Practice Questions and Answers from Lesson III-3: Monopoly

The following questions practice these skills:

✓ Explain the sources of market power.
✓ Apply the quantity and price affects on revenue of any movement along a demand curve.
✓ Find the profit maximizing quantity and price of a single-price monopolist.
✓ Compute deadweight loss from a single-price monopolist.
✓ Compute marginal revenue.
✓ Define the efficiency of P = MC.
✓ Find the profit-maximizing quantity and price of a perfect-price-discriminating monopolist.
✓ Find the profit-maximizing quantity and price of an imperfect-price-discriminating monopolist.

Question: Each of the following firms possesses market power. Explain its source.

a. Merck, the producer of the patented cholesterol-lowering drug Zetia
b. Chiquita, a supplier of bananas and owner of most banana plantations

Answer to Question:

a. Merck has a patent for Zetia. This is an example of a government-created barrier to entry, which gives Merck market power.

b. Chiquita controls most banana plantations. Control over a scarce resource gives Chiquita market power.

Question: Skyscraper City has a subway system, for which a one-way fare is $1.50. There is pressure on the mayor to reduce the fee by one-third, to $1.00. The mayor is dismayed, thinking that this will mean Skyscraper City is losing one-third of its revenue from sales of subway tickets. The mayor’s economic adviser reminds her that she is focusing only on the price effect and ignoring the quantity effect. Explain why the mayor’s estimate of a one-third loss of revenue is likely to be an overestimate. Illustrate with a diagram.

Answer to Question:

A reduction in fares from $1.50 to $1.00 will reduce the revenue on each ticket that is currently sold by one-third; this is the price effect. But a reduction in price will lead to more tickets being sold at the lower price of $1.00, which creates additional revenue; this is the quantity effect. The price effect is the loss of revenue on all the currently sold tickets. The quantity effect is the increase in revenue from increased sales as a result of the lower price.

Question: Consider an industry with the demand curve \((D)\) and marginal cost curve \((MC)\) shown in the accompanying diagram. There is no fixed cost. If the industry is a single-price monopoly, the monopolist’s marginal revenue curve would be \(MR\). Answer the following questions by naming the appropriate points or areas.
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a. If the industry is perfectly competitive, what will be the total quantity produced? At what price?
b. Which area reflects consumer surplus under perfect competition?
c. If the industry is a single-price monopoly, what quantity will the monopolist produce? Which price will it charge?
d. Which area reflects the single-price monopolist’s profit?
e. Which area reflects consumer surplus under single-price monopoly?
f. Which area reflects the deadweight loss to society from single-price monopoly?
g. If the monopolist can price-discriminate perfectly, what quantity will the perfectly price-discriminating monopolist produce?

Answer to Question:
a. In a perfectly competitive industry, each firm maximizes profit by producing the quantity at which price equals marginal cost. That is, all firms together produce a quantity \( S \), corresponding to point \( R \), where the marginal cost curve crosses the demand curve. Price will be equal to marginal cost, \( E \).
b. Consumer surplus is the area under the demand curve and above price. In part a, we saw that the perfectly competitive price is \( E \). Consumer surplus in perfect competition is therefore the triangle \( ABE \).
c. A single-price monopolist produces the quantity at which marginal cost equals marginal revenue, that is, quantity \( I \). Accordingly, the monopolist charges price \( B \), the highest price it can charge if it wants to sell quantity \( I \).
d. The single-price monopolist’s profit per unit is the difference between price and the average total cost. Since there is no fixed cost and the marginal cost is constant (each unit costs the same to produce), the marginal cost is the same as the average total cost. That is, profit per unit is the distance \( BE \). Since the monopolist sells \( I \) units, its profit is \( BE \) times \( I \), or the rectangle \( BEHF \).
e. Consumer surplus is the area under the demand curve and above the price. In part c, we saw that the monopoly price is \( B \). Consumer surplus in monopoly is therefore the triangle \( AFB \).
f. Deadweight loss is the surplus that would have been available (either to consumers or producers) under perfect competition but that is lost when there is a single-price monopolist. It is the triangle \( FRH \).
g. If a monopolist can price-discriminate perfectly, it will sell the first unit at price \( A \), the second unit at a slightly lower price, and so forth. That is, it will extract from each consumer just that consumer’s willingness to pay, as indicated by the demand curve. It will sell \( S \) units, because for the last unit, it can just make a consumer pay a price of \( E \) (equal to its marginal cost), and that just covers its marginal cost of producing that last unit. For any further units, it could not make any consumer pay more than its marginal cost, and it therefore stops selling units at quantity \( S \).
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**Question:** Bob, Bill, Ben, and Brad Baxter have just made a documentary movie about their basketball team. They are thinking about making the movie available for download on the Internet, and they can act as a single-price monopolist if they choose to. Each time the movie is downloaded, their Internet service provider charges them a fee of $4. The Baxter brothers are arguing about which price to charge customers per download. The accompanying table shows the demand schedule for their film.

