Second Quiz Review: Solutions
Managerial Economics: Eco 685

Shorter Questions

Question 1

a. Revenues increase: the price increases more than demand falls, so total revenues increase. The firm earns enough extra revenue off the customers it keeps (who face higher prices), to more than offset the decrease in revenues from the loss of some customers.

b. Costs fall: by producing less, costs fall, leading to an increase in profits.

Question 2

a. False, accounting profits may be positive.

b. True, economic profits tend to zero, which means the next best option has the same accounting profits.

c. False, marginal costs are equal to the price as a result of firms maximizing profits. The price equals average cost in order to keep economic profits at zero. Therefore, marginal costs equal average costs.

d. True, this is the definition of the long run.

e. False, the price will adjust as competitors enter or exit.

f. True, as firms enter, more competition decreases the price and the reverse.

Question 3

a. False. If demand is price inelastic, the firm should continue to increase the price until the price becomes elastic. The optimal markup will not be 3.

b. False, the firm should decrease production. The price will rise more than enough to increase revenues, despite the loss of some customers.

c. True, The price will rise more than enough to increase revenues, despite the loss of some customers.

d. True, producing less requires less inputs.

e. True, producing less increases the price. As the price rises, consumers become more price sensitive. At some point, even your most loyal customers become unable to afford the product.

f. False. The industry as a whole is always more price inelastic. Individual firms face competitors both from other industries and within an industry. The industry only faces competitors from other industries.

Question 4

a. We are given:

$$Q = 250 - \frac{1}{2}P. \tag{1}$$

$$TC = 50Q + \frac{1}{4}Q^2. \tag{2}$$

The problem asks to maximize profits. We know that the market is imperfectly competitive, both because the problem says the taxi service has a monopoly and because we are given a demand curve, not a price.

For imperfect competition, we know that maximizing profits means $MR = MC$. So we need to find marginal revenue. The first step is to find how the price changes with the amount produced. Using the demand curve:

$$Q = 250 - \frac{1}{2}P. \tag{3}$$

$$\frac{1}{2}P = 250 - Q, \tag{4}$$

$$P = 500 - 2Q. \tag{5}$$

The next step is to find total revenue:

$$TR = P \cdot Q = (500 - 2Q)\,Q = 500Q - 2Q^2. \tag{6}$$

The next step is to find marginal revenue:

$$MR = \frac{dTR}{dQ} = 500 - 4Q. \tag{7}$$

The next step is to compute marginal costs:

$$TC = 50Q + \frac{1}{4}Q^2, \tag{8}$$

$$MC = \frac{dTC}{dQ} = 50 + \frac{1}{2}Q. \tag{9}$$

Finally, we set $MR = MC$:

$$500 - 4Q = 50 + \frac{1}{2}Q, \tag{10}$$

$$450 = \frac{9}{2}Q, \ \rightarrow \ Q = 100. \tag{11}$$

Producing $Q = 100$ maximizes profits.

b. We can use the price equation (5) to get the price:

$$P = 500 - 2Q = 500 - 2 \cdot 100 = 300. \tag{12}$$

The price elasticity formula is:

$$e_p = \frac{P}{Q}\frac{dQ}{dP}. \tag{13}$$

For the derivative, we can use the demand curve (3):

$$\frac{dQ}{dP} = -\frac{1}{2}. \tag{14}$$

Therefore:

$$e_p = \frac{P}{Q}\frac{dQ}{dP} = \frac{300}{100}\left(-\frac{1}{2}\right) = -\frac{3}{2}. \tag{15}$$

The elasticity is in the elastic range, as expected.

c. Under perfect competition, price equals marginal cost. Further, we have the price equation (5). Therefore:

$$P = MC = \frac{dTC}{dQ}, \tag{16}$$

$$500 - 2Q = 50 + \frac{1}{2}Q, \tag{17}$$

$$450 = \frac{5}{2}Q, \;\; \rightarrow \;\; Q = 180. \tag{18}$$

d. From equation (5) the price is:

$$P = 500 - 2Q = 500 - 2 \cdot 180 = 140. \tag{19}$$

Notice that the quantity is higher and the price is lower under perfect competition. Under imperfect competition, the strategy is to reduce output and increase the price. Demand is also price inelastic at the competitive price.

$$e_p = \frac{P}{Q}\frac{dQ}{dP} = \frac{140}{180}\left(-\frac{1}{2}\right) = -\frac{7}{18}. \tag{20}$$

The strategy under imperfect competition is to increase the price until the elasticity becomes sufficiently elastic.

e. The strategy is to restrict production. Few customers are lost until the price increases to the point where the demand becomes elastic. Further, costs fall as we restrict production.

