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**Chapter 9 Problem Set**

**1. Managers at the Ridgeway Corporation produce a medical device sold in Japan, Europe and the United States. Price elasticity of demand is -4 in Japan, -2 in the United States and -1.33 in Europe. Market is sealed.**

a. The firm’s VP for marketing circulates a memo recommending the price of the device be 1,000 in Japan, 2000 in US and 3000 in Europe. Comment on his recommendations.

In general, the VP is following a decent pricing strategy: charging more to countries that have more inelastic price elasticities of demand. However, the VP has not optimized for third degree price discrimination, which is what he is attempting to practice here. Marginal revenues for all three countries need to be equal.

In this case:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Japan | United States | Europe |
| Price | 1000 | 2000 | 3000 |
| Marginal Revenue | 1000(1-1/4) = 750 | 2000(1-1/2) = 1000 | 3000(1-1/1.33) = 750 |

The United States is not optimized given their price elasticity of demand.

**b. Quantity of devices being sold into the United States is lower than expected. Why?**

The Price has been set too high. The VP needs to set the United States price lower to optimize profits and sell more units. In this case, the price would need to be set at $1500. (0.5x = 750) if output is pre-determined. However, the VP will also need to account for marginal costs if optimizing profits and output is not pre-determined.

**c. Price is lowered in US to $1,500. IS this a wise decision?**

It is if output is pre-determined and MC is known. However, we do not know marginal cost, so one cannot say for sure if it is truly wise. We have not optimized for profit and have not been given any information on costs or goals.

**d. Can you be sure that managers are maximizing profit?**

No. We do not know marginal cost.

**2. Ann McCutcheon, two distinct markets, sealed off from one another.**

**P1 = 160 – 8Q**

**P2 = 80 – 2Q**

**MC = 5 + Q**

**a. How many units of output should she tell managers to sell in the *second* market?**

TR1 = 160Q – 8Q^2

TR2 = 80Q – 2Q^2

MR1 = 160 – 16Q1

MR2 = 80 – 4Q2

80 – 4Q2 = 5 + Q1 + Q2

Q1 = 75 – 5Q2

160 – 16Q1 = 5 + Q1 + Q2

Q2 = 155 – 17Q1

Q2 = 155 – 17(75 – 5Q2)

Q2 = 13.33 units sold in second market

**b. How many units of output should she tell managers to sell in the first market?**

Q1 = 75 – 5(13.33) = 8.33 units of output in first market.

**c. What price should managers charge in each market?**

P1 = 160 – 8(8.33) = $93.33 in first market

P2 = 80 – 2(13.33) = $53.33 in second market

**5.** **In the town of Oz, there are wizards and imps that play tennis. Wizards and imps don’t socialize (single demanders) so we cannot start a club with both. Imps have access to credit but a weak demand for tennis:**

**Pi = 30 – Qi**

**Where Qi is the number of games at price Pi. Imps are willing to pay an upfront fee to join the club.**

**Wizards live paycheck to paycheck and would be willing to pay for each tennis game as they go along.**

**Pw = 40 – Qw**

**There are an equal number of wizards and imps. The marginal cost of one game of tennis is a constant 2. You can design your facility to attract either wizards or imps but not both. Which clientele would you like to attract and what would be your profit per “person”?**

Imps prefer a two-part tariff pricing strategy. Because we have a case where there is a single demand curve with constant MC, to maximize profit and capture all surplus, we set P\* = MC, which in this case P\* = 2.

We can rearrange Pi above to get Qi = 30 – Pi, which would give us a quantity demanded of 28 games at a price of 2.

At this quantity, the use fee would only cover marginal cost. 28(2) = 56. However, to capture the consumer surplus from imps, we can charge them an entry fee. This entry fee is the area of the trapezoid above the marginal cost line and below the demand curve:

**Imps entry fee would be 0.5(30-2)28 = 392, resulting in a profit of $392 and maximization of producer surplus for us.**

Wizards, on the other hand, would follow a typical single price maximization strategy, although we could implement peak load pricing or second degree pricing, but not enough information is given. We set MR = MC for wizards.

In this case, TRw = 40Q – Qw^2 and MRw = 40 – 2Qw

Therefore, 40 – 2Qw = 2 and Qw = 19

Plugging optimal quantity back into the wizard’s demand curve, we get 40 – 19 = $21 for their optimal price.

**This results in a total revenue of 21(19) = $399. Subtracting out marginal costs per game 19(2) = 38, wizards profit is $361.**

**Therefore, we would serve imps over wizards, as they are more profitable per “person.”**

**7.** **The demand for a strong demander for a round of golf is**

**Ps = 6 – Qs**

**Where Qs it the number of rounds demanded by a strong demander when the price of a round of golf is Ps**

**The demand for a weak demander for a round of golf is**

**Pw = 4 – Qw**

**The marginal cost is a constant 2 and there is one golfer of each type. Pricing strategy is a two-part tariff. Find optimal entry and use fee to maximize club’s profit. The club cannot discriminate on either the use or entry fee and fixed cost is 1.**

**With no discrimination, there are three main strategies: P = MC and obtain surplus from weak demander, P = MC and obtain surplus from strong demander or set P > MC to capture variable revenue and then obtain surplus from weak demander.**

**Scenario 1: P = MC, Capture Surplus from Weak Demander**

This strategy does *not* price out the weak demander.

