	Total Revenue	Marginal Revenue
1	5.75	5.75	5.75
2	5.50	11.00	5.25
3	5.25	15.75	4.75
<b>4</b>	<b>5.00</b>	<b>20</b>	<b>4.25</b>
5	4.75	23.75	3.75
6	4.50	27	3.25

Region A will have a \$5 price. Profits in Region A will be  $(\$5-4)*4 = \$4$

Now, repeat the process for region B.

$$Q = 20 - 4P + .1(80) = 28-4P$$

Solving for P, we get  $P = 7 - .25Q$

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Quantity	Price	Total Revenue	Marginal Revenue
1	6.75	6.75	6.75
2	6.50	13.00	6.25
3	6.25	18.75	5.75
4	6	24	5.25
5	5.75	28.75	4.75
<b>6</b>	<b>5.50</b>	<b>33</b>	<b>4.25</b>
7	5.25	36.75	3.75

Region B has a \$5.50 Price. Profits are equal to  $(\$5.50 - 4) \cdot 6 = \$9$

- b) Calculate your profits. What is your producer surplus?

$$\text{Total Profits} = \$4 + \$9 - \$5 = \$8$$

$$\text{Producer Surplus} = \$13$$

- c) Now, suppose that you could not prevent resale across the two regions and therefore, had to set one common price. How would you go about finding this price?

This is trickier...we need to add up total sales across both regions for any price we charge:

Recall,

$$\text{Region A: } Q = 24 - 4P$$

$$\text{Region B: } Q = 28 - 4P$$

So, for example, if we charge a price equal to \$5

Region A	Region B	Total
4	8	12

Suppose that we charged some price, P

Region A	Region B	Total
$24 - 4P$	$28 - 4P$	$52 - 8P$

So, our total demand across the two regions is  $Q = 52 - 28P$ .  
 If we solve for price, we get  $P = 6.5 - .125Q$ . We could repeat the above process.

Quantity	Price	Total Revenue	Marginal Revenue
1	6.375	6.375	6.375
2	6.25	12.50	6.125
3	6.125	18.375	5.875
4	6	24	5.625

If you are interested, the correct price is \$5.25 and sales across the two regions will equal 10. Profits will be  $(5.25 - 4) * 10 - 5 = \$7.5$

- 2) Suppose that you are a potato farmer. You have three potato fields with varying degrees of productivity:

Field #1: You can harvest 10 pounds of potatoes per hour (80 pounds max)

Field #2: You can harvest 5 pounds of potatoes per hour (50 pounds max)

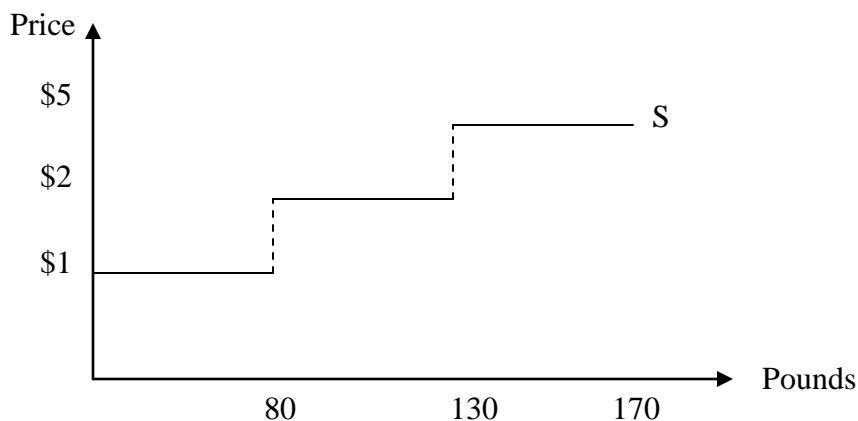
Field #3: You can harvest 2 pounds of potatoes per hour (20 pounds max)

You pay your potato picker \$10 per hour. Assume that you bought the land for \$1,000.

- a) Sketch your supply curve for potatoes.

