Pricing Strategies for Firms with Market Power
# Introduction

<table>
<thead>
<tr>
<th>Chapter Outline</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10.1</strong></td>
<td>The Basics of Pricing Strategy</td>
</tr>
<tr>
<td><strong>10.2</strong></td>
<td>Direct Price Discrimination I: Perfect/First-Degree Price Discrimination</td>
</tr>
<tr>
<td><strong>10.3</strong></td>
<td>Direct Price Discrimination II: Segmenting/Third-Degree Price Discrimination</td>
</tr>
<tr>
<td><strong>10.4</strong></td>
<td>Indirect/Second-Degree Price Discrimination</td>
</tr>
<tr>
<td><strong>10.5</strong></td>
<td>Bundling</td>
</tr>
<tr>
<td><strong>10.6</strong></td>
<td>Advanced Pricing Strategies</td>
</tr>
<tr>
<td><strong>10.7</strong></td>
<td>Conclusion</td>
</tr>
</tbody>
</table>
In Chapter 9, we examined how firms with market power can generate positive economic profit by influencing the price at which their products or services are sold.

This conclusion was based on the assumption that firms must charge the same price to all customers.

In this chapter, we explore alternative pricing strategies and show that when a firm with market power can discriminate among customers, additional surplus (beyond that achieved by a single-price monopolist) can be generated.

Firms with market power do not behave like those in perfect competition.
A **pricing strategy** is a firm’s method of pricing its product based on market characteristics.

For a perfectly competitive firm, the pricing strategy is straightforward: charge the equilibrium market price and take zero economic profit in the long run.

For firms with market power, strategies become more complex:

- For a single-price producer, the optimal strategy is to increase production until marginal revenue is equal to marginal cost, which yields maximum profit.
- Some firms with market power are able to charge different prices to different customers.
- **Price discrimination** refers to the practice of charging different prices to different customers for the same product.
  - The ability to price-discriminate allows firms with market power to generate even more economic profit.
When Can a Firm Pursue a Pricing Strategy?

There are two requirements a firm must meet to engage in price discrimination.

1. The firm must have market power.
   - Without market power, firms must charge all customers the market equilibrium price.

2. The firm must prevent resale and arbitrage.
   - Arbitrage is the practice of reselling a product at a price higher than its original selling price.
   - If this requirement is not met, customers subject to a lower price could simply purchase excess product and resell to those facing the higher price.
The Basics of Pricing Strategy

Figure 10.1 Overview of Pricing Strategies

A firm’s optimal pricing strategy is determined by characteristics of the firm, its product, and its consumers. In particular, a firm takes into account its degree of market power, whether the product can be resold, and its knowledge of its customers’ demand for the product.

**Does the firm have market power?**
- **No**: Perfect competition produces quantity at which \( MR = P = MC \) (Chapter 8)
- **Yes**: Can the firm prevent resale and arbitrage?
  - **No**: Monopoly produces quantity \( (Q^*) \) at which \( MR = MC \), sets price \( P^* \) where \( Q^* = D(P^*) \) (Chapter 9)
  - **Yes**: Do the firm’s customers have different demand curves?
    - **No**: Advanced pricing strategies (Section 10.6)
      - Block pricing
      - Two-part tariff
    - **Yes**: Direct price discrimination
      - Firm has complete information about every customer.
        - Perfect (first-degree) price discrimination (Section 10.2)
      - Firm has information on groups of customers.
        - Segmenting (third-degree) price discrimination (Section 10.3)
        - Can the firm directly identify customers’ demands before they buy the product?
          - **Yes**: Bundling (Section 10.5)
          - **No**: Advanced pricing strategies (Section 10.6)
            - Block pricing
            - Two-part tariff
          - Indirect (second-degree) price discrimination (Section 10.4)
            - Quantity discounts
            - Versioning
            - Coupons
Strategies for Customers with Different Demands

For price discrimination to be profitable, a firm must have different types of customers with different price sensitivities. Ultimately, the discrimination strategy will depend on the information available to the firm.

1. Can a firm identify its customers’ demands before they buy?
   - If so, and the information is complete, it can practice perfect price discrimination and charge every customer a different price.
   - A more likely situation is that the firm has incomplete information; in this case, it may be able to discriminate by grouping customers based on their willingness to pay.

2. Can a firm identify its customers’ differing demands only after they make a purchase?
   - In this case, a firm must rely on more indirect forms of price discrimination (e.g., quantity discounts, bundling).
**When to Use It:** Perfect/First-Degree Price Discrimination

1. The firm has market power and can prevent resale.
2. The firm’s customers have different demand curves.
3. The firm has complete information about every customer and can identify each one’s level of demand before purchase.
When to Use It: Perfect/First-Degree Price Discrimination

If a firm is able to observe characteristics of demand prior to purchase, it can increase producer surplus through **direct price discrimination**

- A pricing strategy in which firms charge different prices to different customers based on observable characteristics of the customers

In the extreme case, that the firm has complete information about customers, it can engage in **perfect price discrimination**.

