Figure 3.1

3.1 Measures of Center for Ungrouped Data

We often represent a data set by numerical summary measures, usually called the *typical values*. A **measure of center** gives the center of a histogram or a frequency distribution curve. This section discusses five different measures of center: the mean, the median, the trimmed mean, the weighted mean, and the mode. However, another measure of center, the geometric mean, is explained in an exercise following this section. We will learn how to calculate each of these measures for ungrouped data. Recall from Chapter 2 that the data that give information on each member of the population or sample individually are called *ungrouped data*, whereas *grouped data* are presented in the form of a frequency distribution table.

3.1.1 Mean

The **mean**, also called the *arithmetic mean*, is the most frequently used measure of center. This book will use the words *mean* and *average* synonymously. For ungrouped data, the mean is obtained by dividing the sum of all values by the number of values in the data set:

$$\text{Mean} = \frac{\text{Sum of all values}}{\text{Number of values}}$$

The mean calculated for sample data is denoted by $\bar{x}$ (read as "x bar"), and the mean calculated for population data is denoted by μ (Greek letter *mu*). We know from the discussion in Chapter 2 that the number of values in a data set is denoted by n for a sample and by N for a population. In Chapter 1, we learned that a variable is denoted by x, and the sum of all values of x is denoted by $\sum x$. Using these notations, we can write the following formulas for the mean.

Calculating Mean for Ungrouped Data The *mean for ungrouped data* is obtained by dividing the sum of all values by the number of values in the data set. Thus,

$$\text{Mean for population data:} \quad \mu = \frac{\sum x}{N}$$

$$\text{Mean for sample data:} \quad \bar{x} = \frac{\sum x}{n}$$

where $\sum x$ is the sum of all values, N is the population size, n is the sample size, μ is the population mean, and $\bar{x}$ is the sample mean.

EXAMPLE 3-1 2014 Profits of 10 U.S. Companies

Calculating the sample mean for ungrouped data.

Table 3.1 lists the total profits (in million dollars) of 10 U.S. companies for the year 2014 (www.fortune.com).

Table 3.1 2014 Profits of 10 U.S. Companies

Company	Profits (million of dollars)
Apple	37,037
AT&T	18,249
Bank of America	11,431
Exxon Mobil	32,580
General Motors	5346
General Electric	13,057
Hewlett-Packard	5113
Home Depot	5385
IBM	16,483
Wal-Mart	16,022

Find the mean of the 2014 profits for these 10 companies.

Solution The variable in this example is 2014 profits of a company. Let us denote this variable by x. The 10 values of x are given in the above table. By adding these 10 values, we obtain the sum of x values, that is:

$$\sum x = 37{,}037 + 18{,}249 + 11{,}431 + 32{,}580 + 5346 + 13{,}057 + 5113 + 5385 + 16{,}483 + 16{,}022 = 160{,}703$$

Note that the given data include only 10 companies. Hence, it represents a sample with $n = 10$. Substituting the values of $\sum x$ and n in the sample formula, we obtain the mean of 2014 profits of 10 companies as follows:

$$\bar{x} = \frac{\sum x}{n} = \frac{160{,}703}{10} = 16{,}070.3 = \mathbf{\$16{,}070.3\ \ million}$$

Thus, these 10 companies earned an average of $16,070.3 million profits in 2014.

EXAMPLE 3-2 Ages of Employees of a Company

Calculating the population mean for ungrouped data.

The following are the ages (in years) of all eight employees of a small company:

53	32	61	27	39	44	49	57

Find the mean age of these employees.

Solution Because the given data set includes *all* eight employees of the company, it represents the population. Hence, $N = 8$. We have

$$\sum x = 53 + 32 + 61 + 27 + 39 + 44 + 49 + 57 = 362$$

The population mean is

$$\mu = \frac{\sum x}{N} = \frac{362}{8} = \mathbf{45.25\ years}$$

Thus, the mean age of all eight employees of this company is 45.25 years, or 45 years and 3 months.