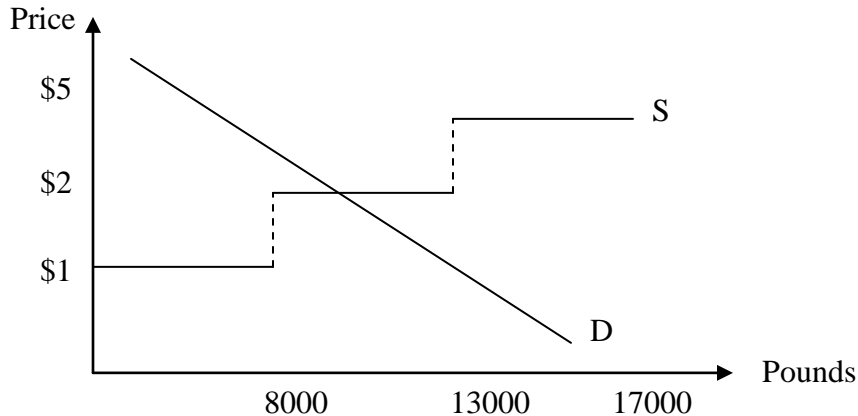
	Field #1	Field #2	Field #3
Wage (\$/hr)	\$10	\$10	\$10
Productivity (lbs/hr)	10	5	2
MC (\$/LB)	\$1	\$2	\$5

The supply curve is basically a plot of marginal cost.



- b) Suppose that there are 99 other farmers in the area that are exactly like you. Sketch the market supply curve for potatoes.

The market is 100 times that of the individual.



- c) Suppose that the demand curve for potatoes is  $Q = 18000 - 3000P$ . Could \$2 be an equilibrium price for potatoes? At a \$2 price, calculate the % return in potato farming. Are firms earning economic profits? If so, what will happen?

At a \$2 price, each farmer would be willing to sell between 80 and 100 pounds of potatoes, so total supply will be between 8000 and 13000. At a \$2 price, demand will be  $Q = 18000 - 3000(2) = 12000$ . Supply and demand intersect, so this can be equilibrium.

Price:\$2

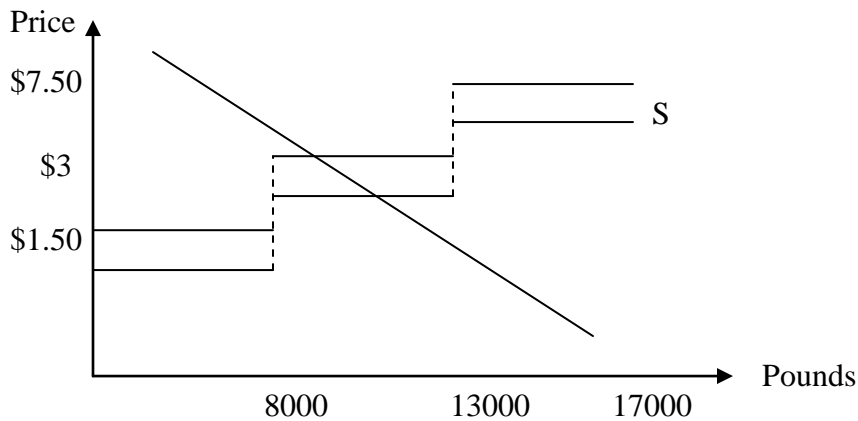
Total Sales: 12000

Sales per firm: 120

Profit Per Firm:  $(\$2 - 1)*80 + (\$2-2)*40 = \$80$  (An 8% return)

- d) Suppose that potato pickers formed a labor union and negotiated a \$15 per hour wage. What will happen?

	Field #1	Field #2	Field #3
Wage (\$/hr)	\$15	\$15	\$15
Productivity (lbs/hr)	10	5	2
MC (\$/LB)	\$1.50	\$3	\$7.50



Price:\$3

Total Sales: 9000

Sales per firm: 90

Profit Per Firm:  $(\$3 - 1.50) \times 80 + (\$3 - 3) \times 10 = \$120$  (A 12% return)

- 3) Suppose that the market for beef is perfectly competitive. Explain how each of the events would affect the supply of beef (i.e. will the event influence supply decisions), demand for beef (i.e. will the event effect buying decisions), and the market equilibrium (market price, total sales).

- a) Ethanol production pushes up the price of corn (used in the feed for cattle)

The increased price of corn raises the marginal cost of producing beef. This causes a drop in supply (supply curve shifts left). Demand decisions are unaffected by this event, but now there is a shortage in the market. With excess demand, price increases and sales decrease.

- b) A recession causes consumers to tighten their household budgets.

