

### Problem Set 11

On what and how to submit

- For this and all future problem sets, questions are from the “Problems” section of the questions at the end of the chapter.
- Due before Lecture 12 to your Box folder
- Name the file “ps11-[lastname].[extension]”. For example, my file would be “ps11\_brooks.pdf”.
- You do not need to type your submission. Any **legible** submission is ok. For example, you can write the problem set with hand-drawn graphs, take a picture, and submit the picture.

1. GLS Chapter 10, Question 12

(a) What price should Carolina Atlantic charge for each group?

A profit maximizing firm with market power would like to charge each group the profit maximizing price. To find the profit maximizing price, remember that the profit maximizing firm with market power sets  $MR = MC$ , and that  $MR$  has the same intercept and is twice as steep as the original demand curve.

With these ideas in mind, for intensive users,  $MR_I = 8 - \frac{2}{10}Q$ . The profit maximizing firm sets  $MR = MC$ , and  $MC =$  is given:

$$\begin{aligned}MR_I &= MC \\8 - \frac{2}{10}Q &= 0 \\ \frac{1}{5}Q &= 8 \\ Q_I &= 40\end{aligned}$$

Now, while the profit maximizing firm with market power *could* choose to set  $P = MC$ , it does not, since it can charge the price on the demand curve. Therefore, to find the profit maximizing price, we plug  $Q = 40$  into the demand curve:

$$\begin{aligned}P_I &= 8 - \frac{1}{10}Q_I \\ &= 8 - \frac{1}{10}(40) \\ &= 8 - 4 \\ &= 4\end{aligned}$$

The firm behaves differently for the consumers with less intensive demand, but uses the same logical process. With these ideas in mind, for the intensive user,  $MR_L = 10 - \frac{4}{10}Q$ . The profit maximizing firm sets  $MR = MC$ :

$$\begin{aligned} MR_L &= MC \\ 10 - \frac{4}{10}Q &= 0 \\ \frac{2}{5}Q &= 10 \\ Q &= \frac{10(5)}{2} \\ Q_L &= 25 \end{aligned}$$

Again, the firm finds the price from the demand curve:

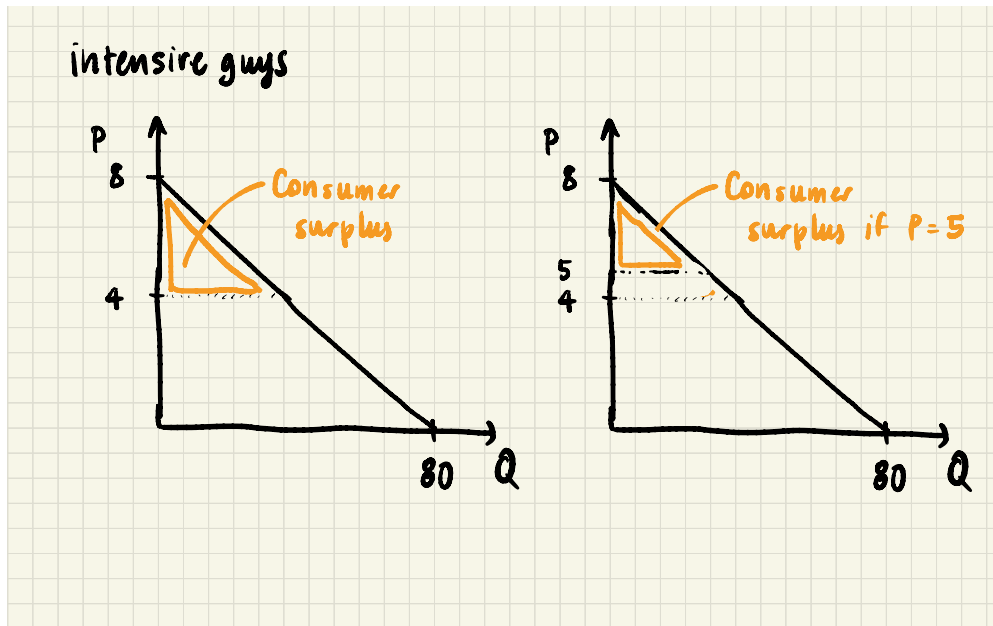
$$\begin{aligned} P_L &= 10 - \frac{2}{10}Q_L \\ &= 10 - \frac{2}{10}(25) \\ &= 10 - 5 \\ &= 5 \end{aligned}$$

Given all this information, how does the firm set prices? In an attempt to segment the two groups, it can say “if you want to buy 40 units or more, your price is \$4. If you want to buy fewer than 40 units, your price is \$5.”

(b) Show that this is not incentive compatible.

To evaluate whether this scheme is incentive compatible or not, we need to know whether either group would like to switch. To figure out if a group would like to switch, we need to know their consumer surplus under each pricing plan.

Let’s start with consumer surplus for the intensive types. See the picture below. Consumer surplus under the “buy at least 40 units at price of \$4” plan gives a consumer surplus  $CS = \frac{1}{2}(40)(8 - 4) = 20(4) = 80$ . Were these intensive types to buy at \$5, they would buy fewer units and get less consumer surplus. Therefore, for the intensive types, they have no desire to switch and the plan is incentive compatible.