- Also called **first-degree price discrimination**, a type of direct price discrimination in which a firm charges each customer exactly according to his or her willingness to pay.

✔ What does this mean for consumer surplus?
  - It is driven to zero under perfect price discrimination!
Figure 10.2 Perfect (First-Degree) Price Discrimination

(a) Perfect competition and monopoly

- Consumer surplus (competition) = $A + B + C$
- Producer surplus (competition) = 0
- Consumer surplus (market power) = $A$
- Producer surplus (market power) = $B$
- Deadweight loss from market power = $C$

Diagram:
- Price ($/unit)$
- Quantity
- $A$, $B$, $C$, $P_m$, $P_c$, $Q_m$, $Q_c$, $MC$, $MR$, $D$
Direct Price Discrimination II: Segmenting/Third-Degree Price Discrimination

When to Use It: Segmenting/Third-Degree Price Discrimination

1. The firm has market power and can prevent resale.
2. The firm’s customers have different demand curves.
3. The firm can directly identify specific *groups* of customers (but not individual customers) with different price sensitivities before purchase.
When to Use It: Segmenting/Third-Degree Price Discrimination

In most cases, direct price discrimination requires too much information; however, firms may be able to use common characteristics to engage in segmenting:

- A type of direct price discrimination in which a firm charges different prices to different groups of customers
- In third-degree price discrimination, a firm is able to extract surplus in excess of that collected by a single-price monopolist but not as much as under first-degree price discrimination.
  - Examples: senior citizen and student discounts
Consider an example with two consumer groups:
The Ironman Cozumel 70.3 Triathlon is a prestigious annual race. Two types of consumers would like to enter the race:
1. Locals
2. People who fly in from somewhere else (usually the United States)

Do you think this situation might present a good case for third-degree price discrimination?
- Does the firm have market power?
  - Yes, this is a well-known, prestigious event
- Do the customers have different demand curves?
  - It is reasonable to think that international customers may have different demand characteristics from those of the locals.
- Can the firm identify groups and prevent resale?
  - Yes, requiring identification should allow for effective segmentation.
How might the demand curves differ between local and international customers?

- Income differences between U.S. and Mexican triathletes.
  - U.S. competitors are likely have higher incomes, be less sensitive to the fee.
- The entrance fee as a share of total cost of attending the triathlon (airfare, hotel, etc.) is smaller for international athletes, which should make them less sensitive to the fee.

The two consumer groups can be described graphically.
Direct Price Discrimination II: Segmenting/Third-Degree Price Discrimination

Figure 10.4 Segmenting Entry Fees at the Ironman Cozumel 70.3 Triathlon

Traveling participants have less price-elastic demand, and therefore the amount of producer surplus extracted from them will be relatively large.
If organizers engage in segmenting, they will charge a higher price to traveling participants.

What if the organizers cannot price-discriminate?
- They will face a kinked demand curve.

Graphically:
Figure 10.5  Single-Price Monopolist at the Ironman Cozumel 70.3 Triathlon

A single-price monopolist cannot extract as much surplus as a monopolist with the power to price-discriminate.
The Benefits of Segmenting: A Mathematical Approach

Traveling triathlon participants have demand

\[ Q_T = 1,700 - 5P_T \]

while locals have demand

\[ Q_L = 2,400 - 10P_L \]

As suggested, locals are more price-sensitive than travelers.

The marginal cost to the organizer of adding participants is assumed to be constant at $100.
Direct Price Discrimination II: Segmenting/Third-Degree Price Discrimination

We follow the steps from Chapter 9 and first determine the marginal revenue curves for each group of participants

**Travelers**

\[ Q_T = 1,700 - 5P_T \]
\[ P_T = 340 - 0.2Q_T \]
\[ MR_T = 340 - 0.4Q_T \]

**Locals**

\[ Q_L = 2,400 - 10P_L \]
\[ P_L = 240 - 0.1Q_L \]
\[ MR_L = 240 - 0.2Q_L \]
Setting marginal revenue equal to marginal cost for each group:

**Travelers**

\[
MR_T = MC \\
340 - 0.4Q_T = 100 \\
Q_T = 600
\]

**Locals**

\[
MR_L = MC \\
240 - 0.2Q_L = 100 \\
Q_L = 700
\]

And using the demand curves to solve for price:

**Travelers**

\[
P_T = 340 - 0.2Q_T = $220
\]

**Locals**

\[
P_L = 240 - 0.1Q_L = $170
\]
Total producer surplus is the area below price but above marginal cost, summed over the two consumer groups:

**Travelers**

\[ PS_T = (220 - 100) \times 600 \]
\[ = $72,000 \]

**Locals**

\[ PS_L = (170 - 100) \times 700 \]
\[ = $49,000 \]

\[ PS_{combined} = $121,000 \]

How does this compare to the single-price monopolist?
First, find the equation for the market demand area to the right of the kink.

\[ Q = 1,700 - 5P + 2,400 - 15P = 4,100 - 15P \]

Inverse demand is

\[ P = \frac{4,100}{15} - \frac{Q}{15} \]

and marginal revenue is

\[ MR = \frac{4,100}{15} - \frac{2Q}{15} \]

Setting marginal revenue equal to marginal cost yields the single-price equilibrium quantity

\[ MR = MC \rightarrow \frac{4,100}{15} - \frac{2Q}{15} = 100 \Rightarrow Q = 1,300 \]
And plugging in 1,300 to the market demand curve yields

\[ P = \frac{4,100}{15} - \frac{1,300}{15} = \$186.67 \]

As expected, the market price is slightly higher than the local price under segmentation but lower than the traveler price.

Producer surplus for the single-price monopolist is

\[ PS = (186.67 - 100) \times 1,300 = \$112,671 \]

This is less than the \$121,000 achieved when the market can be segmented.
How Much Should Each Segment Be Charged?

Segmenting monopolists treat each segment as a different market
• Therefore, the Lerner index can be used to compute the optimal markup for each segment.
• From Chapter 9, the markup formula is given as:

\[
\frac{(P - MC)}{1 - E^D} = \frac{1}{\text{% mark up}}
\]

The monopolist will solve this formula for each segment.
Ways to Directly Segment Customers

By customer characteristics
- Age (e.g., senior citizen discounts)
- Gender (e.g., ladies night specials)
  - May sometimes run afoul of antidiscrimination laws

By past purchase behavior
- Repeat customers may be more price sensitive (e.g., software updates less expensive than initial purchase).

By location
- Based on local demand characteristics

Over time
**Indirect/Second-Degree Price Discrimination**

**When to Use It:** Indirect/Second-Degree Price Discrimination

1. The firm has market power and can prevent resale.
2. The firm’s customers have different demand curves.
3. The firm cannot directly identify which customers have which type of demand before purchase.

**Indirect price discrimination** is a pricing strategy in which customers pick among a variety of pricing options offered by the firm.
Indirect Price Discrimination through Quantity Discounts

Firms often use *quantity discounts* to price-discriminate.
- The practice of charging a lower per-unit price to customers who buy larger quantities

Relies on a concept known as *incentive compatibility*.
- The requirement under an indirect price discrimination strategy is that the price offered to each consumer group be chosen by that group.
- Firms must be careful not to discount too steeply on large quantities or else they will cannibalize consumers from the uninterested consumer segment.
Indirect Price Discrimination through Versioning

Versioning is a pricing strategy in which a firm offers different product options designed to attract different types of consumers.

- Common example: air travel for leisure versus business passengers

For versioning to work, the marginal cost of the products offered to different consumers need not be equal.

- The only requirement: the markup must be higher for the segment with the less elastic demand.
Consider the car manufacturer Toyota

- The firm offers two brands, Toyota and Lexus, with similar models.
- Assume the following willingness to pay for two car models:

<table>
<thead>
<tr>
<th></th>
<th>Toyota Camry</th>
<th>Lexus ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budget consumer</td>
<td>$28,000</td>
<td>$31,000</td>
</tr>
<tr>
<td>Luxury consumer</td>
<td>$30,000</td>
<td>$43,000</td>
</tr>
</tbody>
</table>

What if Toyota charges $26,000 for the Camry and $38,000 for the ES 350?
- Budget consumers will purchase the Camry and gain $2,000 surplus per car (they would get $7,000 if purchase the Lexus ES)
- Luxury consumers will purchase the ES 350 and gain $5,000 surplus per car (they would only get $4,000 in surplus if they buy the Camry)

This pricing scheme would be incentive compatible.
Indirect/Second-Degree Price Discrimination

Consider the car manufacturer Toyota

- The firm offers two brands, Toyota and Lexus, with similar models
- Assume the following willingness to pay for two car models

<table>
<thead>
<tr>
<th>Table 10.1 Consumer Valuations for Camrys and ESs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Toyota Camry</strong></td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Budget consumer</td>
</tr>
<tr>
<td>Luxury consumer</td>
</tr>
</tbody>
</table>

- What if Toyota charges $40,000 for the ES 350?
  - The budget consumers would still buy the Camry.
  - Luxury consumers now find the Camry preferable ($4,000 versus $3,000 consumer surplus).

Prices are NOT incentive compatible, as only Camrys would be sold.
Indirect/Second-Degree Price Discrimination

Indirect Price Discrimination Through Coupons

Coupons are also a form of indirect price discrimination.