The recession creates a drop in demand. The drop in incomes have no effect on supply decisions, but the market now has a surplus with will lower price and lower sales.

- c) Poultry prices increase.

The rise in poultry prices creates an increase in demand. This event has no effect on supply decisions, but the market now has a shortage with will raise price and increase sales.

- d) Cattle ranchers are found guilty of animal abuse and are fined \$10,000.

This event effects no decisions at the margin and, hence, has no effect on the market.

- 4) Suppose that you are the manager of a bar. You know that you face two populations that frequent your bar; students from the local college and natives that live in town. You've identified their demands as follows. You have a marginal cost of your drinks equal to \$3. Assume that there is one of each type.

College Students:  $Q = 10 - 2P$

“Townies”:  $Q = 5 - P$

- a) Now, suppose that you could distinguish between the two groups and charge them different drink prices. What would your prices be?

First, college students:  $Q = 10 - 2P$

Solve for P:  $P = 5 - .5Q$

Quantity	Price	Total Revenue	Marginal Revenue
1	4.50	4.50	4.50
<b>2</b>	<b>4</b>	<b>8</b>	<b>3.50</b>
3	3.50	10.50	2.50
4	3	12	1.50
5	2.50	12.50	.50

Now, townies:  $Q = 5 - P$

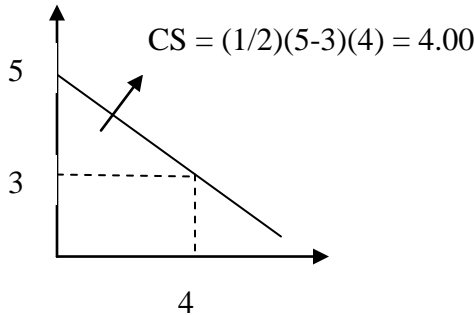
Solve for P:  $P = 5 - Q$

Quantity	Price	Total Revenue	Marginal Revenue
<b>1</b>	<b>4</b>	<b>4</b>	<b>4</b>
2	3	6	2
3	2	6	0
4	1	4	-2
5	0	0	-4

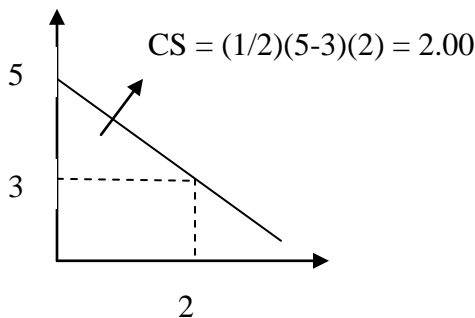
- b) Now, suppose that you are considering a cover charge for the bar. Assuming that, once in the bar, patrons can buy drinks for \$3, and that you can charge different cover charges to different people what would you charge.

We set a price per drink equal to \$3 and then charge each patron their consumer surplus as a cover charge.

College Students:  $Q = 10 - 2P$



Townies:  $Q = 5 - P$



- c) How would your answer to (d) change if you couldn't distinguish between types?

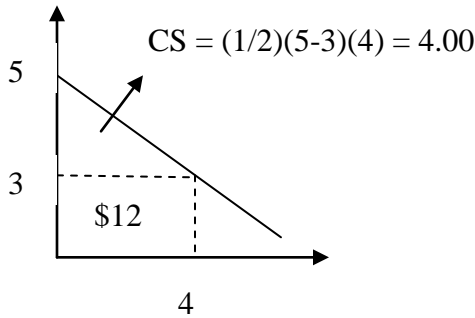
\$4 Cover: Only College students show up: Profits = \$4

\$2 Cover: Both show up: Profit =  $2 * \$2 = \$4$

It really doesn't matter.

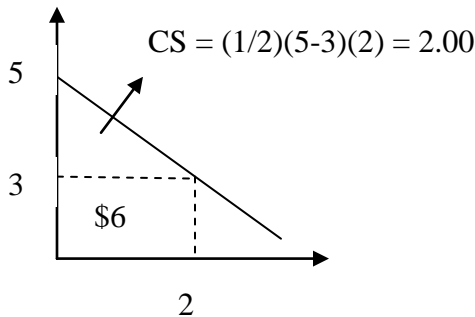
- d) Suppose that, instead of a cover charge, you offered different drink packages (i.e. X drinks for Y dollars). What would your drink packages be and how much would they cost?