<table>
<thead>
<tr>
<th>Price of download</th>
<th>Quantity of downloads demanded</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10</td>
<td>0</td>
</tr>
<tr>
<td>$8</td>
<td>1</td>
</tr>
<tr>
<td>$6</td>
<td>3</td>
</tr>
<tr>
<td>$4</td>
<td>6</td>
</tr>
<tr>
<td>$2</td>
<td>10</td>
</tr>
<tr>
<td>$0</td>
<td>15</td>
</tr>
</tbody>
</table>

**a.** Calculate the total revenue and the marginal revenue per download.

**b.** Bob is proud of the film and wants as many people as possible to download it. Which price would he choose? How many downloads would be sold?

**c.** Bill wants as much total revenue as possible. Which price would he choose? How many downloads would be sold?

**d.** Ben wants to maximize profit. Which price would he choose? How many downloads would be sold?

**e.** Brad wants to charge the efficient price. Which price would he choose? How many downloads would be sold?

**Answer to Question:**

a. The accompanying table calculates total revenue (TR) and marginal revenue (MR). Recall that marginal revenue is the additional revenue per unit of output.

<table>
<thead>
<tr>
<th>Price of download</th>
<th>Quantity of downloads demanded</th>
<th>TR</th>
<th>MR</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10</td>
<td>0</td>
<td>$0</td>
<td>-</td>
</tr>
<tr>
<td>$8</td>
<td>1</td>
<td>$8</td>
<td>$8</td>
</tr>
<tr>
<td>$6</td>
<td>3</td>
<td>$18</td>
<td>$5</td>
</tr>
<tr>
<td>$4</td>
<td>6</td>
<td>$24</td>
<td>$2</td>
</tr>
<tr>
<td>$2</td>
<td>10</td>
<td>$20</td>
<td>$1</td>
</tr>
<tr>
<td>$0</td>
<td>15</td>
<td>$0</td>
<td>$4</td>
</tr>
</tbody>
</table>

b. Bob would charge $0. At that price, there would be 15 downloads, the largest quantity they can sell.

c. Bill would charge $4. At that price, total revenue is greatest ($24). At that price, there would be 6 downloads.

d. Ben would charge $6. At that price, there would be 3 downloads. For any more downloads, marginal revenue would be below marginal cost, and so further downloads would lose the Baxters’ money.

e. Brad would charge $4. A price equal to marginal cost is efficient. At that price, there would be 6 downloads.
Question: Suppose that De Beers is a single-price monopolist in the market for diamonds. De Beers has five potential customers: Raquel, Jackie, Joan, Mia, and Sophia. Each of these customers will buy at most one diamond—and only if the price is just equal to, or lower than, her willingness to pay. Raquel’s willingness to pay is $400; Jackie’s, $300; Joan’s, $200; Mia’s, $100; and Sophia’s, $0. De Beers’s marginal cost per diamond is $100. This leads to the demand schedule for diamonds shown in the accompanying table.