Question 5

a. For the cost plus price, we multiply one plus the markup times the average cost. For the single and double sized plants:

$$P = 1.15 \cdot 4.47 = \$5.14. \tag{21}$$

For the nuclear plant:

$$P = 1.15 \cdot 2.14 = \$2.46. \tag{22}$$

b. Plugging into the optimal price formula, we see that:

$$P = \frac{1}{\frac{1}{e_p} + 1} MC = \frac{1}{\frac{1}{-6} + 1} \cdot MC, \tag{23}$$

$$P = \frac{6}{5} MC = 1.2MC. \tag{24}$$

Now since average variable costs are constant, then average variable costs equal marginal costs:

$$TC = TFC + AVC \cdot Q, \tag{25}$$

$$\frac{dTC}{dQ} = MC = AVC. \tag{26}$$

Therefore, the optimal price in this example is a 20% markup over average variable costs. Therefore for a single unit:

$$P = 1.2MC, \tag{27}$$

$$P = 1.2 \cdot 4.47 = \$5.36. \tag{28}$$

For a nuclear unit:

$$P = 1.2 \cdot \$2.14 = \$2.57. \tag{29}$$

c. Since marginal and average variable costs are the same, the only difference is that the cost plus price is a 15% markup, whereas the unregulated price has a 20% markup. The regulator is forcing the monopolist to sell at a low price.

Question 6

a. We are maximizing profits so we need to set $MR = MC$ for each type of customer. Starting with the LA customers, the first step is to find the price as a function of the quantity demanded:

$$Q_{LA} = 70 - 2P_{LA}, \tag{30}$$

$$2P_{LA} = 70 - Q_{LA}, \;\; \rightarrow \;\; P_{LA} = 35 - \frac{1}{2}Q_{LA}. \tag{31}$$

The next step is to construct total revenue:

$$TR = P \cdot Q_{LA} = \left(35 - \frac{1}{2}Q_{LA}\right) Q_{LA}, \tag{32}$$

$$TR = 35Q_{LA} - \frac{1}{2}Q_{LA}^2. \tag{33}$$

Then next step is to find marginal revenue:

$$MR_{LA} = \frac{dTR}{dQ_{LA}} = 35 - Q_{LA}. \tag{34}$$

Next, marginal cost is:

$$TC = 100 + 6\left(Q_{LA} + Q_{SF}\right), \tag{35}$$

$$MC_{LA} = \frac{dTC}{dQ_{LA}} = 6. \tag{36}$$

So setting $MR_{LA} = MC_{LA}$ results in:

$$MR_{LA} = 35 - Q_{LA} = MC_{LA} = 6, \;\; \rightarrow \;\; Q_{LA} = 29. \tag{37}$$

Repeating for SF:

$$Q_{SF} = 50 - P_{SF}, \tag{38}$$

$$P_{SF} = 50 - Q_{SF}. \tag{39}$$

Construct total revenue:

$$TR = P \cdot Q_{SF} = \left(50 - Q_{SF}\right) Q_{SF}, \tag{40}$$

$$TR = 50Q_{SF} - Q_{SF}^2. \tag{41}$$

Marginal revenue:

$$MR_{SF} = \frac{dTR}{dQ_{SF}} = 50 - 2Q_{SF}. \tag{42}$$

Marginal cost:

$$TC = 100 + 6\left(Q_{SF} + Q_{SF}\right), \tag{43}$$

$$MC_{SF} = \frac{dTC}{dQ_{SF}} = 6. \tag{44}$$

Set $MR_{SF} = MC_{SF}$:

$$50 - 2Q_{SF} = 6, \ \rightarrow \ Q_{SF} = 22. \tag{45}$$

For the prices we can use the demand curves (31) and (39):

$$P_{LA} = 35 - \frac{1}{2} \cdot 29 = \$20.5 \tag{46}$$

$$P_{SF} = 50 - 22 = \$28. \tag{47}$$

b. The price elasticity in LA is:

$$e_{p,LA} = \left(\frac{P}{Q}\right)\left(\frac{dQ}{dP}\right) = \frac{\$20.5}{29}(-2) = -1.41. \tag{48}$$

$$e_{p,SF} = \left(\frac{P}{Q}\right)\left(\frac{dQ}{dP}\right) = \frac{\$28}{22}(-1) = -1.27 \tag{49}$$

LA is more price sensitive: the elasticity is more negative, and the price in LA is lower, which reflects that increasing the price in LA would drive away too many customers.

c. Customers in San Fransisco could drive to LA to purchase clothes.