Reconsider Example 3-2. If we take a sample of three employees from this company and calculate the mean age of those three employees, this mean will be denoted by $\bar{x}$. Suppose the three values included in the sample are 32, 39, and 57. Then, the mean age for this sample is

$$\bar{x} = \frac{32 + 39 + 57}{3} = 42.67 \text{ years}$$

If we take a second sample of three employees of this company, the value of $\bar{x}$ will (most likely) be different. Suppose the second sample includes the values 53, 27, and 44. Then, the mean age for this sample is

$$\bar{x} = \frac{53 + 27 + 44}{3} = 41.33 \text{ years}$$

Consequently, we can state that the value of the population mean μ is constant. However, the value of the sample mean $\bar{x}$ varies from sample to sample. The value of $\bar{x}$ for a particular sample depends on what values of the population are included in that sample.

Sometimes a data set may contain a few very small or a few very large values. As mentioned in Chapter 2, such values are called **outliers** or **extreme values**.

A major shortcoming of the mean as a measure of center is that it is very sensitive to outliers. Example 3-3 illustrates this point.

EXAMPLE 3-3 Prices of Eight Homes

Illustrating the effect of an outlier on the mean.

Following are the list prices of eight homes randomly selected from all homes for sale in a city.

$245,670	176,200	360,280	272,440
450,394	310,160	393,610	3,874,480

Note that the price of the last house is $3,874,480, which is an outlier. Show how the inclusion of this outlier affects the value of the mean.

Solution If we do not include the price of the most expensive house (the outlier), the mean of the prices of the other seven homes is:

$$\begin{aligned}\text{Mean without the outlier} &= \frac{254{,}670+176{,}200+360{,}280+272{,}440+450{,}394+310{,}160+393{,}610}{7} \\ &= \frac{2{,}208{,}754}{7} = \mathbf{\$315{,}536.29}\end{aligned}$$

Now, to see the impact of the outlier on the value of the mean, we include the price of the most expensive home and find the mean price of eight homes. This mean is:

Mean with the outlier

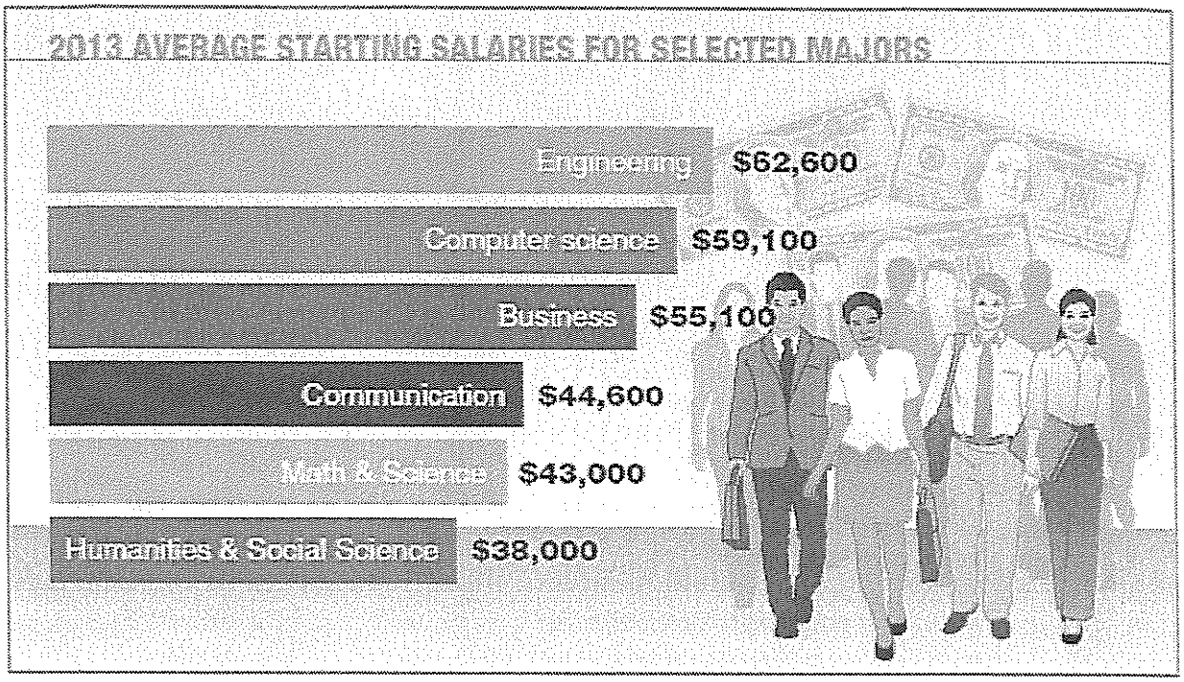
$$\begin{aligned}&= \frac{245{,}670+176{,}200+360{,}280+272{,}440+450{,}394+310{,}160+393{,}610+3{,}874{,}480}{8} \\ &= \frac{6{,}083{,}234}{8} = \mathbf{\$760{,}404.25}\end{aligned}$$

Thus, when we include the price of the most expensive home, the mean more than doubles, as it increases from $315,536.29 to $760,404.25.