<table>
<thead>
<tr>
<th>Price of Diamond</th>
<th>Quantity of Diamonds Demanded</th>
</tr>
</thead>
<tbody>
<tr>
<td>$500</td>
<td>0</td>
</tr>
<tr>
<td>$400</td>
<td>1</td>
</tr>
<tr>
<td>$300</td>
<td>2</td>
</tr>
<tr>
<td>$200</td>
<td>3</td>
</tr>
<tr>
<td>$100</td>
<td>4</td>
</tr>
<tr>
<td>$0</td>
<td>5</td>
</tr>
</tbody>
</table>

a. Calculate De Beers’s total revenue and its marginal revenue. From your calculation, draw the demand curve and the marginal revenue curve.
b. Explain why De Beers faces a downward-sloping demand curve.
c. Explain why the marginal revenue from an additional diamond sale is less than the price of the diamond.
d. Suppose De Beers currently charges $200 for its diamonds. If it lowers the price to $100, how large is the price effect? How large is the quantity effect?
e. Add the marginal cost curve to your diagram from part a and determine which quantity maximizes De Beers’s profit and which price De Beers will charge.

Answer to Question:
a. Total revenue (TR) and marginal revenue (MR) are given in the accompanying table.

<table>
<thead>
<tr>
<th>Price of Diamond</th>
<th>Quantity of Diamonds Demanded</th>
<th>TR</th>
<th>MR</th>
</tr>
</thead>
<tbody>
<tr>
<td>$500</td>
<td>0</td>
<td>$0</td>
<td>-</td>
</tr>
<tr>
<td>$400</td>
<td>1</td>
<td>$400</td>
<td>$400</td>
</tr>
<tr>
<td>$300</td>
<td>2</td>
<td>$600</td>
<td>$200</td>
</tr>
<tr>
<td>$200</td>
<td>3</td>
<td>$600</td>
<td>$0</td>
</tr>
<tr>
<td>$100</td>
<td>4</td>
<td>$400</td>
<td>-$200</td>
</tr>
<tr>
<td>$0</td>
<td>5</td>
<td>$0</td>
<td>-$400</td>
</tr>
</tbody>
</table>

The accompanying diagram illustrates De Beers’s demand curve and marginal revenue (MR) curve.

b. De Beers is the only producer of diamonds, so its demand curve is the market demand curve. And the market demand curve slopes downward: the lower the price, the more customers will buy diamonds.
c. If De Beers lowers the price sufficiently to sell one more diamond, it earns extra revenue equal to the
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price of that one extra diamond. This is the quantity effect of lowering the price. But there is also a price
effect: lowering the price means that De Beers also has to lower the price on all other diamonds, and
that lowers its revenue. So the marginal revenue of selling an additional diamond is less than the price
at which the additional diamond can be sold.

d. If the price is $200, then De Beers sells to Raquel, Jackie, and Joan. If it lowers the price to $100, it
will also sell a diamond to Mia. The price effect is that De Beers loses $100 (the amount by which it
lowered the price) each from selling to Raquel, Jackie, and Joan. So the price effect lowers De Beers’s
revenue by 3 × $100 = $300. The quantity effect is that De Beers sells one more diamond (to Mia), at
$100. So the quantity effect is to raise De Beers’s revenue by $100.
e. The marginal cost (MC) curve is constant at $100, as shown in the diagram. Marginal revenue equals
marginal cost at a quantity of 2 diamonds. So De Beers will sell 2 diamonds at a price of $300 each.

Question: Use the demand schedule for diamonds given in the previous question. The marginal
cost of producing diamonds is constant at $100. There is no fixed cost.
a. If De Beers charges the monopoly price, how large is the individual consumer surplus that each
buyer experiences? Calculate total consumer surplus by summing the individual consumer surpluses.
How large is producer surplus?

Suppose that upstart Russian and Asian producers enter the market and the market becomes
perfectly competitive.
b. What is the perfectly competitive price? What quantity will be sold in this perfectly competitive
market?
c. At the competitive price and quantity, how large is the consumer surplus that each buyer
experiences? How large is total consumer surplus? How large is producer surplus?
d. Compare your answer to part c to your answer to part a. How large is the deadweight loss associated
with monopoly in this case?