College Students:  $Q = 10 - 2P$



4 Drinks for \$16

Townies:  $Q = 5 - P$

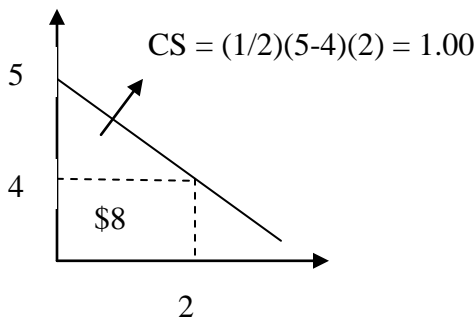


2 Drinks for \$8

- e) How would your answer to (d) change if you couldn't distinguish customer type?

We need to insure that the college students don't buy the smaller package. We need to figure out the consumer surplus college students would get if they bought 2 drinks for \$8.

College Students:  $Q = 10 - 2P$



A college student is willing to pay \$9 for two drinks, but we are only charging \$8 – this gives them \$1 in surplus. Therefore, subtract that off the larger package

4 Drinks for \$15  
2 Drinks for \$8

- 5) Suppose that there are two firms in a market facing a common industry demand curve given by

$$P = 28 - 2Q$$

Where Q is the combined output of the two firms and P is the market price. Each firm has a constant marginal cost equal to \$4.

- a) Suppose that one firm chooses a production level equal to 2, the other firm's best response is to set a production level equal to 5.

Set Q1 equal to 2

Q1	Q2	Q	P	TR = Q2*P	MR
2	1	3	22	22	22
2	2	4	20	40	18
2	3	5	18	54	14
2	4	6	16	64	10
<b>2</b>	<b>5</b>	<b>7</b>	<b>14</b>	<b>70</b>	<b>6</b>
2	6	8	12	72	2

- b) Show that each firm producing 4 is an equilibrium.

If firm 1 is producing 4, we need to show that firm 2's best response is also 4.

Q1	Q2	Q	P	TR = Q2*P	MR
4	1	5	18	18	18
4	2	6	16	32	14
4	3	7	14	42	10
<b>4</b>	<b>4</b>	<b>8</b>	<b>12</b>	<b>48</b>	<b>16</b>
4	5	9	10	50	2
4	6	10	8	48	-2

So, in equilibrium each firm produces 4, market sales are 8, the market price is 12, and each firm earns  $(\$12-4)*4 = \$32$  in profits.

- c) How would market shares change (qualitatively) if firm one experienced a decrease in marginal cost?

Firm one's market share would increase while firm two's market share would decrease.

- d) What would the equilibrium in this market be if, instead of choosing quantity, firms were choosing price?

Each firm would set a price equal to marginal cost, total sales would be 12 (plug price equal to \$4 into the demand curve), and profits would be zero.

- 6) Consider the following game. Each player can select a high price or a low price. The payouts represent each players profits given each combination of moves.

		Player Two	
		High Price	Low Price
Player One	High Price	<b>\$80</b> \$80	<b>\$0</b> \$40
	Low Price	<b>\$40</b> \$0	<b>\$20</b> \$20

- a) Describe each player's strategy (i.e. each player's best response to the other players actions). Does either player have a dominant strategy?

If player two charges a high price, player one's best response is a high price. If player two charges a low price, player one's best response is a low price. Neither player has a dominant strategy.

- b) Is it possible for each player to play the same move over and over again without regretting his/her decision?

If both players select a high price, neither side has an incentive to deviate (i.e. if both players are charging a high price, player one would do worse if she switched to a low price). Likewise, if each player selects a low price, neither side has an incentive to deviate.

- c) Suppose that Player two follows a strategy of charging a high price half the time. Which move for player 1 is reward dominant? Which move is risk dominant? How will player one react to player two's strategy?