The preceding example should encourage us to be cautious. We should remember that the mean is not always the best measure of center because it is heavily influenced by outliers. Sometimes other measures of center give a more accurate impression of a data set. For example, when a data set has outliers, instead of using the mean, we can use either the trimmed mean or the median as a measure of center.

CASE STUDY 3-1

2013 AVERAGE STARTING SALARIES FOR SELECTED MAJORS



Data source: www.forbes.com

The above chart, based on data from Forbes.com, shows the 2013 average starting salaries for a few selected majors. As we can notice, among these six majors, engineering commanded the highest starting salary of $62,600 in 2013, and humanities and social science majors had the lowest starting salary of $38,000 in 2013. Computer science major was the second highest with a starting salary of $59,100. As we can observe, there is a large variation in the 2013 starting salaries for these six majors.

Source: Forbes.com.

3.1.2 Median

Another important measure of center is the **median**. It is defined as follows.

Median The **median** is the value that divides a data set that has been ranked in increasing order in two equal halves. If the data set has an odd number of values, the median is given by the value of the middle term in the ranked data set. If the data set has an even number of values, the median is given by the average of the two middle values in the ranked data set.

As is obvious from the definition of the median, it divides a ranked data set into two equal parts. The calculation of the median consists of the following two steps:

1. Rank the given data set in increasing order.
2. Find the value that divides the ranked data set in two equal parts. This value gives the median.[1]

Note that if the number of observations in a data set is *odd*, then the median is given by the value of the middle term in the ranked data. However, if the number of observations is *even*, then the median is given by the average of the values of the two middle terms.

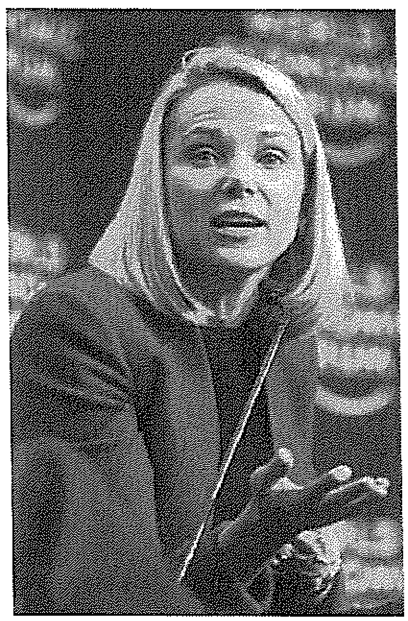
EXAMPLE 3-4 Compensations of Female CEOs

Calculating the median for ungrouped data: odd number of data values.

Table 3.2 lists the 2014 compensations of female CEOs of 11 American companies (*USA TODAY*, May 1, 2015). (The compensation of Carol Meyrowitz of TJX is for the fiscal year ending in January 2015.)

Table 3.2 Compensations of 11 Female CEOs

Company & CEO	2014 Compensation (millions of dollars)
General Dynamics, Phebe Novakovic	19.3
GM, Mary Barra	16.2
Hewlett-Packard, Meg Whitman	19.6
IBM, Virginia Rometty	19.3
Lockheed Martin, Marillyn Hewson	33.7
Mondelez, Irene Rosenfeld	21.0
PepsiCo, Indra Nooyi	22.5
Sempra, Debra Reed	16.9
TJX, Carol Meyrowitz	28.7
Yahoo, Marissa Mayer	42.1
Xerox, Ursula Burns	22.2



Chris Ratcliffe/Bloomberg via/GettyImages, Inc.

Find the median for these data.

Solution To calculate the median of this data set, we perform the following two steps.

Step 1: The first step is to rank the given data. We rank the given data in increasing order as follows:

16.2	16.9	19.3	19.3	19.6	21.0	22.2	22.5	28.7	33.7	42.1

Step 2: The second step is to find the value that divides this ranked data set in two equal parts. Here there are 11 data values. The sixth value divides these 11 values in two equal parts. Hence, the sixth value gives the median as shown below.

