University of Notre Dame
Department of Finance
Economics of the Firm
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Suggested Solutions to Practice Questions for Chapters 10,11,14

Chapter 10:

5) We have the following demand and supply curves:

Demand: $Q_D = 212 - 20P$

Supply: $Q_S = 20 + 4P$

a) To solve for price and quantity, set demand equal to supply:

$$Q_D = Q_S$$
$$212 - 20P = 20 + 4P$$
$$192 = 24P$$
$$P = 8$$
$$Q = 212 - 20(8) = 20 + 4(8) = 52$$

b) If the price ceiling is set at $6 (below the equilibrium price), quantity will be determined by supply: $Q_S = 20 + 4P = 20 + 4(6) = 44$

c) If the price can't drop below $9 (above the equilibrium price), quantity will be determined by demand: $Q_D = 212 - 20P = 212 - 20(9) = 3$

d) Repeat the process in (a) and set the new supply equal to demand: Q = 64.3, P = 7.38

e) Repeat the process in (a) and set the new demand equal to supply: Q = 60, P = 10

6) See Excel file

8) See Excel file

9) See Excel file

Chapter 11:

3) a) Marginal cost represents the change in costs per unit change in production:

$$MC = \frac{\Delta TC}{\Delta Q} = 200Q - 5{,}000$$

b) If Ajax sets a price above it's competitor, it will get zero sales and marginal revenue is zero. Likewise, if it sets a price below its competitor, a price war will start and (if its competitor undercuts Ajax), marginal revenues and sales will be zero. As long as it sets a price equal to it's competition, MR = P = 20,000.

c) Now, set MR = MC and solve for Q

$$200Q - 5000 = 20000$$
$$200Q = 25{,}000$$
$$Q = 125$$

$$TC = 800{,}000 - 5000Q + 100Q^2 = 800{,}000 - 5000(125) + 100(125^2) = 1{,}737{,}500$$

d) $TR = 20{,}000 * 125 = 2{,}500{,}000$

$$\pi = TR - TC = 2{,}500{,}000 - 1{,}737{,}500 = 762{,}500$$

4) See Excel File

5) The numerical version in in the excel file, but here is the math:

We are assuming a monopoly setting price given a demand curve of:

$$Q = 120{,}000 - 10{,}000P$$

First, solve for price as a function of quantity:

$$P = 12 - \left(\frac{1}{10{,}000}\right)Q$$

Now, Total revenues equal price times quantity:

$$TR = PQ = 12Q - \left(\frac{1}{10{,}000}\right)Q^2$$

Marginal revenue is the change in total revenues with respect to Q

$$MR = \frac{\Delta TR}{\Delta Q} = 12 - \left(\frac{2}{10{,}000}\right)Q$$

Total cost in this case is $12{,}000 + 1.50Q$, Marginal Cost is 1.50. Set MR = MC and solve for Q

$$12 - \left(\frac{2}{10{,}000}\right)Q = 1.50$$

$$Q = 52{,}500$$

$$P = 12 - \left(\frac{1}{10{,}000}\right)52{,}500 = 6.75$$

$$\pi = (6.75 - 1.50)52{,}500 - 12{,}000 = 263{,}625$$

6) In this example, marginal cost (the change in cost per unit change in quantity is constant at 20) and elasticity of demand is constant at -1.5.

a) MC = 20

b) $P = \frac{MC}{1 + \frac{1}{\varepsilon}} = \frac{20}{1 - \frac{1}{1.5}} = 60$

c) MR = MC = 20

d) $P = \frac{MC}{1 + \frac{1}{\varepsilon}} = \frac{20}{1 - \frac{1}{3}} = 30$

11) In an unregulated environment, the firm acts as a monopoly:

a) First, find marginal revenue:

$$P = 250 - .15Q$$
$$TR = PQ = 250Q - .15Q^2$$
$$MR = 250 - .30Q$$

Set marginal revenue equal to the marginal cost of 10 and solve for Q

$$MR = 250 - .30Q = 10$$
$$Q = 800$$
$$P = 250 - .15(800) = 130$$
$$\pi = TR - TC = 71{,}000$$
$$ROR = \frac{71{,}000}{500{,}000} * 100 = 14.2\%$$

b) if Price = $100

$$100 = 250 - .15Q$$
$$Q = 1{,}000$$
$$TR = 100{,}000$$
$$TC = 35{,}000$$
$$\pi = 65{,}000$$
$$ROR = 13\%$$

c) See Excel File

Chapter 14

1) Here we can use the same pricing formula as in chapter 11, number 6

$$P_{US} = \frac{MC}{1+\frac{1}{\varepsilon}} = \frac{40}{1-\frac{1}{2}} = 80 \qquad P_E = \frac{MC}{1+\frac{1}{\varepsilon}} = \frac{15}{1-\frac{1}{3}} = 27.50$$

3) First, find profits:

$$\pi = P_1 Q_q + P_2 Q_2 - 20 - 4(Q_1 + Q_2)$$

Note that MC = 4 for both goods:

Now, find MR for each good:

$$P_1 = 100 - 2Q_1$$
$$TR_1 = P_1 Q_1 = 100Q_1 - 2Q_1^2$$
$$MR_1 = 100 - 4Q_1$$

$$P_2 = 80 - Q_2$$
$$TR_2 = P_2 Q_2 = 80Q_2 - Q_2^2$$
$$MR_2 = 80 - 2Q_2$$

Now, set MR = MC for each good and solve for Q

$100 - 4Q_1 = 4$	$80 - 2Q_2 = 4$
$Q_1 = 24$	$Q_2 = 38$
$P_1 = 100 - 2Q_1 = 52$	$P_2 = 80 - Q_2 = 42$

Plugging into the profit function, we get profits of $2,576

If we have to set the same price for each good, we need to figure up how many total sales we will get at any common price.

$$P = 100 - 2Q_1 \Rightarrow Q_1 = 50 - \frac{1}{2}P$$
$$P = 80 - Q_2 \Rightarrow Q_2 = 80 - P$$
$$Q_1 + Q_2 = 130 - \frac{3}{2}P$$

Now, with our demand curve, find Marginal Revenue:

$$Q = 130 - \frac{3}{2}P \Rightarrow P = \frac{260}{3} - \frac{2}{3}P$$

$$TR = PQ = \frac{260}{3}Q - \frac{2}{3}Q^2$$

$$MR = \frac{260}{3} - \frac{4}{3}Q = 4 = MC$$

$$Q = 62$$

$$P = 45.33$$

$$\pi = 2295$$

f) With constant marginal costs, you are basically looking for the price that maximizes revenues. When you can charge different prices to the two markets, you are finding the point on each individual demand curve where elasticity is 1, but when you charge a common price, the elasticity of the combined demand curve is 1, but on the individual demands, it is not!

4) This is an example of two part pricing. The basic idea is to charge a low price for the DVD player to make sure everyone buys one and then charge a high price for the DVDs. However, if there are "high price" and "low price" buyers of DVDs and players, you have to be careful with this strategy!

8) First, calculate the monopoly price:

$$P = 2500 - .0005Q$$

$$TR = PQ = 2500Q - .0005Q^2$$

$$MR = 2500 - .001Q = 900 = MC$$

$$Q = 1.6M$$

$$P = \$1700$$

$$\pi = (1700 - 900)1.6M = 1.28B$$

For the price skimming, see the excel file;