Market structures are characterized by level of competition and product type. The 4 main market structures are (1) perfect competition, (2) monopolistic competition, (3) oligopoly and (4) monopoly.

In **perfect competition**, there are so many firms that all firms are price takers, competing to sell **homogeneous products**. Homogeneous products are identical products that consumers cannot tell apart. A close example of a homogenous product is regular gasoline. Many different firms sell near-identical gasoline products and consumers cannot tell them apart. This makes many nearly perfectly competitive industries compete on price alone.

In **monopoly**, there is only one firm supplying a unique product. Unique products are products for which there are no close substitutes. A close example of a unique product is a patented cancer drug. The monopolist that owns the rights to the patented cancer drug has the legal protection to be the sole supplier of the drug for a predetermined period of time. Unlike perfect competition where firms are price takers, the monopolists are price setters.

If perfect competition and monopoly are two polar opposite ends of market structures, monopolistic competition and oligopoly fall somewhere in between. In **monopolistic competition**, there are many firms competing to sell differentiated products. Because the products are not identical, firms in monopolistic competition have some pricing power. In **oligopoly**, there are few firms competing to sell homogeneous products or differentiated products. Because there are only few firms, firms in oligopoly have some pricing power even if they may be selling homogeneous products.
Firms engage in many different business activities. However, these activities can be broken into three categories. Firms incur cost and buy unfinished products and incur some more cost to add value to these products. And firms finally sell the value-added products to consumers and generate revenue. The motivation for firms is profit, the difference between revenue and cost.

These categories apply to both goods and services. Consider a one-person firm that buys hot dogs from Bosco for $1.50 each and sells them for $5.00 each outside of Robelus Arena on concert days. The firm incurs the cost of $1.50 for each hot dog purchased from Bosco. The time and effort exerted by the person to purchase the hot dogs and bring them to the concert venue also represent cost for the one-person firm. Note that the hot dogs sold at the concert venue by the one-person firm are not the same hot dogs that the one-person firm purchased from Bosco. The hot dogs at the concert venue are value-added hot dogs. The fact that the hot dogs are made available just outside the Robelus arena represents value for consumers who would have had to spend the time and effort to travel to Bosco for these hot dogs. The money brought in from the sale of these value-added hot dogs represents the revenue of the firm.

Consider a law firm that provides legal advice and services. The law firm hires lawyers and pays for their time in wages or salaries. In essence, the law firm incurs a cost to buy an unfinished product, collective knowledge of the law possessed by the lawyers hired. As the law firm takes on cases, the collective knowledge of the law is carved to the specific needs of each case. The resulting legal advice and services represents the product to be sold to consumers. Because the legal advice and services were specifically designed for the consumer, there is a value added to the service provided. The value-added service is sold to the consumer and the money received from the consumer represents revenue of the firm.

Revenue of a firm is the inflow of money in exchange for goods and services provided by the firm to its consumers. It can be calculated as a product of price and quantity. The sum of all revenues for a firm is called the total revenue of the firm.

\[
\text{Revenue} = \text{Price} \times \text{Quantity}
\]

Cost of a firm is the outflow of money that was necessary for selling goods and services to the consumers of the firm. Money outflow as a result of purchasing raw materials would be a cost for the firm. Money outflow as a result of paying wages and salaries to workers that add value to the goods and services would be a cost for the firm. The sum of all costs for a firm is called the total cost for the firm.

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Costs can be broken down into fixed costs and variable costs. Fixed costs are all costs that do not vary with the level of production. For example, rent is commonly a fixed cost. Consider a froyo store. It does not matter whether the store sells 100kg of froyo or 500kg of froyo. As long as the froyo store does not require additional space and the rent contract does not have a revenue dependent rent provision, the froyo store does not pay more rent with a higher quantity of froyo. This means that for this froyo store, rent is a fixed cost.

Variable costs are all costs that vary with the level of production. For example, raw material is commonly a variable cost. Consider a pulp and paper producer. In order to make more paper, the producer needs more trees. More trees mean more raw materials cost. If the producer makes less paper, the producer needs fewer trees. Fewer trees mean less raw materials cost. The raw materials cost depends very much on the level of production. This means that the raw materials cost for the firm is a variable cost.

