

11.6 ANALYZING DATA

A MEASURE OF CENTRAL
TENDENCY INDICATES THE
"MIDDLE" OF THE DATA SET.

MEAN : AVERAGE VALUE
$$\frac{\text{SUM OF DATA VALUES}}{\text{\# OF DATA VALUES}}$$

MEDIAN : THE MIDDLE VALUE
IN AN ORDERED DATA
SET

MODE : THE MOST FREQUENTLY
OCCURRING VALUE(S).

Ex) FIND THE MEAN, MEDIAN,
AND MODE.

4, 7, 12, 6, 4, 3, 11, 3, 6, 3, 2

MEAN: $\frac{4+7+12+6+4+3+11+3+6+3+2}{11} = \frac{61}{11} \approx 5.55$

↑
11 TOTAL DATA VALUES

MEDIAN: ORDER DATA VALUES

2, 3, 3, 3, 4, 4, 6, 6, 7, 11, 12

5 VALUES 5 VALUES

↑
MIDDLE VALUE

MEDIAN IS 4

NOTE: IF AN EVEN NUMBER OF VALUES,
THEN MEDIAN IS THE MEAN OF THE
TWO MIDDLE VALUES.

MODE: 3

NOTE: IT IS POSSIBLE
TO HAVE MULTIPLE MODES.

MEAN
5.55

MEDIAN
4

MODE
3

AN OUTLIER IS A VALUE THAT IS SUBSTANTIALLY DIFFERENT FROM THE REST OF THE DATA IN THE SET.

THEY CAN AFFECT MEASURES OF CENTRAL TENDENCY.

THE RANGE OF A SET OF DATA IS THE DIFFERENCE BETWEEN THE GREATEST AND LEAST VALUES.

4, 7, 12, 6, 4, 3, 11, 3, 6, 3, 2

RANGE IS $12 - 2 = 10$

The **range of a set of data** is the difference between the greatest and least values. If you order data from least value to greatest value, the median divides the data into two parts. The median of each part divides the data further and you have four parts in all. The values separating the four parts are **quartiles**. The **interquartile range** is the difference between the third and first quartiles.

Problem 3 Comparing Data Sets

Temperature The table shows average monthly water temperatures for four locations on the Gulf of Mexico. How can you compare the 12 water temperatures from St. Petersburg with the 12 water temperatures from Key West?

Gulf of Mexico Eastern Coast Water Temperatures (°F)

Location	J	F	M	A	M	J	J	A	S	O	N	D
St. Petersburg, Florida	62	64	68	74	80	84	86	86	84	78	70	64
Key West, Florida	69	70	75	78	82	85	87	87	86	82	76	72
Dauphin Island, Alabama	51	53	60	70	75	82	84	84	80	72	62	56
Grand Isle, Louisiana	61	61	64	70	77	83	85	85	83	77	70	65

SOURCE: National Oceanographic Data Center

Know

Water temperatures near the two cities

Need

The means, medians, modes, ranges, and interquartile ranges

Plan

Order the data. Find the means, medians, modes, minimums, maximums, quartiles, range, and interquartile range.

St. Petersburg:

$$\bar{x} = \frac{62 + 64 + 64 + 68 + 70 + 74 + 78 + 80 + 84 + 84 + 86 + 86}{12} = \frac{900}{12} = 75 \text{ (mean water temperature)}$$

Modes: 64, 84, and 86

Min.: 62; Max.: 86; Range: $86 - 62 = 24$

Median (Q_2) = 76

62 64 (64 68) 70 (74 78) 80 (84 84) 86 86

Median of lower part (Q_1) = 66

Median of upper part (Q_3) = 84

Interquartile range:

$$Q_3 - Q_1 = 84 - 66 = 18$$

Key West:

$$\bar{x} = \frac{69 + 70 + 72 + 75 + 76 + 78 + 82 + 82 + 85 + 86 + 87 + 87}{12} = \frac{949}{12} \approx 79.1 \text{ (mean water temperature)}$$

Modes: 82 and 87

Min.: 69; Max.: 87; Range: $87 - 69 = 18$

Median (Q_2) = 80

69 70 (72 75) 76 (78 82) 82 (85 86) 87 87

Median of lower part (Q_1) = 73.5

Median of upper part (Q_3) = 85.5

Interquartile range:

$$Q_3 - Q_1 = 85.5 - 73.5 = 12$$

The range and the interquartile range show the temperatures varying less at Key West than at St. Petersburg. Also, the temperatures at Key West are generally higher.

Think

What location has a greater range in water temperature? The range of water temperatures at St. Petersburg is 6°F greater than the range at Key West.

- Got It?** 3. How can you compare the 12 water temperatures in Problem 3 from Dauphin Island with the 12 water temperatures from Grand Isle?

A *box-and-whisker plot* uses minimum and maximum values, the median, and the first and third quartiles to display the spread, or variability, in a data set.

Take note

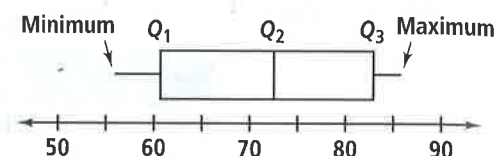
Key Concept Box-and-Whisker Plot

Definition

A **box-and-whisker plot** is a way to display data that uses

- quartiles to bound the center box and
- the minimum and maximum values to form the whiskers.

Graph



Problem 4 Using a Box-and-Whisker Plot

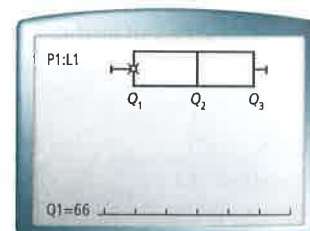
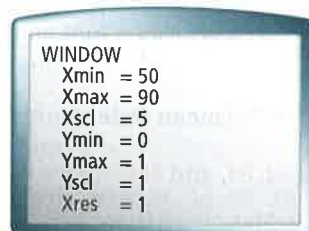
How can you use a graphing calculator box-and-whisker plot to find quartiles for the water temperature data of St. Petersburg from Problem 3?

Think

What about the appearance of a box-and-whisker plot might suggest an outlier?

If a "whisker" is much longer than the box, it's endpoint may be an outlier.

- Step 1** For St. Petersburg, use **STAT EDIT** to enter the temperature data in **L1**.
Step 2 In **STAT PLOT**, select a box-and-whisker plot. Enter **L1** for the St. Petersburg data. Enter the window values. Draw the box-and-whisker plot.



- Step 3** Use **TRACE** to find the quartiles: $Q_1 = 66$, $Q_2 = 76$, and $Q_3 = 84$.

- Got It?** 4. a. How can you use graphing calculator box-and-whisker plots to find water temperature quartiles for other Gulf Coast sites in Problem 3?
 b. **Reasoning** Is a box-and-whisker plot a useful graphical display for data with an outlier? Explain.

A **percentile** is a number from 0 to 100 that you can associate with a value x from a data set. It shows the percent of the data that are less than or equal to x . If x is at the 63rd percentile, then 63% of the data are less than or equal to x .