Retailers would like to charge customers with less elastic demand more.

What types of consumers have less elastic demand for groceries?

- Generally, the smaller the proportion of income spent on an item, the less elastic the demand—wealthier consumers have less elastic demand.
- Wealthier consumers also value time, are less likely to search around for low prices or coupons.
**Bundling** is a pricing strategy in which a firm sells two or more products together at a single price.

**When to Use It:** Bundling

1. The firm has market power and can prevent resale
2. The firm sells a second product, and consumers’ demand for that product is *negatively correlated* with their demand for the first product.
Examples of Bundling

Cable and satellite television providers

- In general, there is little flexibility in choosing a menu of channels from the cable company.
- Cable companies have resisted attempts to decouple channels. Why?
Consider two consumers, Madison and Dakota, who are looking to subscribe to a cable service with two channels, ESPN and the History Channel.

- First, consider *positively correlated* demand. (As demand for one channel increases across consumers, demand for the other increases as well.)

<table>
<thead>
<tr>
<th>Table 10.2</th>
<th>Positively Correlated Valuations per Subscriber-Month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ESPN</td>
</tr>
<tr>
<td>Madison</td>
<td>$9.00</td>
</tr>
<tr>
<td>Dakota</td>
<td>$10.00</td>
</tr>
</tbody>
</table>

- Without bundling, the company can charge a maximum of $9 for ESPN and $1 for the History Channel, for a total of $20 in revenue, if they want both Madison and Dakota to subscribe.
- With bundling, they can charge a maximum of $10 for the bundle and get both customers.
- No benefit to bundling with positive correlation.
Now consider the same market, but with *negatively correlated* demand.

<table>
<thead>
<tr>
<th></th>
<th>ESPN</th>
<th>History</th>
<th>Bundle</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Madison</strong></td>
<td>$9.00</td>
<td>$1.50</td>
<td>$10.50</td>
</tr>
<tr>
<td><strong>Dakota</strong></td>
<td>$10.00</td>
<td>$1.00</td>
<td>$11.00</td>
</tr>
</tbody>
</table>

- Once again, without bundling, the company can charge a maximum of $9 for ESPN and $1 for the History Channel, for a total of $20 in revenue, if they want both Madison and Dakota to subscribe.
- However, with bundling, they can charge a maximum of $10.50 for the bundle and keep both consumers, increasing total revenue to $21 for the two consumers.
Mixed Bundling

Pure bundling is a type in which the firm offers products only as a bundle.

Alternatively, in **mixed bundling** the firm offers consumers the choice of buying two or more products separately or as a bundle.

- Example: Value meals at fast-food restaurants
Block pricing is the practice of reducing the price of a good when the customer buys more of it.

- Unlike indirect price discrimination (quantity discounts), block pricing does not consider buyers’ demand curves.

**When to Use It:** Block Pricing and Two-Part Tariffs

1. The firm has market power and can prevent resale.
2. The firm’s customers may have either identical or different demand curves.
Walmart can reduce its per-item price at higher purchase quantities, thereby increasing surplus by \( C + E \).

Consumers increase their surplus by \( B + D \).
A **two-part tariff** is a pricing strategy in which the payment has two components, a per-unit price and a fixed fee.

- **Examples:**
  - Video game systems: fixed fee (console), per-unit price (games)
  - Zipcar: fixed fee (annual membership), per-unit price (hourly rental fee)
  - Popular clubs: fixed fee (cover charge), per-unit price (beverages)
  - Amazon Prime: fixed fee (yearly charge), per-unit price (any purchases)
By adding a fixed monthly fee equal to $A + B + C$, the firm can lower the per-minute price to $10 per GB, where $D = MC$ (the competitive outcome). It can set a fixed fee equal to the consumer’s surplus and collect the entire amount of surplus.
Assume you have been hired as an intern at the Golden Eagle Country Club golf course. You are assigned to set up a pricing scheme for the course, for which typical structure is to charge an annual membership fee and a per-round fee. Each of your customers is estimated to have the following demand curve for rounds of golf per year:

$$Q = 300 - 5P$$

If Golden Eagle can provide rounds of golf at a constant marginal cost of $50 and charges that amount per round to its customers, what is the most customers will be willing to pay for an annual membership?
This structure is a two-part tariff. The maximum customers are willing to pay for an annual membership is the amount of surplus they receive at a price of $50 per round. First solve for the quantity of rounds played per year when $P = 50$.

$$Q = 300 - 5P$$

$$= 300 - 5(50)$$

$$= 50$$

routines per year

The easiest way to calculate consumer surplus is to draw a diagram using the inverse demand curve.

$$Q = 300 - 5P \implies P = 60 - 0.2Q$$
Plotting the curve against the marginal cost curve gives this:

The vertical intercept is $60, so Area $A$ is the consumer surplus for each customer at $50 per round. $A$ is a right triangle with area

$$A = \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times 50 \times ($60 - $50)$$

$$= $250$$

Therefore, customers should be willing to pay a fixed fee of up to $250 per year for a membership.
figure it out

Assume you have been hired as an intern at the Ravenwood Golf Club, and you are assigned to set up a pricing plan for the course. The typical structure is to charge an annual membership fee and a per-round fee. Each customer is estimated to have the following demand curve for rounds of golf per year:

\[ Q = 400 - 8P \]

If Ravenwood can provide rounds of golf at a constant marginal cost of $40 and charges that amount per round to its customers, what is the most customers will be willing to pay for an annual membership?
This structure is a two-part tariff. The maximum customers are willing to pay for an annual membership is the amount of surplus they receive at a price of $40 per round. First, solve for the quantity of rounds played per year when \( P = 40 \).

\[
Q = 400 - 8P
\]
\[
= 400 - 8(40)
\]
\[
= 80 \text{ rounds per year}
\]

The easiest way to calculate consumer surplus is to draw a diagram using the inverse demand curve.

\[
Q = 400 - 8P \quad \Rightarrow \quad P = 50 - 0.125Q
\]
Plotting the curve against the marginal cost curve gives this:

And Area $A$ is the consumer surplus for each customer at a price of $40$ per round. $A$ is a right triangle, with area

$$A = \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times 80 \times (50 - 40)$$

$$= 400$$

Therefore, customers should be willing to pay a fixed fee of up to $400$ per year for a membership.
Conclusion

In this chapter, we explored how firms with market power may increase producer surplus beyond that achieved with a single price.

• None of the strategies will work if the firm does not have market power.
• Firm must always prevent resale (or market or product attributes must make resale unrealistic).
• Each strategy entails charging different consumers different prices.
• In some cases, the firm decides who to charge each price, but in others, consumers self-select, which requires *incentive compatibility*.

In the next chapter, we examine firms with degrees of market power that fall between perfect competition and monopoly:

• Oligopoly
• Monopolistic competition
Suppose the inverse demand for a product produced by a single firm is given by

\[ P = 100 - 10Q \]

and that this firm has a marginal cost of production of

\[ MC = 10 + 10Q \]

**Answer the following questions:**

a. If the firm cannot price-discriminate, what is the profit-maximizing price and level of output?

b. If the firm cannot price-discriminate, what are the levels of producer and consumer surplus in the market? What is the deadweight loss?

c. If the firm has the ability to practice perfect price discrimination, what output level will it choose?

d. If the firm has the ability to practice perfect price discrimination, what are the levels of producer and consumer surplus and deadweight loss under perfect price discrimination?
a. From Chapter 9, the firm will produce so that marginal revenue is equal to marginal cost. The equation for the marginal revenue for a linear demand curve is

\[ MR = a - 2bQ \rightarrow MR = 100 - 20Q \]

and setting equal to marginal cost,

\[ MR = MC \rightarrow 100 - 2Q = 10 + 10Q \Rightarrow Q^* = 3 \]

The firm will produce 3 units of output at a price of

\[ P_m = 100 - 10(3) = $70 \]
b. Producer surplus is the area under the monopoly price but above marginal cost, here a trapezoid because of the upward-sloping marginal cost curve.

\[ PS = \text{Area } B + \text{Area } C \]
\[ = (70 - 40) \times 3 + \frac{1}{2} \times (40 - 10) \times 3 \]
\[ PS = $135 \]

Consumer surplus is the area under the demand curve, above the monopoly price.

\[ CS = \text{Area } A \]
\[ = \frac{1}{2} \times (100 - 70) \times 3 \]
\[ CS = $45 \]

Deadweight loss is shown by area D.

\[ DWL = \text{Area } D \]
\[ = \frac{1}{2} \times (70 - 40) \times (4.5 - 3) \]
\[ DWL = $22.5 \]
c. If the firm practices perfect price discrimination, it can charge everyone their specific willingness to pay. In this case, the demand curve becomes the marginal revenue curve and the firm will produce so that $P = MC$.