Answer to Question:
a. The monopoly price is $300. At that price Raquel and Jackie buy diamonds. Raquel’s consumer
surplus is $400 − $300 = $100; Jackie’s is $300 − $300 = $0. So total consumer surplus is $100 + $0 =
$100. Producer surplus is $300 − $100 = $200 for each diamond sold; 2 × $200 = $400.
b. In a perfectly competitive market, \( P = MC \). That is, the perfectly competitive price is $100, and at that
price 4 diamonds will be sold—to Raquel, Jackie, Joan, and Mia.
c. At the competitive price, Raquel’s consumer surplus is $400 − $100 = $300; Jackie’s, $300 − $100 =
$200; Joan’s, $200 − $100 = $100; and Mia’s, $100 − $100 = $0. So total consumer surplus is $300 +
$200 + $100 + $0 = $600. Since the price is equal to marginal cost, there is no producer surplus.
d. Under perfect competition, the sum of consumer and producer surplus is $600 + $0 = $600. Under
monopoly, the sum of consumer and producer surplus is $100 + $400 = $500. So the loss of surplus to
society from monopoly—the deadweight loss—is $600 − $500 = $100.

Question: Use the demand schedule for diamonds given in the previous questions. De Beers is a
monopolist, but it can now price-discriminate perfectly among all five of its potential customers. De
Beers’s marginal cost is constant at $100. There is no fixed cost.
a. If De Beers can price-discriminate perfectly, to which customers will it sell diamonds and at what
prices?
b. How large is each individual consumer surplus? How large is total consumer surplus? Calculate
producer surplus by summing the producer surplus generated by each sale.
Answer to Question:
a. If De Beers can price-discriminate perfectly, it will charge each customer that customer’s willingness to pay. That is, it will charge Raquel $400, Jackie $300, Joan $200, and Mia $100. De Beers does not want to sell to Sophia since she will only buy at a price of $0, and that would be below De Beers’s marginal cost.
b. Since each consumer is charged exactly her willingness to pay, there is no consumer surplus. De Beers’s producer surplus is $400 − $100 = $300 from selling to Raquel; $300 − $100 = $200 from selling to Jackie; $200 − $100 = $100 from selling to Joan; $100 − $100 = $0 from selling to Mia. So producer surplus is $300 + $200 + $100 + $0 = $600.

Question: Download Records decides to release an album by the group Mary and the Little Lamb. It produces the album with no fixed cost, but the total cost of downloading an album to a CD and paying Mary her royalty is $6 per album. Download Records can act as a single-price monopolist. Its marketing division finds that the demand schedule for the album is as shown in the accompanying table.

<table>
<thead>
<tr>
<th>Price of album</th>
<th>Quantity of albums demanded</th>
</tr>
</thead>
<tbody>
<tr>
<td>$22</td>
<td>0</td>
</tr>
<tr>
<td>$20</td>
<td>1,000</td>
</tr>
<tr>
<td>$18</td>
<td>2,000</td>
</tr>
<tr>
<td>$16</td>
<td>3,000</td>
</tr>
<tr>
<td>$14</td>
<td>4,000</td>
</tr>
<tr>
<td>$12</td>
<td>5,000</td>
</tr>
<tr>
<td>$10</td>
<td>6,000</td>
</tr>
<tr>
<td>$8</td>
<td>7,000</td>
</tr>
</tbody>
</table>

a. Calculate the total revenue and the marginal revenue per album.
b. The marginal cost of producing each album is constant at $6. To maximize profit, what level of output should Download Records choose, and which price should it charge for each album?
c. Mary renegotiates her contract and now needs to be paid a higher royalty per album. So the marginal cost rises to be constant at $14. To maximize profit, what level of output should Download Records now choose, and which price should it charge for each album?

Answer to Question:
a. Total revenue ($TR$) and marginal revenue per album ($MR$) is shown in the following table:

<table>
<thead>
<tr>
<th>Price of album</th>
<th>Quantity of albums demanded</th>
<th>TR</th>
<th>MR</th>
</tr>
</thead>
<tbody>
<tr>
<td>$22</td>
<td>0</td>
<td>$0</td>
<td>-</td>
</tr>
<tr>
<td>$20</td>
<td>1,000</td>
<td>$20,000</td>
<td>$20</td>
</tr>
<tr>
<td>$18</td>
<td>2,000</td>
<td>$36,000</td>
<td>$16</td>
</tr>
<tr>
<td>$16</td>
<td>3,000</td>
<td>$48,000</td>
<td>$12</td>
</tr>
<tr>
<td>$14</td>
<td>4,000</td>
<td>$56,000</td>
<td>$8</td>
</tr>
<tr>
<td>$12</td>
<td>5,000</td>
<td>$60,000</td>
<td>$4</td>
</tr>
<tr>
<td>$10</td>
<td>6,000</td>
<td>$60,000</td>
<td>$0</td>
</tr>
<tr>
<td>$8</td>
<td>7,000</td>
<td>$56,000</td>
<td>-4</td>
</tr>
</tbody>
</table>

b. If the marginal cost of each album is $6, Download Records will maximize profit by producing 4,000 albums, since for each album up to 4,000, marginal revenue is greater than marginal cost. For any further albums, marginal cost would exceed marginal revenue. Producing 4,000 albums, Download Records will charge $14 for each album.
c. If the marginal cost of each album is $14, Download Records will maximize profit by producing 2,000 albums, and it will charge $18 per album.
Question: The movie theater in Collegetown serves two kinds of customers: students and professors. There are 900 students and 100 professors in Collegetown. Each student's willingness to pay for a movie ticket is $5. Each professor's willingness to pay for a movie ticket is $10. Each will buy at most one ticket. The movie theater's marginal cost per ticket is constant at $3, and there is no fixed cost.

a. Suppose the movie theater cannot price-discriminate and needs to charge both students and professors the same price per ticket. If the movie theater charges $5, who will buy tickets and what will the movie theater's profit be? How large is consumer surplus?

b. If the movie theater charges $10, who will buy movie tickets and what will the movie theater's profit be? How large is consumer surplus?

c. Now suppose that, if it chooses to, the movie theater can price-discriminate between students and professors by requiring students to show their student ID. If the movie theater charges students $5 and professors $10, how much profit will the movie theater make? How large is consumer surplus?

Answer to Question:

a. If the movie theater charges $5 per ticket, both students and professors will buy tickets. The movie theater will sell to 1,000 customers (students and professors), at a price of $5 each. Since the movie theater's cost per ticket is $3, its profit is $2 per ticket for a total profit of 1,000 × $2 = $2,000. Students will experience no consumer surplus, but each of the 100 professors will experience consumer surplus of $10 − $5 = $5 for a total consumer surplus of 100 × $5 = $500.

b. If the movie theater charges $10 per ticket, only professors will buy tickets. The movie theater will sell to 100 customers (professors) at a price of $10 each. Since the movie theater's cost per ticket is $3, its profit is $7 per ticket for a total profit of 100 × $7 = $700. Students experience no consumer surplus since they do not buy any tickets. Each of the 100 professors experiences no consumer surplus since the price is equal to their willingness to pay. So consumer surplus is $0.

c. If the movie theater charges students a price of $5, it sells 900 tickets at a profit of $5 − $3 = $2 each for a profit from selling to students of 900 × $2 = $1,800. Charging professors $10, it sells 100 tickets at a profit of $10 − $3 = $7 each for a profit from selling to professors of 100 × $7 = $700. So the theater's total profit is $1,800 + $700 = $2,500. Since each customer is charged exactly his or her willingness to pay, there is no consumer surplus.

Question: A monopolist knows that in order to expand the quantity of output it produces from 8 to 9 units that it must lower the price of its output from $2 to $1. Calculate the quantity effect and the price effect. Use these results to calculate the monopolist's marginal revenue of producing the 9th unit. The marginal cost of producing the 9th unit is positive. Is it a good idea for the monopolist to produce the 9th unit?

Answer to Question:

The quantity effect is $1 (the increase in total revenue from selling the 9th unit at $1). The price effect is 8 × (−$1) = −$8 (the decrease in total revenue from having to lower the price of 8 units by $1 each). So the marginal revenue of producing the 9th unit is $1 − $8 = −$7. Since marginal revenue is negative, producing the 9th unit is definitely not a good idea: it lowers revenue (since marginal revenue is negative), and it increases the total cost (since marginal cost is positive). So it will definitely lower profit. Instead, the monopolist should produce less output.