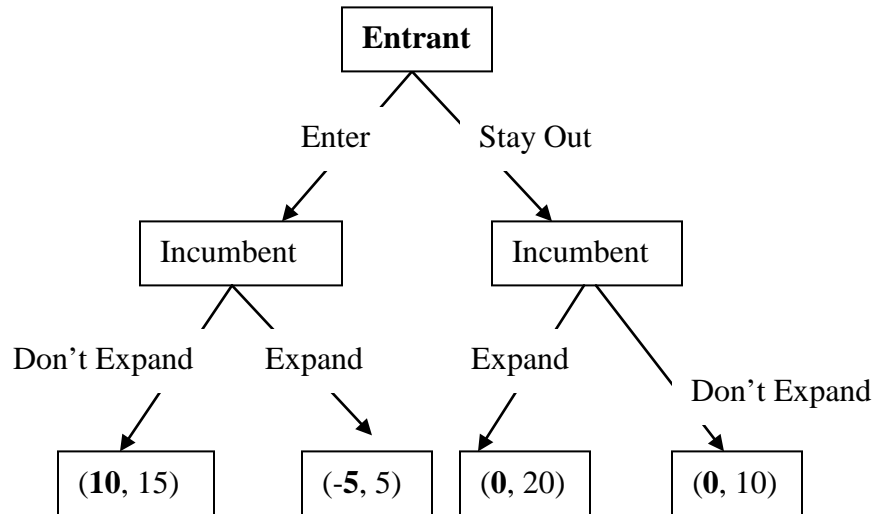
If player two selected high and low, each with equal odds, we can calculate the expected return to each move by player 1.

$$\text{High Price: } (.5)(80) + (.5)(0) = \$40$$

$$\text{Low Price: } (.5)(40) + (.5)(20) = \$30$$

Charging a high price is reward dominant (does better on average), but charging a low price is risk dominant (lower variance of outcome). If player one is risk neutral and chooses a move that does better on average, she will choose a high price.

- 7) Consider the following sequential game: A new firm is considering entering an industry. Once the entry decision has been made and the incumbent firm has observed the decision, the incumbent firm can choose to expand production to lower the market price and drive the new entrant out of business or maintain its current production level. The game can be mapped out as (entrants payouts are in bold):



- a) What is the equilibrium to this game? Explain.

We solve this game backwards. If the entrant stays out, the incumbent chooses between expand (20) and don't expand (10). His best move is to expand.

If the entrant enters, the incumbent chooses between expand (5) and don't expand (15). His best move is to not expand.

Now, the entrant is choosing between enter (the incumbent doesn't expand – 10) or stay out (the incumbent expands – 0), The entrant chooses to enter.

- b) What does this game suggest about the possibility of credible threats? Can the entrant make a credible threat in this game?

In this game, it doesn't matter whether the incumbent threatens the entrant with expanding because the threat is never credible. Once the entry has occurred, it is always optimal not to expand.

- 8) Suppose you run a fast food restaurant. You have three items for sale: burgers, fries, and soda. You face four potential customers given below:

(The dollar figures represent the maximum each consumer is willing to pay for each product)

Customer	Burger	Fries	Soda
1	\$4.00	\$2.00	\$1.00
2	\$1.00	\$4.00	\$3.00
3	\$2.00	\$1.00	\$4.00
4	\$3.00	\$2.00	\$2.00

For simplicity, assume that your marginal cost for all three products is \$1.

- a) If you only had an ala carte menu, what would you charge for each item?

Burger:

Price	Sales	Total Revenue	Total Cost	Profit
\$4	1	\$4	\$1	\$3
<b>\$3</b>	<b>2</b>	<b>\$6</b>	<b>\$2</b>	<b>\$4</b>
\$2	2	\$4	\$2	\$2
\$1	4	\$4	\$4	\$0

Fries:

Price	Sales	Total Revenue	Total Cost	Profit
<b>\$4</b>	<b>1</b>	<b>\$4</b>	<b>\$1</b>	<b>\$3</b>
<b>\$2</b>	<b>3</b>	<b>\$6</b>	<b>\$3</b>	<b>\$3</b>
\$1	4	\$4	\$4	\$0

Soda:

Price	Sales	Total Revenue	Total Cost	Profit
\$4	1	\$4	\$1	\$3
<b>\$3</b>	<b>2</b>	<b>\$6</b>	<b>\$2</b>	<b>\$4</b>
\$2	3	\$6	\$3	\$3
\$1	4	\$4	\$4	\$0

Note: Total Profit = \$11

- b) Now, suppose that you bundle the three products into a combo meal, what price would you set for a combo meal?