The amount produced is equal to the amount that would be produced in a competitive market.

\[ P = MC \rightarrow 100 - 10Q = 10 + 10Q \]

\[ Q = 4.5 \]

d. The producer is able to absorb the entire surplus.

\[ PS = \text{Area } A = \frac{1}{2} \times (100 - 10) \times 4.5 \]

\[ PS = $202.50 \]

Consumers receive no surplus, and there is no deadweight loss.
Suppose the inverse demand for a product produced by a single firm is given by

\[ P = 200 - 5Q \]

and this firm has a marginal cost of production of

\[ MC = 20 + 2Q \]

Answer the following questions:

a. If the firm cannot price-discriminate, what is the profit-maximizing price and level of output?

b. If the firm cannot price-discriminate, what are the levels of producer and consumer surplus in the market? What is the deadweight loss?

c. If the firm can practice perfect price discrimination, what output level will it choose? What are the levels of producer and consumer surplus and deadweight loss under perfect price discrimination?
a. From Chapter 9, the firm will produce where marginal revenue is equal to marginal cost. The equation for the marginal revenue for a linear demand curve is

\[ MR = a - 2bQ \rightarrow MR = 200 - 10Q \]

and setting equal to marginal cost,

\[ MR = MC \rightarrow 200 - 10Q = 20 + 2Q \Rightarrow Q^* = 15 \]

The firm will produce 15 units of output at a price of

\[ P_m = 200 - 5(15) = $125 \]
b. Producer surplus is the area under the monopoly price but above marginal cost, here a trapezoid because of the upward-sloping marginal cost curve.

\[ PS = \text{Area } B + \text{Area } C \]

\[ = (125 - 50) \times 15 + \frac{1}{2} \times (50 - 20) \times 15 \]

\[ PS = $1,350 \]

Consumer surplus is the area under the demand curve, above the monopoly price.

\[ CS = \text{Area } A \]

\[ = \frac{1}{2} \times (200 - 125) \times 15 \]

\[ CS = $562.50 \]

Deadweight loss is equal to area D.

\[ DWL = \text{Area } D \]

\[ = \frac{1}{2} \times (25.7 - 15) \times (125 - 50) \]

\[ DWL = $401.25 \]
c. If the firm practices perfect price discrimination, it can charge everyone their willingness to pay. In this case, the demand curve becomes the marginal revenue curve.

The amount produced is equal to the amount that would be produced in a competitive market.

The producer is able to absorb the entire surplus.

\[
PS = \text{Area } A = \frac{1}{2} \times (200 - 20) \times 25.7
\]

\[
PS = $2,313.75
\]

Consumers receive no surplus, and there is no deadweight loss.
Suppose you own two hair salons, one in a large city in Ohio with several competing salons, and one in a small city in Pennsylvania with less competition.

In Ohio, the price elasticity of demand is $-3$, while in Pennsylvania, it is $-2$. Assume the marginal cost of providing a haircut is $30$ regardless of location.

**Answer the following questions:**

a. What are the optimal prices and markups in each location?
b. Why do they differ?
The Lerner index describes how markup should vary as a function of demand elasticity.

\[
\frac{P - MC}{P} = \frac{1}{-E^D}
\]

In Ohio, we have

\[
\frac{(P_{OH} - 30)}{P_{OH}} = \frac{1}{3} \rightarrow 3P_{OH} = P_{OH} + 90 \Rightarrow P_{OH} = $45
\]

The markup is

\[
\frac{(P_{OH} - MC)}{P_{OH}} = \frac{(45 - 30)}{45} = 33\%
\]
And in Pennsylvania, we have

\[
\frac{(P_{PA} - 30)}{P_{PA}} = \frac{1}{2} \rightarrow 2P_{PA} = P_{PA} + 60 \Rightarrow P_{PA} = $60
\]

The markup is

\[
\frac{(P_{PA} - MC)}{P_{PA}} = \frac{(60 - 30)}{60} = 50\%
\]

b. Because demand is relatively more elastic in Ohio than in Pennsylvania—the absolute value of the price elasticity of demand is greater—customers in Ohio are more price-sensitive. Therefore they will be charged a lower price.
Suppose you own two hair salons, one in Washington, D.C., with lots of competition, and one in Charlottesville, Virginia, with little competition.

In Washington, the price elasticity of demand is $-2$, while in Charlottesville, it is $-1.5$. Assume the marginal cost of providing a haircut is $20$.

What are the optimal prices and markups in each location?
The Lerner index describes how markup should vary as a function of demand elasticity.

\[ \frac{(P - MC)}{P} = \frac{1}{-E^D} \]

In Washington, we have

\[ \frac{(P_{DC} - 20)}{P_{DC}} = \frac{1}{2} \rightarrow 2P_{DC} = P_{DC} + 40 \Rightarrow P_{DC} = $40 \]

The markup is

\[ \frac{(P_{DC} - MC)}{P_{DC}} = \frac{(40 - 20)}{40} = 50\% \]
And in Charlottesville, we have

$$\frac{(P_{VA} - 20)}{P_{VA}} = \frac{1}{1.5} \rightarrow 1.5P_{VA} = P_{VA} + 30 \Rightarrow P_{VA} = 60$$

As expected, the markup is greater in the market with a lower price elasticity of demand (Charlottesville).
Suppose you are a pricing analyst for MegaDat Corporation. Two types of clients use your software product. Type A’s inverse demand for your software is $P = 120 - 10Q$, where $Q$ represents users and $P$ is in dollars per user. Type B’s inverse demand is $P = 60 - 2Q$. Assume the marginal cost of supplying software is $20 per user.