Pw = 2

Qw = 4 – 2 = 2

Variable cost use fee: (2)(2) = 4

Variable cost use fee \* 2 (because both pay) = **8**

Entry fee: 0.5(4-2)2 = 2

Entry fee \* 2 (because both strong and weak demanders pay fee) = **4**

**Total Profit = 4 – FC(1) = $3**

**Scenario 2: P = MC, Capture Surplus from Strong Demander**

Ps = 2

Qs = 6 – Ps

Qs = 4

Variable cost use fee = 4(2) = 8 (only strong demander pays b/c weak priced out)

Surplus = 0.5(6 - 2)4 = 8

**Total Profit = 8 – FC(1) = 7 (where variable revenue covers variable costs)**

**Scenario 3: P\* > MC and entry fee = weak surplus**

P\*, unknown, let’s find it by optimizing. Combine the demand & inverse demand curves:

P = 10 – 2Q

Q = 10 – 2P

Use fee revenue = [10 - 2P][P - 2] = 10P – 20 -2P^2 + 4P = **-2P^2 +14P – 20**

* Scenario provides a profit here, so cannot discard like previous scenarios

**Entry fee: because we don’t know P**

0.5[4-P][4-P] = 0.5(16 – 8P + P^2) = 0.5P^2 – 4P + 8

Entry fee \* 2 (since both pay) = **P^2 - 8P + 16**

Optimal price:

VC profit = (-2P^2 +14P – 20) + (P^2 - 8P + 16)

= -P^2 + 6P – 4

optimize to find P\*:

d(vcp)/d(p) = -2P + 6 = 0

**P = 3 is the optimal price**

Use fee: -2(3)^2 + 14(3) – 20 = 4

Entry fee: 3^2 – 8(3) + 16 = 1

**VC Profit = -9 + 18 – 4 = 5 – 1 = 4 = Total profit**

**Scenario 2 is the most profitable. The optimal use fee is the marginal cost, $2, and the optimal entry fee of $8 is obtained by considering only strong demanders surplus.**

**8. The university museum has two types of visitors. University employees and non-affiliated employees. All employees have identical annual demands for museum visits:**

**Pp = 30 – Qp**

**Where Qp is the number of visits demanded if the price is Pp per visit. Nonaffiliated people have identical annual demands for museum visits, but differ from university employees:**

**Pn = 100 – Qn**

**The museum is considering two different pricing policies:**

**Policy 1:**

* **For university employees, an annual membership fee and an additional price per visit. (Only university employees are eligible for this membership plan)**
* **For nonaffiliated visitors: a SINGLE price per visit with no membership fee. (This price per visit is not necessarily the same as the university employee price per visit.)**

**Policy 2:**

* **This policy would offer a different price per visit for each type of visitor, but no membership fees at all.**

**Constant marginal cost of $6 per visit, regardless of visitor’s type. One university employee and one nonaffiliated person in the target population.**

**How much more profit does the best policy yield than the other policy?**

**Policy 1:**

There are two sub-policies in policy 1. The first sub-policy considers only university employees with a single demand curve. The sub policy also identifies a two-part tariff. Therefore, to maximize profit, we can set P\* = MC, in this case, 6. To capture all of the resulting surplus, we solve for the area of the trapezoid not including the use fee revenue (cost):

**0.5(30-6)24 = 288**

The second sub-policy considers a single price per visit for non-affiliated visitors. We want to optimize for the single price and quantity that maximizes profit using MRn = MC.

TR = 100Q – Qn^2

MR = 100 – 2Qn

100 – 2Qn = 6

Qn = 47

Qp = 100 – 47 = 53

TRn = (53)(47) = 2491

The museum does not have any fixed costs listed, however, we know that marginal costs are constant at $6 and thus equal average variable costs.

VC = 47(6) = 282

Profit for sub policy 2 is thus: 2491 – 282 = 2209

and

**Total profit for policy 1 = 2209 + 288 = 2497**

**Policy 2:**

This policy price discriminates. In this case, since we have groups and charge different prices to these groups for the same cost product, this is a third-degree price discrimination strategy.

Thus, MRp = MRn = MC(Qp+Qn) where MC in this case is a constant 6 and is made up of Qp and Qn.

Affiliates:

Pp = 30 – Qp

TRp **=** 30Q – Qp^2

MRp = 30 – 2Qp

Non-affiliates:

Pn = 100 – Qn

TRn = 100Q – Qn^2

MRn = 100 – 2Qn

Because MC is a constant 6, we have

30 – 2Qp = 6

Qp = 12 and Pp = 18 with a TR of (18)(12) = 216

And

100 – 2Qn = 6

Qn = 47 and Pn = 53 with a TR of (47)(53) = 2491

Summing both revenues, we arrive at a total revenue of 2707

With 59 units at MC = AVC of 6, total variable cost is 354

Thus, profit for policy 2 is:

**2707 – 354 = 2353**

**Decision: we’d go with policy 1 which has a (2497-2353) = $144 larger profit than policy 2**