16.2	16.9	19.3	19.3	19.6	21.0	22.2	22.5	28.7	33.7	42.1
					↑					
					Median					

Thus, the median of 2014 compensations for these 11 female CEOs is $21.0 million. Note that in this example, there are 11 data values, which is an odd number. Hence, there is one value in the middle that is given by the sixth term, and its value is the median. Using the value of the median, we can say that half of these CEOs made less than $21.0 million and the other half made more than $21.0 million in 2014.

EXAMPLE 3-5 Cell Phone Minutes Used

Calculating the median for ungrouped data: even number of data values.

The following data give the cell phone minutes used last month by 12 randomly selected persons.

230	2053	160	397	510	380	263	3864	184	201	326	721

Find the median for these data.

Solution To calculate the median, we perform the following two steps.

Step 1: In the first step, we rank the given data in increasing order as follows:

160	184	201	230	263	326	380	397	510	721	2053	3864

Step 2: In the second step, we find the value that divides the ranked data set in two equal parts. This value will be the median. The value that divides 12 data values in two equal parts falls between the sixth and the seventh values. Thus, the median will be given by the average of the sixth and the seventh values as follows.

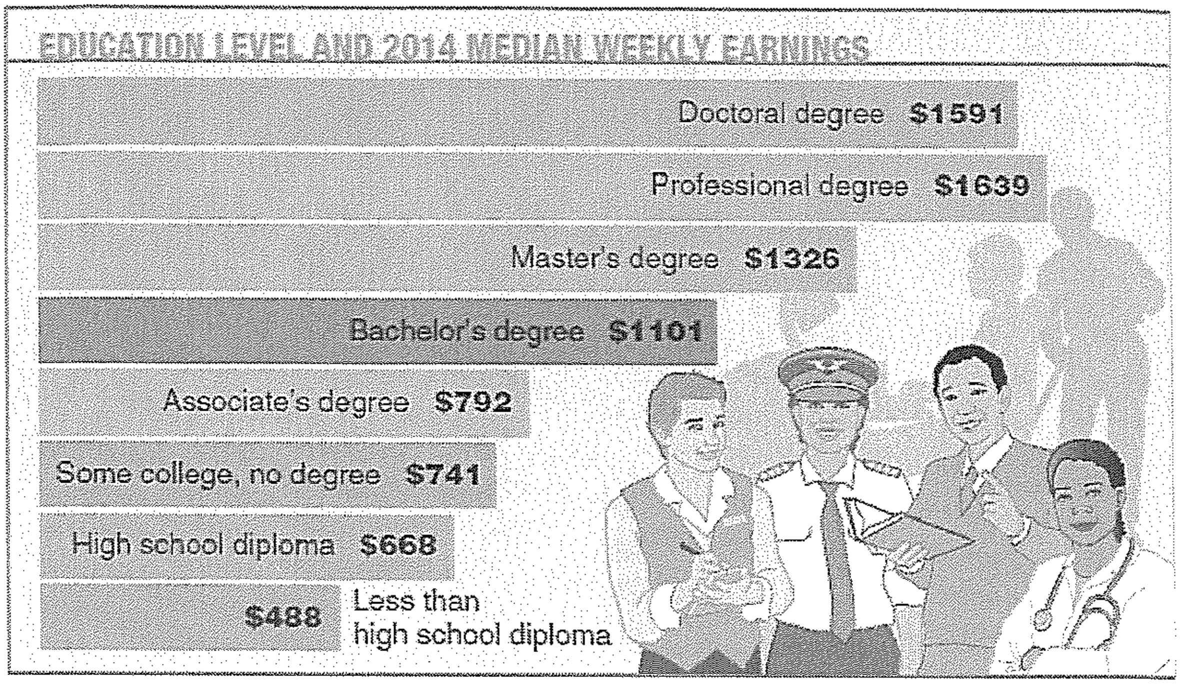
160	184	201	230	263	326	380	397	510	721	2053	3864
					↑						
					Median = 353						

$$\text{Median} = \text{Average of the two middle values} = \frac{326 + 380}{2} = \mathbf{353\ minutes}$$

Thus, the median cell phone minutes used last month by these 12 persons was 353. We can state that half of these 12 persons used less than 353 cell phone minutes and the other half used more than 353 cell phone minutes last month. Note that this data set has two outliers, 2053 and 3864 minutes, but these outliers do not affect the value of the median.

