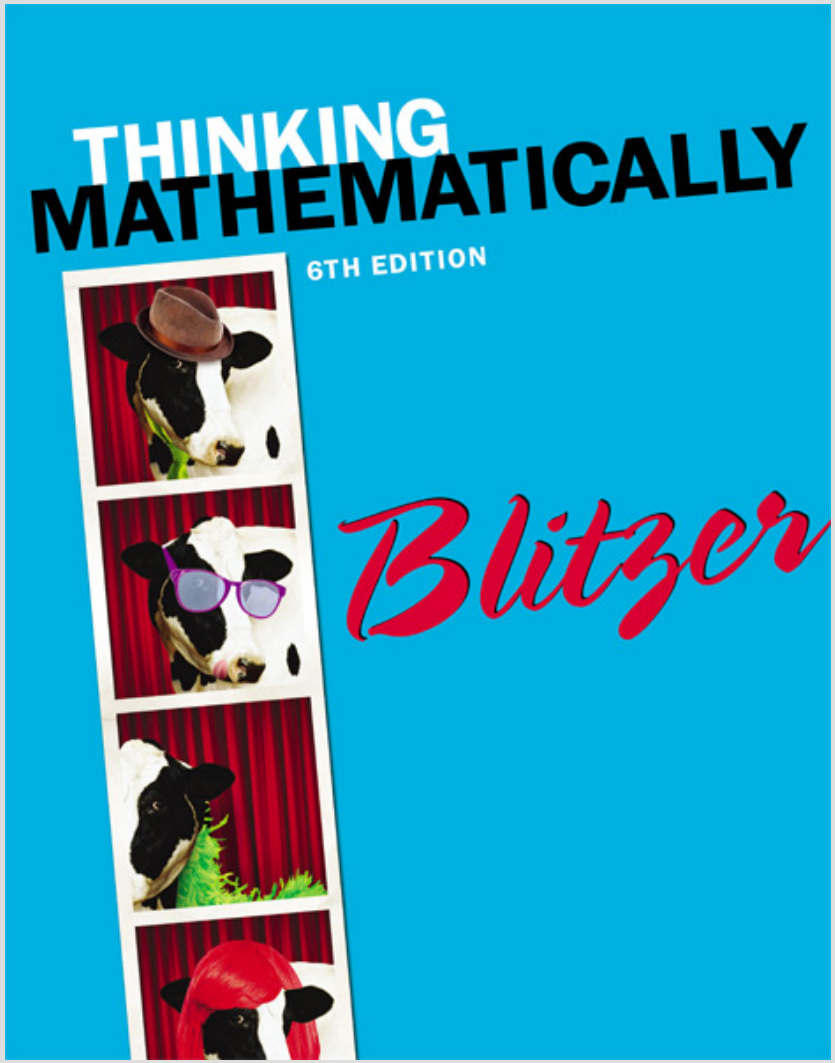
CHAPTER 12

Statistics



12.3

Measures of Dispersion

Objectives

1. Determine the range for a data set.

2. Determine the standard deviation for a data set.

Range

Used to describe the spread of data items in a data set. Two of the most common measures of dispersion are range and standard deviation.

Range: The difference between the highest and the lowest data values in a data set:

Range = highest data value – lowest data value

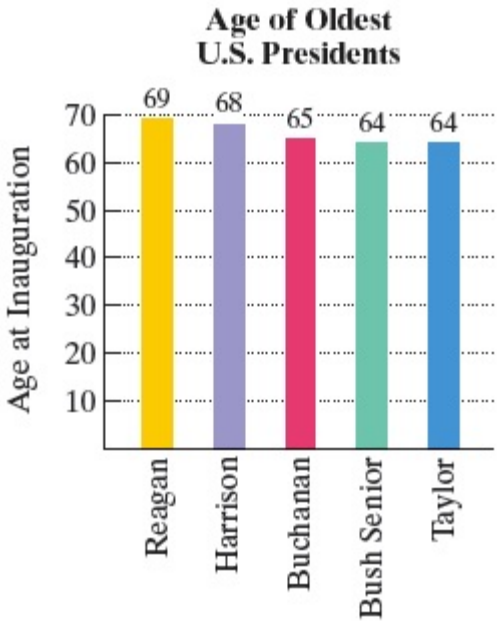
Honolulu's hottest day is 89º and its coldest day is 61º.