Answer the following questions:

a. If you can determine which buyer is which before a purchase is made, what price will you charge each type?

b. Suppose you cannot tell which type of buyer each client is. Suggest a possible way to use quantity discounts to have buyers self-select into the pricing scheme set up for them.

c. Determine whether the pricing scheme you determined in part (b) is incentive compatible.
a. To maximize profit, set \( MR = MC \)

\[
MR = a - 2bQ
\]

Type A

\[
MR = 120 - 10Q_A
\]

\[
120 - 10Q_A = 20
\]

\[
Q_A^* = 5
\]

Type B

\[
MR = 60 - 4Q_B
\]

\[
60 - 4Q_B = 20
\]

\[
Q_B^* = 10
\]

and the price charged to each will be

Type A

\[
P = 120 - 10Q_A^*
\]

\[
P = $70
\]

Type B

\[
P = 60 - 2Q_B^*
\]

\[
P = $40
\]

b. The firm could charge $70 per user for a package in which the buyer can purchase any quantity and offer a price of $40 for any buyer willing to purchase 10 or more units.
The plan is incentive-compatible for Type B users, as they are willing to continue to purchase $Q = 10$ at a price of $40$ each.

For Type A consumers, we must consider the amount of consumer surplus they would receive under each scheme. Using a diagram:

At a price of $70$, Type A would choose to buy $5$ units, and consumer surplus would be equal to Area $A$.

If they purchased the second option (intended for Type B), their consumer surplus would equal $A + B + C$ for the first $8$ units, but the additional $2$ would reduce their surplus by $L$.

Since area $B + C$ outweighs area $L$, the benefit is positive compared to option $A$, so they will choose the option meant for Type B. It is NOT incentive compatible.
Suppose you are a pricing analyst for MegaDat Corporation. Two types of clients use your software product. Type A's inverse demand for your software is \( P = 100 - 6Q \), where \( Q \) represents users and \( P \) is in dollars per user. Type B's inverse demand is \( P = 60 - 3.5Q \). Assume the marginal cost of supplying software is $13 per user.

**Answer the following questions:**

a. If you can determine which buyer is which before a purchase is made, what price will you charge each type?

b. Suppose you cannot tell which type of buyer each client is. Suggest a possible way to use quantity discounts to have buyers self-select into the pricing scheme set up for them.
a. To maximize profit, set $MR = MC$

$$MR = a - 2bQ$$

<table>
<thead>
<tr>
<th>Type A</th>
<th>Type B</th>
</tr>
</thead>
<tbody>
<tr>
<td>$MR = 100 - 12Q$</td>
<td>$MR = 60 - 7Q$</td>
</tr>
<tr>
<td>$100 - 12Q = 13$</td>
<td>$60 - 7Q = 13$</td>
</tr>
<tr>
<td>$Q = 7.25$</td>
<td>$Q = 6.71$</td>
</tr>
</tbody>
</table>

and the price charged to each will be

<table>
<thead>
<tr>
<th>Type A</th>
<th>Type B</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P = 100 - 6Q$</td>
<td>$P = 60 - 3.5Q$</td>
</tr>
<tr>
<td>$P = $56.5$</td>
<td>$P = $36.52$</td>
</tr>
</tbody>
</table>

b. There would be no way to get the Type A individuals to choose a plan different from Type B because their demand is larger and they are more willing to pay.
Fit Club is a health club that offers two types of equipment: weight machines and a swimming pool. There are three customers, Abdul, Betty, and Chris. The table shows their willingness to pay for the different products. Each product has a constant marginal cost of $20 per month per user. Each customer is considering monthly access to each type of equipment.

<table>
<thead>
<tr>
<th>Willingness to Pay (per month)</th>
<th>WEIGHT MACHINES</th>
<th>INDOOR POOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdul</td>
<td>$60</td>
<td>$50</td>
</tr>
<tr>
<td>Betty</td>
<td>$50</td>
<td>$125</td>
</tr>
<tr>
<td>Chris</td>
<td>$25</td>
<td>$140</td>
</tr>
</tbody>
</table>

**Answer the following questions:**

a. What price will Fit Club charge for each product if it wants each customer to purchase a membership to each product? Calculate the producer surplus if it offers separate access to the weight room and pool at these prices.

b. What price will Fit Club charge if it decides to bundle the two products? Calculate the producer surplus the firm will earn in this case.

c. Suppose the firm offers a choice: access for each separately, with the weight room at $60 and the pool at $140, or the bundle for $175. Which option will each consumer choose? How much producer surplus will be earned by the firm in this case?
figure it out

a. To sell access to the weight machines and pool, Fit Club can charge a maximum of $25 and $50 respectively and still get all consumers to join. Consumer surplus is calculated as

\[
PS_{\text{weights}} = (P - MC) \times Q \\
PS_{\text{pool}} = (P - MC) \times Q
\]

\[
PS_{\text{weights}} = (25 - 20) \times 3 = $15 \\
PS_{\text{pool}} = (50 - 20) \times 3 = $90
\]

\[
PS_{\text{total}} = PS_{\text{pool}} + PS_{\text{weights}} = $105
\]

b. To get the bundle price, calculate each buyer’s willingness to pay for the bundle: simply sum WTP for each product.