Average total cost (ATC), sometimes referred to as average cost (AC), is calculated by dividing the total cost of a firm by the number of goods and services sold by the firm.

\[
\text{Average Total Cost} = \frac{\text{Total Cost}}{\# \text{ of Goods and Services}}
\]

Average variable cost (AVC) is calculated by dividing the variable cost of a firm by the number of goods and services sold by the firm.

\[
\text{Average Variable Cost} = \frac{\text{Variable Cost}}{\# \text{ of Goods and Services}}
\]

Marginal cost is the cost of producing the last unit. It measures how much the total cost changes by when the level of production increases by one unit.

Consider a producer that collects and packages coconuts for sale. A packaging facility costs $1,500/month to rent. The producer hires workers by the hour to collect and package coconut packages according to the production schedule below. Each labour hour costs $50. Given this information, various cost measures can be calculated.

\[
\text{Labour Hour} = \sqrt{\text{Product Quantity}}
\]

<table>
<thead>
<tr>
<th>Product Quantity</th>
<th>Labour Hour</th>
<th>Fixed Cost</th>
<th>Variable Cost</th>
<th>Total Cost</th>
<th>Marginal Cost</th>
<th>Average Cost</th>
<th>Average Variable Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1,500</td>
<td>50</td>
<td>1,550</td>
<td>1,550/1=1,550</td>
<td>50/1=50</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>1,500</td>
<td>100</td>
<td>1,600</td>
<td>(1600-1550)/(4-1)=16.67</td>
<td>1,600/4=400</td>
<td>100/4=25</td>
</tr>
<tr>
<td>9</td>
<td>3</td>
<td>1,500</td>
<td>150</td>
<td>1,650</td>
<td>(1650-1600)/(9-4)=10.00</td>
<td>1,650/9=183.33</td>
<td>150/9=16.67</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
<td>1,500</td>
<td>200</td>
<td>1,700</td>
<td>(1700-1650)/(16-9)=7.14</td>
<td>1,700/16=106.25</td>
<td>200/16=12.50</td>
</tr>
<tr>
<td>25</td>
<td>5</td>
<td>1,500</td>
<td>250</td>
<td>1,750</td>
<td>(1750-1700)/(25-16)=5.56</td>
<td>1,750/25=70</td>
<td>250/25=10</td>
</tr>
</tbody>
</table>

Product quantity measures the number of coconut packages produced. Labour hour measures the total labour hours used. Fixed cost is the cost of the facility rent. Variable cost is the cost of the labour hours. Each labour hour costs $50. Total cost is the sum of the fixed cost and the variable cost. Marginal cost is the cost of producing the last unit of
coconut package. For example, from producing 1 coconut package to producing 4 coconut packages, the total cost increased by $50. With this increase of $50 in the total cost, 3 additional coconut packages are produced. The cost of producing the last unit of coconut package is therefore $16.67. Average cost measures the cost of each unit if the total cost is spread equally across all the units. For example, if the total cost of making 4 coconut packages is $1,600, then the average cost is the cost of each unit if $1,600 is spread across 4 units equally. Dividing $1,600 by 4 units gives the average cost of $400. Average variable cost is the variable cost of each unit if the total variable cost is spread equally across all the units. For example, if the total variable cost of producing 4 coconut packages is $100, then the average variable cost is the cost of each unit if $100 is spread across 4 units equally. Dividing $100 by 4 units gives the average variable cost of $25.

Typical cost curves illustrated below are just examples of cost curves. The curves may, in fact, take on different shapes. Marginal cost curve slopes downwards, meaning that marginal cost decreases with increasing output. However, all marginal cost curves eventually slope upwards with increasing output. This is because at some point in the production, additions of a factor of production help less and less with the output, a concept we described in an earlier worksheet as the **law of diminishing marginal returns**. Total variable cost curve slopes upwards because more money is required to buy more of variable inputs. Total fixed cost curve is drawn as a horizontal line below because, by definition, fixed cost does not change with output.