The range in temperature is:

$$89^\circ - 61^\circ = 28^\circ$$

Example: Computing the Range

The figure shows the age of the five oldest U.S presidents at the start of their first term. Find the age range for the five oldest presidents.



Solution

Range = High Value – Low Value

= 69 – 64

= 5

Example: Preparing to Find the Standard Deviation; Finding Deviations from the Mean

Find the deviations from the mean for the five data items 69, 68, 65, 64, and 64.

First calculate the mean. $\bar{x} = \frac{\sum x}{n} = \frac{69+68+65+65+64}{5} = \frac{330}{5} = 66$

Data Item	Deviation: data item – mean
69	69 – 66 = 3
68	68 – 66 = 2
65	65 – 66 = –1
64	64 – 66 = –2
64	64 – 66 = –2

Computing The Standard Deviation for a Data Set

COMPUTING THE STANDARD DEVIATION FOR A DATA SET

1. Find the mean of the data items.
2. Find the deviation of each data item from the mean:

$$\text{data item} - \text{mean}.$$

3. Square each deviation:

$$(\text{data item} - \text{mean})^2.$$

4. Sum the squared deviations:

$$\Sigma(\text{data item} - \text{mean})^2.$$

5. Divide the sum in step 4 by $n - 1$, where n represents the number of data items:

$$\frac{\Sigma(\text{data item} - \text{mean})^2}{n - 1}.$$

6. Take the square root of the quotient in step 5. This value is the standard deviation for the data set.

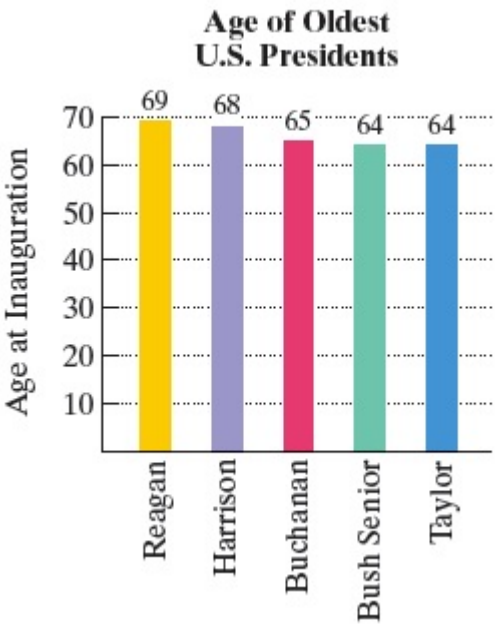
$$\text{Standard deviation} = \sqrt{\frac{\Sigma(\text{data item} - \text{mean})^2}{n - 1}}$$

Example: Computing the Standard Deviation

Find the standard deviation, of the ages of the five presidents.

Step 1: We found the mean to be 66.

Step 2: Find the deviation of each data item from the mean. This was done on the previous slide.



Example continued

Data Item	Deviation	(Deviation)^2
69	$69 - 66 = 3$	$3^2 = 9$
68	$68 - 66 = 2$	$2^2 = 4$
65	$65 - 66 = -1$	$(-1)^2 = 1$
64	$64 - 66 = -2$	$(-2)^2 = 4$
64	$64 - 66 = -2$	$(-2)^2 = 4$
Totals	$\sum\left(x-\bar{x}\right)=0$	$\sum\left(x-\bar{x}\right)^2=22$

Example continued

Step 5: Divide the sum in step 4 by $n-1$, where n represents the number of data items, which is 5:

$$\frac{\sum\left(x-\bar{x}\right)^2}{n-1}=\frac{22}{4}=5.5$$

Step 6: The standard deviation is the square root of the quotient in the previous step.

$$\sqrt{\frac{\sum\left(x-\bar{x}\right)^2}{n-1}}=\sqrt{5.5}\approx 2.35$$