CASE STUDY 3–2

EDUCATION LEVEL AND 2014 MEDIAN WEEKLY EARNINGS



Data source: U.S. Bureau of Labor Statistics

The above chart shows the 2014 median weekly earnings by education level for persons aged 25 and over who held full-time jobs. These salaries are based on the Current Population Survey conducted by the U.S. Bureau of Labor Statistics. Although this survey is called the Current Population Survey, actually it is based on a sample. Usually the samples taken by the U.S. Bureau of Labor Statistics for these surveys are very large. As shown in the chart, the highest median weekly earning (of $1639) in 2014 was for workers with professional degrees, and the lowest (of $488) was for workers with less than high school diplomas. According to this survey, the median earning for all workers (aged 25 and over with full-time jobs) included in the survey was $839 in 2014, which is not shown in the graph.

Source: www.bls.gov.

The median gives the center of a histogram, with half of the data values to the left of the median and half to the right of the median. The advantage of using the median as a measure of center is that it is not influenced by outliers. Consequently, the median is preferred over the mean as a measure of center for data sets that contain outliers.

Sometime we use the terms resistant and nonresistant with respect to outliers for summary measures. A summary measure that is less affected by outliers is called a **resistant** summary measure, and the one that is affected more by outliers is called a **nonresistant** summary measure. From the foregoing discussion about the mean and median, it is obvious that the mean is a nonresistant summary measure, as it is influenced by outliers. In contrast, the median is a resistant summary measure because it is not influenced by outliers.

3.1.3 Mode

Mode is a French word that means *fashion*—an item that is most popular or common. In statistics, the mode represents the most common value in a data set.

Mode The *mode* is the value that occurs with the highest frequency in a data set.

EXAMPLE 3-6 Speeds of Cars

Calculating the mode for ungrouped data.

The following data give the speeds (in miles per hour) of eight cars that were stopped on I-95 for speeding violations.

77	82	74	81	79	84	74	78

Find the mode.

Solution In this data set, 74 occurs twice, and each of the remaining values occurs only once. Because 74 occurs with the highest frequency, it is the mode. Therefore,

$$\text{Mode} = \mathbf{74\ miles\ per\ hour}$$

A major shortcoming of the mode is that a data set may have none or may have more than one mode, whereas it will have only one mean and only one median. For instance, a data set with each value occurring only once has no mode. A data set with only one value occurring with the highest frequency has only one mode. The data set in this case is called **unimodal** as in Example 3-6 above. A data set with two values that occur with the same (highest) frequency has two modes. The distribution, in this case, is said to be **bimodal** as in Example 3-8 below. If more than two values in a data set occur with the same (highest) frequency, then the data set contains more than two modes and it is said to be **multimodal** as in Example 3-9 below.

EXAMPLE 3-7 Incomes of Families

Data set with no mode.

Last year's incomes of five randomly selected families were \$76,150, \$95,750, \$124,985, \$87,490, and \$53,740. Find the mode.

Solution Because each value in this data set occurs only once, this data set contains **no mode.**

EXAMPLE 3-8 Commuting Times of Employees

Data set with two modes.

A small company has 12 employees. Their commuting times (rounded to the nearest minute) from home to work are 23, 36, 14, 23, 47, 32, 8, 14, 26, 31, 18, and 28, respectively. Find the mode for these data.

Solution In the given data on the commuting times of these 12 employees, each of the values 14 and 23 occurs twice, and each of the remaining values occurs only once. Therefore, this data set has two modes: 14 and 23 minutes.

EXAMPLE 3-9 Ages of Students

Data set with three modes.

The ages of 10 randomly selected students from a class are 21, 19, 27, 22, 29, 19, 25, 21, 22, and 30 years, respectively. Find the mode.

Solution This data set has three modes: **19**, **21**, and **22**. Each of these three values occurs with a (highest) frequency of 2.

One advantage of the mode is that it can be calculated for both kinds of data—quantitative and qualitative—whereas the mean and median can be calculated for only quantitative data.

EXAMPLE 3-10 Status of Students

Finding the mode for qualitative data.

The status of five students who are members of the student senate at a college are senior, sophomore, senior, junior, and senior, respectively. Find the mode.

Solution Because **senior** occurs more frequently than the other categories, it is the mode for this data set. We cannot calculate the mean and median for this data set.