Now let's evaluate the consumer surplus for the less intensive types. See the picture below. When the less intensive type consumers are charged a price of \$5, their consumer surplus is area  $A$ , so  $CS = \frac{1}{2}(25)(10 - 5) = 125/2 = 62.5$ . What if the price declines to \$4, and consumers are required to purchase at least 40 units? Would these consumers do that?

Return to the picture below. When the price drops to \$4, consumers gain the surplus between 4 and 5 dollars, but they have to purchase a bunch of units that they don't want. Are they better off purchasing these extra units, due to the lower price and throwing some away? If they purchase at \$5, they receive surplus of area  $A$ . If they purchase at \$4, then receive surplus of  $A + B - C$ .

Fundamentally, we are interested in whether area  $B$  is greater than area  $C$ .

How do we find the size of these areas? There are two key points we need to know, labeled  $a$  and  $b$  in the figures below. For the upper point ( $a$ ), we need to know the quantity demanded when price is 4, which we can find from the demand curve:

$$\begin{aligned}
 P &= 10 - \frac{2}{10}Q \\
 4 &= 10 - \frac{2}{10}Q \\
 \frac{2}{10}Q &= 6 \\
 Q &= \frac{60}{2} \\
 Q &= 30
 \end{aligned}$$

For the lower point (*b*), we need to know the price where quantity is 40 – remember that our pricing plan required consumers to buy at least 40 units. We find this price by plugging  $Q = 40$  into the demand curve:

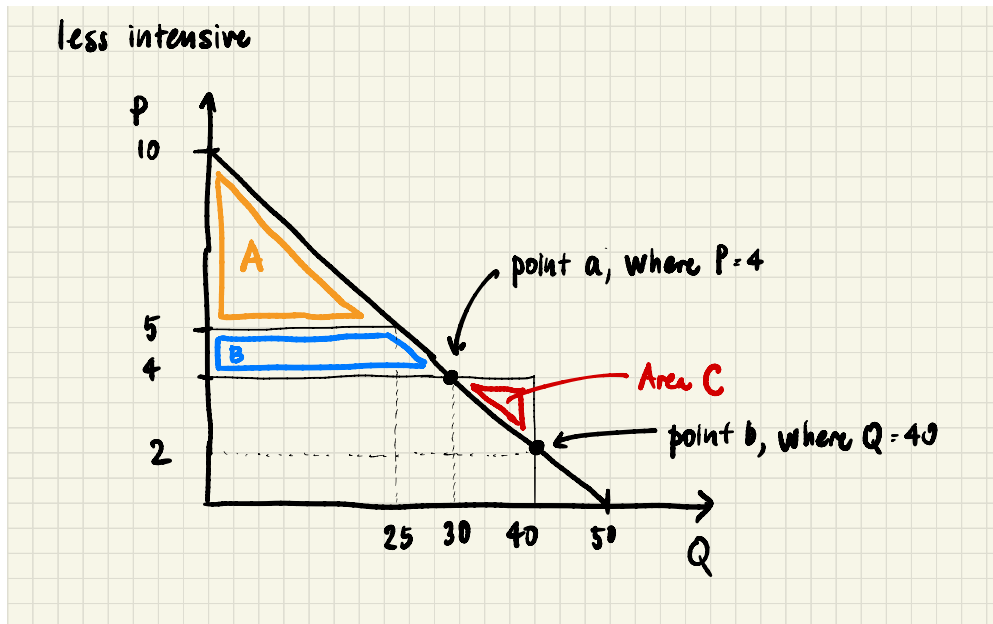
$$\begin{aligned}
 P &= 10 - \frac{2}{10}Q \\
 &= 10 - \frac{2}{10}40 \\
 &= 10 - \frac{80}{10} \\
 &= 10 - 8 \\
 &= 2
 \end{aligned}$$

The area of *B* is a rectangle of height 1 (= 5-4) and a width of 25, plus the area of the little triangle. We know that the triangle is one unit high and 5 (=30-25) units wide. This total area is  $B = (5 - 4)25 + \frac{1}{2}(5)(1) = 27.5$ .

The area of *C* is a triangle of height 2 (=4-2) and a width of 20 (=40-30). Therefore, the area of is  $C = \frac{1}{2}(40 - 30)(4 - 2) = \frac{1}{2}(20) = 10$ .

Since area *C* is smaller than area *B*, these less intensive users are better off buying 40 units and either reselling them or putting them in the trash. In other words, these consumers want to take the \$4 price that the profit maximizing firm would prefer they avoid.

Bottom line – this scheme is not incentive compatible.



2. GLS Chapter 10, Question 23

(a) Ladies' Night

This is segmenting, where the firm thinks that some consumers have a higher willingness to pay.

(b) Tires at \$160 each, or 4 for \$400

This is a quantity discount, which in the firm is trying to charge a profit maximizing price to two different groups.

(c) Joining fee, plus per use fee

This is a two-part tariff.

(d) Charmin is only sold in 12-roll packages

Block pricing

(e) Denny's bacon and egg, or bacon and egg separately

mixed bundling

(f) handplane in cast iron versus cast bronze

versioning

#### 4. Pricing Strategies

Use a paragraph or two to explain a pricing strategy to which you have been a party. What kind of strategy was it, and how did you take part?

Any reasonably argued example is acceptable here.