d. If no price discrimination exists, April charges the same price P in both regions. Demand is:

$$Q_{LA} = 70 - 2P \tag{50}$$

$$Q_{SF} = 50 - P \tag{51}$$

Therefore, total demand is:

$$Q = Q_{LA} + Q_{SF} = 120 - 3P. \tag{52}$$

So the inverse demand is:

$$3P = 120 - Q, \tag{53}$$

$$P = 40 - \frac{1}{3}Q. \tag{54}$$

Next,

$$TC = 100 + 6\left(Q_{LA} + Q_{SF}\right) = 100 + 6Q. \tag{55}$$

Next, we set marginal revenue equal to marginal cost:

$$TR = P \cdot Q = \left(40 - \frac{1}{3}Q\right)Q = 40Q - \frac{1}{3}Q^2, \tag{56}$$

$$MR = \frac{dTR}{dQ} = 40 - \frac{2}{3}Q. \tag{57}$$

$$TC = 100 + 6Q, \tag{58}$$

$$MC = \frac{dTC}{dQ} = 6. \tag{59}$$

Therefore,

$$40 - \frac{2}{3}Q = 6, \ \rightarrow \ Q = 51. \tag{60}$$

The price is then:

$$P = 40 - \frac{1}{3}51 = 23. \tag{61}$$

Without price discrimination exactly the same amount is produced (51). This is not always true, however. The price is between the two prices under price discrimination and reflects an average of the two regions price sensitivity.

Question 7

a. Second degree since we have a quantity discount. For 2 GB the cost is \$15 per GB, for 5 GB the cost is \$10 per GB, and for 10 GB the cost is \$8 per GB.

b. We have 3rd degree price discrimination here, the drink is the same good, but the price is different for happy hour customers and night customers. Apparently, the after work group is more price sensitive than the group going out later. Note that one would think that the after work group is wealthier and therefore more price sensitive, but there are many reasons other than income why a group might be more price sensitive. For example, the after work group may have less free time.

c. Third degree price discrimination, since different income levels have different prices.

d. First degree price discrimination, since each customer is charged a potentially different price.

e. One could argue either third degree price discrimination, or argue that women's hair cuts are a different good, for example by taking longer to cut.

Question 8

a. Fixed costs are the same regardless of Q, so because total fixed costs for $Q = 7$ are \$5, total fixed costs are \$5 for all other values of Q.

   Next marginal cost for $Q = 5$ may be computed using the delta formula:

$$MC_5 = \frac{\Delta TC}{\Delta Q} = \frac{\Delta TVC}{\Delta Q} = \frac{30 - 10.5}{5 - 2} = 6.5. \tag{62}$$

   Notice that one could get the same answer by first computing total costs. This is because fixed costs are the same regardless of Q and will not affect the cost of one additional unit (marginal costs). The rest of the numbers are in the table.

   For marginal revenue, we need total revenues, and then we can use the delta formulas. For $Q = 5$, we have $TR = P \cdot Q = 15 \cdot 5 = 75$. For $Q = 2$, we have $TR = 18 \cdot 2 = 36$. Therefore:

$$MR_5 = \frac{\Delta TR}{\Delta Q} = \frac{75 - 36}{5 - 2} = 13. \tag{63}$$

   The rest of the numbers are in the table.

For the elasticity, we can use the formula:

$$e_p = \frac{P}{Q}\frac{\Delta Q}{\Delta P}, \tag{64}$$

So for example, for $Q = 5$:

$$e_p = \frac{15}{5}\frac{5-2}{15-18} = -3, \tag{65}$$

The rest of the numbers are in the table. As expected, the higher the price, the more elastic is demand.

Q	Price	Total Variable Cost	Total Fixed Costs	Marginal Revenue	Marginal Cost	Price Elasticity
2	18	10.5	5	NA	NA	NA
5	15	30	5	13	6.5	-3
6	14	38.5	5	**9**	**8.5**	-2.33
7	13	48	5	**7**	**9.5**	-1.86
8	12	58.5	5	5	10.5	-1.5
10	10	82.5	5	2	12	-1

Table 1: Cost/Revenue table.

b. We produce where marginal revenue equals marginal cost. Unit 6 has marginal revenue of 9 and marginal cost of 8.5. Therefore, we make profits of 0.5 on this unit. The marginal revenue is less than the price because we must lower the price on all units to sell all six units. Unit 7 has marginal revenue of 7 and marginal cost of 9.5. Therefore, we lose 2.5 on this unit. Therefore, produce between 6 and 7 units, where $MR = MC$ (probably pretty close to 6 units). From the table, we should charge a price of between 13 and 14 but probably close to 14. Notice the elasticity is in the elastic range at the optimal price as expected.

Question 9

a. We have:

$$MC = \frac{\Delta TC}{\Delta Q} = \frac{\$150{,}000 \cdot (4-3)}{40-30} = \$15{,}000. \tag{66}$$

Apparently, the marginal cost of taking on another investor is \$15K (10% of a manager's time).

b. We can use the pricing formula:

$$P = \frac{MC}{1 + \frac{1}{e_P}}, \tag{67}$$

$$\$20{,}000 = \frac{\$15{,}000}{1 + \frac{1}{e_P}}, \tag{68}$$

$$1 + \frac{1}{e_P} = \frac{3}{4}, \tag{69}$$

$$\frac{1}{e_P} = -\frac{1}{4}, \tag{70}$$

$$e_P = -4. \tag{71}$$

The firm believes the price elasticity is −4.