Customer	Burger	Fries	Soda	Total
1	\$4.00	\$2.00	\$1.00	\$7
2	\$1.00	\$4.00	\$3.00	\$8
3	\$2.00	\$1.00	\$4.00	\$7
4	\$3.00	\$2.00	\$2.00	\$7

Combo:

Price	Total Sales	Total Revenues	Total Cost	Profit
\$8	1	\$8.00	\$3.00	\$5
<b>\$7</b>	<b>4</b>	<b>\$28.00</b>	<b>\$12.00</b>	<b>\$14</b>

- 9) Consider the following version of the prisoners dilemma game (Player one's payoffs are in bold):

		Player Two	
		Cooperate	Cheat
Player One	Cooperate	<b>\$30</b> \$30	<b>\$0</b> \$50
	Cheat	<b>\$50</b> \$0	<b>\$10</b> \$10

- a) What is each player's dominant strategy? Explain the Nash equilibrium of the game?

Both players have a dominant strategy to always cheat. Therefore, the equilibrium is both sides cheating.

- b) Suppose that this game was to be played ten times in a row. Player 1 makes the following offer: "I will cooperate today. If you cooperate I will trust you and cooperate tomorrow. If you cheat, I will always cheat". Calculate the rewards from cheating and cooperating. Would cooperation occur? Explain.

If I cooperate, I get \$30 per year for 10 years - \$300

If I cheat, I get \$50 now and then \$10 for the next 9 years 0 - \$140

The problem this cooperation scheme is that it only works when there is the possibility of future punishment for cheating. When the game is played the tenth time, both sides will cheat. But, if both sides always cheat in period ten, they will both cheat in period nine...and so on.

10) Consider the following demand curve:

$$Q = 120 - 6P$$

- a) Calculate the elasticity of demand at a price of \$15.

At a price of \$15, Quantity demanded equals  $120 - (6)(15) = 30$ .

Recall that elasticity is the percentage change in quantity divided by the percentage change in price. Suppose that price increases by 10% to \$16.50, the new quantity demanded would be  $120 - 6(16.50) = 21$ .

$$\text{So, } \left( \frac{21 - 30}{30} \right) * 100 = -30\%$$

$$\text{Therefore, } \varepsilon = \frac{\% \Delta Q}{\% \Delta P} = \frac{-30}{10} = -3$$

- b) With a price of \$15, what are your revenues? Would you be better off raising or lowering price if you want to increase revenues? Explain.

Currently, revenues are equal to  $\$15 * 30 = \$450$

In this case, every 1% drop in price will raise sales by 3%, so lowering price is the right thing to do.

- c) If revenues are maximized, what is the elasticity of demand?

At maximum revenues, elasticity equals -1.

11) Suppose that the average rental property in south bend costs \$800 per month to rent. Also assume that the average savings account in south bend pays 4% per year. Further, assume that the average home in South Bend can be purchased with an interest only mortgage that requires \$36,000 down and then a monthly payment of \$700 (with an interest only mortgage, you have no equity in the house).

- a) Would the average south bend resident be better off renting or buying under these circumstances?

Renting will cost you \$800 per month;

If you buy, you will pay the \$700 monthly payment plus you will lose \$120 per month on lost interest (4% per year on 36,000 divided by 12) for a total cost of \$820. You would be better off renting.

- b) Given your answer to (a), are the housing markets in South bend in equilibrium? If not, what adjustment would be needed?

If everybody was renting, the demand for rentals will rise (rising rents) and the demand for houses will fall (lowering the price) until the average person is indifferent between the two activities. In this example, if renting cost \$820 per month, the average person would be indifferent.

- 12) Suppose that there are two theatres in the same town that show the same movie. The demand for that movie is given by

$$Q = 600 - 10P$$

Where P is the ticket price and Q is the number of tickets sold. Suppose that each theatre has a constant marginal cost of \$5 per ticket.

- a) Assuming that each theatre has 600 seats available, if each theatre gets to choose the price they charge for a ticket, what price will they select? Explain.

If each theatre is able to satisfy the entire market, they will bid each other down to marginal cost. The price of a ticket will be \$5 total sales will be 550 (each theatre will seat 275 people)

- b) Now, suppose that each theatre decides to reduce its seating capacity to 200 seats. What price will tickets sell for?

If each theatre sets its capacity to 200 seats, the ticket price will rise to \$20. At a \$20 price, there is demand for 400 tickets and, hence, each theatre is full. There is no incentive for either theatre to undercut the other.

- c) How would theatres choose the optimal number of seats?

Quantity competition!