3.1.4 Trimmed Mean

Earlier in this chapter, we learned that the mean as a measure of center is impacted by outliers. When a data set contains outliers, we can use either median or trimmed mean as a measure of the center of a data set.

Trimmed Mean After we drop $k\%$ of the values from each end of a ranked data set, the mean of the remaining values is called the $k\%$ trimmed mean.

Thus, to calculate the trimmed mean for a data set, first we rank the given data in increasing order. Then we drop $k\%$ of the values from each end of the ranked data where k is any positive number, such as 5%, 10%, and so on. The mean of the remaining values is called the $k\%$ trimmed mean. Remember, although we drop a total of $2 \times k\%$ of the values, $k\%$ from each end, it is called the $k\%$ trimmed mean. The following example illustrates the calculation of the trimmed mean.

EXAMPLE 3-11 Money Spent on Books by Students

Calculating the trimmed mean.

The following data give the money spent (in dollars) on books during 2015 by 10 students selected from a small college.

890	1354	1861	1644	87	5403	1429	1993	938	2176

Calculate the 10% trimmed mean.

Solution To calculate the trimmed mean, first we rank the given data as below.

87	890	938	1354	1429	1644	1861	1993	2176	5403

To calculate the 10% trimmed mean, we drop 10% of the data values from each end of the ranked data.

$$10\% \text{of } 10 \text{ values} = 10\,(.10) = 1$$

Hence, we drop one value from each end of the ranked data. After we drop the two values, one from each end, we are left with the following eight values:

890	938	1354	1429	1644	1861	1993	2176

The mean of these eight values will be called the 10% trimmed mean. Since there are 8 values, $n = 8$. Adding these eight values, we obtain $\sum x$ as follows:

$$\sum x = 890 + 938 + 1354 + 1429 + 1644 + 1861 + 1993 + 2176 = 12{,}285$$

The 10% trimmed mean will be obtained by dividing 12,285 by 8 as follows:

$$10\%\text{Trimmed Mean} = \frac{12{,}285}{8} = 1535.625 = \mathbf{\$1535.63}$$

Thus, by dropping 10% of the values from each end of the ranked data for this example, we can state that students spent an average of $1535.63 on books in 2015.

Since in this data set $87 and $5403 can be considered outliers, it makes sense to drop these two values and calculate the trimmed mean for the remaining values rather than calculating the mean of all 10 values.

3.1.5 Weighted Mean

In many cases, when we want to find the center of a data set, different values in the data set may have different frequencies or different weights. We will have to consider the weights of different values to find the correct mean of such a data set. For example, suppose Maura bought gas for her car four times during June 2015. She bought 10 gallons at a price of $2.60 a gallon, 13 gallons at a price of $2.80 a gallon, 8 gallons at a price of $2.70 a gallon, and 15 gallons at a price of $2.75 a gallon. In such a case, the mean of the four prices as calculated in Section 3.1.1 will not give the actual mean price paid by Maura in June 2015. We cannot add the four prices and divide by four to find the average price. That can be done only if she bought the same amount of gas each time. But because the amount of gas bought each time is different, we will have to calculate the weighted mean in this case. The amounts of gas bought will be considered the weight here.

Weighted Mean When different values of a data set occur with different frequencies, that is, each value of a data set is assigned different weight, then we calculate the weighted mean to find the center of the given data set.

To calculate the weighted mean for a data set, we denote the variable by x and the weights by w. We add all the weights and denote this sum by $\sum w$. Then we multiply each value of x by the corresponding value of w. The sum of the resulting products gives $\sum xw$. Dividing $\sum xw$ by $\sum w$ gives the weighted mean.

Weighted Mean The weighted mean is calculated as:

$$\text{Weighted Mean} = \frac{\sum xw}{\sum w}$$

where x and w denote the variable and the weights, respectively.

The following example illustrates the calculation of the weighted mean.

EXAMPLE 3-12 Prices and Amounts of Gas Purchased

Calculating the weighted mean.

Maura bought gas for her car four times during June 2015. She bought 10 gallons at a price of $2.60 a gallon, 13 gallons at a price of $2.80 a gallon, 8 gallons at a price of $2.70 a gallon, and 15 gallons at a price of $2.75 a gallon. What is the average price that Maura paid for gas during June 2015?