Average total cost has a parabola shape, where total cost decreases at low output and total cost increases at high output. At low output, total cost decreases because total fixed cost is spread across more output. Imagine a monthly fee for our mobile phone of $80. If the monthly fee covers unlimited amount of talk time, we can talk for 80 minutes or 160 minutes. When we talk only for 80 minutes, the per-minute cost of our voice calls is $1. When we talk for 160 minutes, the per-minute cost of our voice calls is $0.50. This creates the downwards sloping portion of the average total cost curve. At high output, however, this fixed cost effect is outweighed by diminishing marginal returns, creating the upwards sloping portion of the average total cost curve. Average variable cost has a similar parabola shape, where average variable cost decreases at low output and average cost increases at high output. At low output, average variable cost decreases because division of labour can allow for increasing marginal returns. While one worker making burgers may have to grill buns, meat patties and mushrooms and produce 10 burgers each hour, three workers making burgers can divide the tasks and produce more than three times the number of burgers each hour. This creates the downwards
sloping portion of the average variable cost. At high output, however, the division of labour effect is outweighed by diminishing marginal returns, creating the upwards sloping portion of the average variable cost. Average fixed cost is downwards sloping because fixed cost does not change with output. However, as output increases, the same fixed cost is spread across more output, decreasing the average fixed cost.

So far, we examined the cost structures in the short run, where some costs are fixed. In the short run, not only are some costs fixed but also we cannot change our production technology. Production technology, in broad terms, is a method of transforming inputs to outputs. We can employ labour hours only for a clothing factory that makes t-shirts, we can employ only machinery or a combination of both. All these different methods of transforming inputs to outputs are examples of production technologies. In the long run, however, all costs variable and we can freely change our production technology. Imagine one year that wages to be paid to workers of the clothing factory increase by 100%. In the short run, we cannot change our production technology. If we were employing only labour hours, we would be unable to terminate all workers and move to machinery only. We would need time to provide notice to employees, buy or lease machinery, wait for it to be delivered and installed. In the long run, however, we can change our production technology, making it possible to eventually switch to machinery-only production technology if the cost of labour hours becomes too high.

At any given output, the long run average cost is defined as the average cost of the most inexpensive production technology. Remember, there are infinitely many production technologies. The portion of the long run average cost that is sloping downwards is when there exists economies of scale, where average cost decreases with output. The portion of the long run average cost that is flat is when there exists constant returns to scale, where average cost stays flat with output. The portion of the long run average cost that is sloping upwards is when there exists diseconomies of scale, where average cost increases with output.
Practice Problems

1. Which of the following is **NOT** a characteristic of perfect competition?
   a) All firms are price takers.
   b) Homogeneous products.
   c) All firms have some pricing power.
   d) All firms compete solely on price.

2. Which of the following is **NOT** a characteristic of monopolistic competition?
   a) There are many firms.
   b) Differentiated products.
   c) All firms have some pricing power.
   d) All firms compete solely on price.

3. Which of the following is **NOT** a characteristic of oligopoly?
   a) There are few firms.
   b) There are many firms.
   c) Homogeneous products.
   d) Differentiated products.

4. Which of the following is **NOT** a characteristic of monopoly?
   a) There is only one firm.
   b) Unique product.
   c) Monopolist has no pricing power.
   d) Monopolist has great pricing power.

5. What is profit? Choose **ALL** that applies.
   a) Net inflow of money
   b) Net outflow of money
   c) Revenue minus cost
   d) Inflow of money minus outflow of money

6. What is the difference between fixed cost and variable cost?
   a) Fixed cost is the cost of buying things fixed on a wall and variable cost is the cost of buying things that move.
   b) Fixed cost does not change with output but variable cost does.
   c) Fixed cost increases and variable cost decreases.
   d) Fixed cost decreases and variable cost increases.

7. What is implied by the law of diminishing marginal returns?
   a) Marginal cost curve eventually decreases.
   b) Marginal cost curve eventually increases.
   c) Average fixed cost eventually decreases.
   d) Average fixed cost eventually increases.
8. Which of the following describes average cost?
   a) Total cost divided by output
   b) Total cost divided by input
   c) Expensive production technology
   d) Inexpensive production technology

9. Which of the following describes long run average cost of a given output?
   a) Average cost for 10 years of output
   b) Average cost for 100 years of output
   c) Average cost of the most inexpensive technology at the given output
   d) Average cost of the most expensive technology at the given output

10. Which of the following describes slope of the long run average cost curve when a firm experiences economies of scale at a given output?
   a) Negative
   b) Somewhat positive
   c) Zero
   d) Very positive

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**Answers**

1. C  
2. D  
3. B  
4. C  
5. A,C,D  
6. B  
7. B  
8. A  
9. C  
10. A