Example 1

Table 1.1 lists the total cash donations (rounded to millions of dollars) given by eight U.S. companies during the year 2010 (*Source*: Based on U.S. Internal Revenue Service data analyzed by *The Chronicle of Philanthropy* and *USA TODAY*).

Table 1.1 Cash Donations in 2010 by Eight U.S. Companies

Company	Cash Donations (millions of dollars)
Wal-Mart	319
Exxon Mobil	199
Citigroup	110
Home Depot	63
Best Buy	21
Goldman Sachs	315
American Express	26
Nike	63

Find the mean of cash donations made by these eight companies.

Example 1: Solution

$$\sum x = x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8$$

$$= 319 + 199 + 110 + 63 + 21 + 315 + 26 + 63 = 1116$$

$$\bar{x} = \frac{\sum x}{n} = \frac{1116}{8} = 139.5 = \$139.5 million$$

Thus, these eight companies donated an average of **$139.5 million** in 2010 for charitable purposes.

Example 2

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.

Example 2: Solution

The population mean is

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

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

Example 3

Refer to the data on the number of homes foreclosed in seven states given in Table 2.1. Those values are listed below.

173,175 49,723 20,352 10,824 40,911 18,038 61,848

Find the median for these data.

Table 2.1 Number of Homes Foreclosed in 2010

State	Number of Homes Foreclosed
California	173,175
Illinois	49,723
Minnesota	20,352
New Jersey	10,824
Ohio	40,911
Pennsylvania	18,038
Texas	61,848

Example 3: Solution

First, we rank the given data in increasing order as follows:

10,824 18,038 20,352 40,911 49,723 61,848 173,175

Since there are seven homes in this data set and the middle term is the fourth term,

10,824 18,038 20,352 **40,911** 49,723 61,848 173,175

↑

Median

Thus, the median number of homes foreclosed in these seven states was **40,911** in 2010.

Example 4

Table 3.3 gives the total compensations (in millions of dollars) for the year 2010 of the 12 highest-paid CEOs of U.S. companies.

Table 4.1 Total Compensations of 12 Highest-Paid CEOs for the Year 2010

Find the median for these data.

CEO and Company	2010 Total Compensation (millions of dollars)
Michael D. White (DirecTV)	32.9
David N. Farr (Emerson Electric)	22.9
Brian L. Roberts (Comcast)	28.2
Philippe P. Dauman (Viacom)	84.5
William C. Weldon (Johnson & Johnson)	21.6
Robert A. Iger (Walt Disney)	28.0
Ray R. Iran (Occidental Petroleum)	76.1
Samuel J. Palmisano (IBM)	25.2
John F. Lundgren (Stanley Black & Decker)	32.6
Lawrence J. Ellison (Oracle)	70.1
Alan Mulally (Ford Motor)	26.5
Howard Schultz (Starbucks)	21.7

Example 4: Solution

First we rank the given total compensations of the 12 CESs as follows:

21.6 21.7 22.9 25.2 26.5 28.0 28.2 32.6 32.9 70.1 76.1 84.5

There are 12 values in this data set. Because there are an even number of values in the data set, the median is given by the average of the two middle values.

21.6 21.7 22.9 25.2 26.5 28.0 28.2 32.6 32.9 70.1 76.1 84.5

↑

Median = 28.1

Example 5: Solution

The two middle values are the sixth and seventh in the arranged data, and these two values are 28.0 and 28.2.

$$\text{Median} = \frac{28.0 + 28.2}{2} = \frac{56.2}{2} = 28.1 = \$28.1 \textit{million}$$

Thus, the median for the 2010 compensations of these 12 CEOs is **$28.1 million**.

Example 6

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.

Example 6: 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,

Mode = **74 miles per hour**

Example 7 (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, 12, 23, 47, 32, 8, 12, 26, 31, 18, and 28, respectively.

Find the mode for these data.

Example 7: Solution

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

Example 7

Until about 2009, airline passengers were not charged for checked baggage. Around 2009, however, many U.S. airlines started charging a fee for bags. According to the Bureau of Transportation Statistics, U.S. airlines collected more than $3 billion in baggage fee revenue in 2010. The following table lists the baggage fee revenues of six U.S. airlines for the year 2010. (Note that Delta's revenue reflects a merger with Northwest. Also note that since then United and Continental have merged; and American filed for bankruptcy and may merge with another airline.)

Find the variance and standard deviation for these data.

Table 7.1

Airline	Baggage Fee Revenue (millions of dollars)
United	313
Continental	342
American	581
Delta	952
US Airways	514
Air Tran	152

Example 7: Solution

Let x denote the 2010 baggage fee revenue (in millions of dollars) of an airline. The values of Σx and Σx^2 are calculated in Table 7.2.

x	x^2
313	97,969
342	116,964
581	337,561
952	906,304
514	264,196
152	23,104
$\Sigma x = 2854$	$\Sigma x^2 = 1{,}746{,}098$

Step 1. Calculate Σx

The sum of values in the first column of Table 3.6 gives 2,854.

Step 2. Find Σx^2

The results of this step are shown in the second column of Table 3.6, which is 1,746,098.

Step 3. Determine the variance

$$s^2 = \frac{\sum x^2 - \frac{\left(\sum x\right)^2}{n}}{n-1} = \frac{1{,}746{,}098 - \frac{(2{,}854)^2}{6}}{6-1}$$

$$= \frac{1{,}746{,}098 - 1{,}357{,}552.667}{5}$$

$$= 77{,}709.06666$$

Step 4. Obtain the standard deviation

The standard deviation is obtained by taking the (positive) square root of the variance:

$$s = \sqrt{\frac{\sum x^2 - \frac{\left(\sum x\right)^2}{n}}{n-1}} = \sqrt{77{,}709.06666}$$

$$= 278.7634601 = \$278.76 million$$

Thus, the standard deviation of the 2010 baggage fee revenues of these six airlines is **$278.76 million**.