Solution Here the variable is the price of gas per gallon, and we will denote it by x. The weights are the number of gallons bought each time, and we will denote these weights by w. We list the values of x and w in Table 3.3, and find $\sum w$. Then we multiply each value of x by the corresponding value of w and obtain $\sum xw$ by adding the resulting values. Finally, we divide $\sum xw$ by $\sum w$ to find the weighted mean.

Table 3.3 Prices and Amounts of Gas Purchased

Price (in dollars)	Gallons of Gas	
x	w	xw
2.60	10	26.00
2.80	13	36.40
2.70	8	21.60
2.75	15	41.25
	$\sum w = 46$	$\sum xw = 125.25$

$$\text{Weighted Mean} = \frac{\sum xw}{\sum w} = \frac{125.25}{46} = \mathbf{\$2.72}$$

Thus, Maura paid an average of $2.72 a gallon for the gas she bought in June 2015.

To summarize, we cannot say for sure which of the various measures of center is a better measure overall. Each of them may be better under different situations. Probably the mean is the most-used measure of center, followed by the median. The mean has the advantage that its calculation includes each value of the data set. The median and trimmed mean are better measures when a data set includes outliers. The mode is simple to locate, but it is not of much use in practical applications.

3.1.6 Relationships Among the Mean, Median, and Mode

As discussed in Chapter 2, two of the many shapes that a histogram or a frequency distribution curve can assume are symmetric and skewed. This section describes the relationships among the mean, median, and mode for three such histograms and frequency distribution curves. Knowing the values of the mean, median, and mode can give us some idea about the shape of a frequency distribution curve.

1. For a **symmetric histogram** and frequency distribution curve with one peak (see Figure 3.2), the values of the mean, median, and mode are identical, and they lie at the center of the distribution.

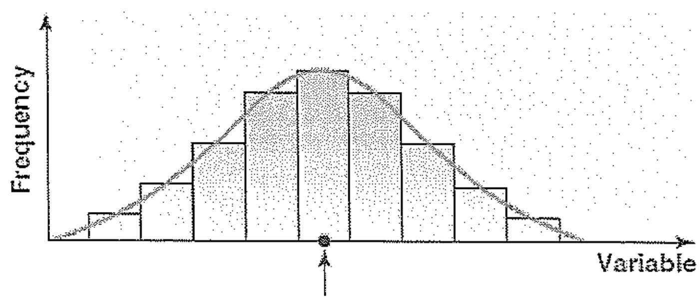


Figure 3.2 Mean, median, and mode for a symmetric histogram and frequency distribution curve.

2. For a histogram and a frequency distribution curve **skewed to the right** (see Figure 3.3), the value of the mean is the largest, that of the mode is the smallest, and the value of the median lies between these two. (Notice that the mode always occurs at the peak point.) The value of the mean is the largest in this case because it is sensitive to outliers that occur in the right tail. These outliers pull the mean to the right.

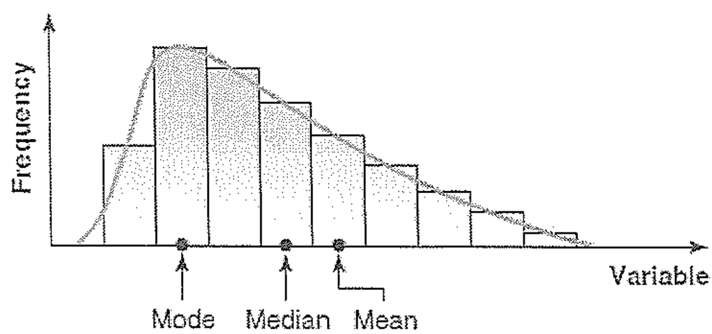


Figure 3.3 Mean, median, and mode for a histogram and frequency distribution curve skewed to the right.

3. If a histogram and a frequency distribution curve are **skewed to the left** (see Figure 3.4), the value of the mean is the smallest and that of the mode is the largest, with the value of the median lying between these two. In this case, the outliers in the left tail pull the mean to the left.

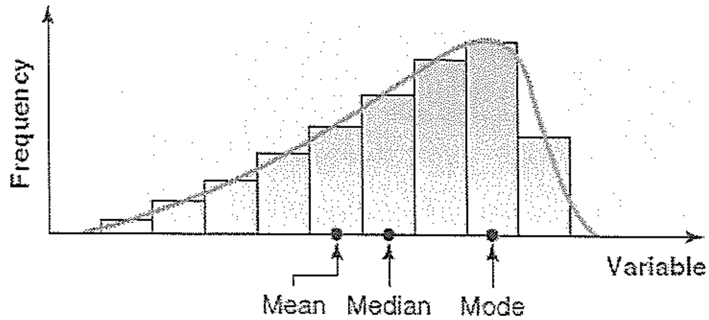


Figure 3.4 Mean, median, and mode for a histogram and frequency distribution curve skewed to the left.