<table>
<thead>
<tr>
<th></th>
<th>WEIGHT MACHINES</th>
<th>INDOOR POOL</th>
<th>BUNDLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdul</td>
<td>$60</td>
<td>$50</td>
<td>= $60 + $50 = $110</td>
</tr>
<tr>
<td>Betty</td>
<td>$60</td>
<td>$125</td>
<td>= $50 + $125 = $175</td>
</tr>
<tr>
<td>Chris</td>
<td>$25</td>
<td>$140</td>
<td>= $25 + $140 = $165</td>
</tr>
</tbody>
</table>
The maximum bundle price Fit Club can charge is $110. At this price, producer surplus is given by

\[ PS_{\text{bundle}} = (P - MC) \times Q \]

\[ PS_{\text{bundle}} = (110 - 20 - 20) \times 3 = $210 \]

c. Compare each buyer’s willingness to pay to the prices set for purchasing access to each room separately and the price of the bundle.

**Abdul** will purchase only the weight machine membership. His WTP for the pool is below $140. The same is true for the bundle which he values at $110.

**Betty** will NOT buy either membership separately because her WTP for each is below the set price. However, her WTP for the bundle ($175) is exactly equal to the price, so she will purchase the bundle.

**Chris** will purchase only access to the indoor pool. His WTP for the weight machines is only $25 (less than the price of $60). He also is only willing to pay $165 for the bundle (less than the price of $175).
Calculate the producer surplus for each option separately.

\[ PS_{weights} = (P - MC) \times Q \]
\[ PS_{weights} = (60 - 20) \times 1 = $40 \]

\[ PS_{pool} = (P - MC) \times Q \]
\[ PS_{pool} = (140 - 20) \times 1 = $120 \]

\[ PS_{bundle} = (P - MC) \times Q \]
\[ PS_{bundle} = (175 - 40) \times 1 = $135 \]

Total producer surplus: $40 + $120 + $135 = $295. This is the highest of the three pricing options.
Country Club Inc. is a health club that offers two types of equipment: weight machines and a pool. There are three customers, Alex, Bobbi, and Chris. The table shows their willingness to pay for the different products.

<table>
<thead>
<tr>
<th>Willingness to Pay (per month)</th>
<th>Weights</th>
<th>Pool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alex</td>
<td>$70</td>
<td>$30</td>
</tr>
<tr>
<td>Bobbi</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>Chris</td>
<td>30</td>
<td>80</td>
</tr>
</tbody>
</table>

Each product has a constant marginal cost of $25 per month per user. Each customer is considering monthly access to each type of equipment.

**Answer the following questions:**

a. What price will Country Club charge for each product if it wants each customer to purchase a membership to each product? Calculate the producer surplus.

b. What price will Country Club charge if it decides to bundle the two products together? Calculate the producer surplus.
**figure it out**

**a.** To sell access to the weight machines and pool, the health club can charge a maximum of $30 and still get all consumers to join. Consumer surplus is calculated as:

\[
PS_{\text{weights}} = (P - MC) \times Q \\
PS_{\text{pool}} = (P - MC) \times Q \\
PS_{\text{weights}} = (30 - 25) \times 3 = $15 \\
PS_{\text{pool}} = (30 - 25) \times 3 = $15 \\
PS_{\text{total}} = PS_{\text{pool}} + PS_{\text{weights}} = $30
\]

**b.** To get the bundle price, calculate each buyer’s willingness to pay for the bundle. Simply sum WTP for each product.

<table>
<thead>
<tr>
<th>Willingness to Pay (per month)</th>
<th>Weights</th>
<th>Pool</th>
<th>Bundle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alex</td>
<td>$70</td>
<td>$30</td>
<td>$100</td>
</tr>
<tr>
<td>Bobbi</td>
<td>80</td>
<td>40</td>
<td>120</td>
</tr>
<tr>
<td>Chris</td>
<td>30</td>
<td>80</td>
<td>110</td>
</tr>
</tbody>
</table>
The maximum bundle price Country Club can charge is $100. At this price, producer surplus is given by

$$PS_{bundle} = (P - MC) \times Q$$

$$PS_{bundle} = (100 - 25 - 25) \times 3 = $150$$