EXERCISES

CONCEPTS AND PROCEDURES

3.1 Explain how the value of the median is determined for a data set that contains an odd number of observations and for a data set that contains an even number of observations.

3.2 Briefly explain the meaning of an outlier. Is the mean or the median a better measure of center for a data set that contains outliers? Illustrate with the help of an example.

3.3 Using an example, show how outliers can affect the value of the mean.

3.4 Which of the five measures of center (the mean, the median, the trimmed mean, the weighted mean, and the mode) can be calculated for quantitative data only, and which can be calculated for both quantitative and qualitative data? Illustrate with examples.

3.5 Which of the five measures of center (the mean, the median, the trimmed mean, the weighted mean, and the mode) can assume more than one value for a data set? Give an example of a data set for which this summary measure assumes more than one value.

3.6 Is it possible for a (quantitative) data set to have no mean, no median, or no mode? Give an example of a data set for which this summary measure does not exist.

3.7 Explain the relationships among the mean, median, and mode for symmetric and skewed histograms. Illustrate these relationships with graphs.

3.8 Prices of cars have a distribution that is skewed to the right with outliers in the right tail. Which of the measures of center is the best to summarize this data set? Explain.

3.9 The following data set belongs to a population:

5	−7	2	0	−9	16	10	7

Calculate the mean, median, and mode.

APPLICATIONS

3.10 The following data give the 2014 profits (in millions of dollars) of the top 10 companies listed in the 2014 *Fortune 500* (*source*: www.fortune.com).

Company	2014 Profits (millions of dollars)
Wal-Mart Stores	16,022
Exxon Mobil	32,580
Chevron	21,423
Berkshire Hathaway	19,476
Apple	37,037
Phillips 66	3726
General Motors	5346
Ford Motor	7155
General Electric	13,057
Valero Energy	2720

Find the mean and median for these data. Do these data have a mode? Explain.

3.11 The following data give the amounts (in dollars) of electric bills for November 2015 for 12 randomly selected households selected from a small town.

205	265	176	314	243	192	297	357	238	281	342	259

Calculate the mean and median for these data. Do these data have a mode? Explain.

3.12 Twenty randomly selected married couples were asked how long they have been married. Their responses (rounded to years) are listed below.

12	27	8	15	5	9	18	13	35	23
19	33	41	59	3	26	5	34	27	51

a. Calculate the mean, median, and mode for these data.

b. Calculate the 10% trimmed mean for these data.

3.13 The following data give the 2015 bonuses (in thousands of dollars) of 10 randomly selected Wall Street managers.

127	82	45	99	153	3261	77	108	68	278

a. Calculate the mean and median for these data.

b. Do these data have a mode? Explain why or why not.

c. Calculate the 10% trimmed mean for these data.

d. This data set has one outlier. Which summary measures are better for these data?

3.14 The following data give the total food expenditures (in dollars) for the past one month for a sample of 20 families.

1125	530	1234	595	427	872	1480	699	1274	1187
933	1127	716	1065	934	930	1046	1199	1353	441

a. Calculate the mean and median for these data.

b. Calculate the 20% trimmed mean for these data.

3.15 The following data give the prices (in thousand dollars) of all 10 homes that were sold in a small town last year.

205	214	265	195	283	188	251	325	219	295

a. Calculate the mean and median for these data.

b. Calculate the 10% trimmed mean for these data.

3.16 The following data give the annual salaries (in thousand dollars) of 20 randomly selected health care workers.

50	71	57	39	45	64	38	53	35	62
74	40	67	44	77	61	58	55	64	59

a. Calculate the mean, median, and mode for these data.

b. Calculate the 15% trimmed mean for these data.

3.17 The following data give the number of patients who visited a walk-in clinic on each of 20 randomly selected days.

23	37	26	19	33	22	30	42	24	26
28	32	37	29	38	24	35	20	34	38

a. Calculate the mean, median, and mode for these data.

b. Calculate the 15% trimmed mean for these data.