

Bell Ringer

Lesson lab – Standard deviation

1. Find the standard deviation for the given data set.

Sales Tax by State

| Percent | Frequency |
|---------|-----------|
| 1 | 1 |
| 4 | 1 |
| 5 | 3 |
| 6 | 4 |
| 7 | 5 |

Review.

2. Solve for d. $\frac{-280-80d}{2} = c$

$$\begin{aligned}
 & -\frac{1280-80d}{2} = \frac{32c-1280}{-80} && \frac{4c-160}{-10} \\
 & -\frac{1280-80d}{2} = \frac{4c-160}{-10} && \frac{2c-80}{-5} \\
 & -\frac{2c}{5} + \frac{80}{5} = \frac{-2c+80}{5} \\
 & -\frac{2c}{5} + 16 = \frac{-2c+80}{5}
 \end{aligned}$$

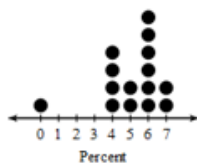
$\left. \begin{matrix} \uparrow + 1.69 \\ \downarrow - 1.69 \end{matrix} \right\} 5.6''$

Solutions

Lesson lab – Standard deviation

1. Find the standard deviation for the given data set.

Sales Tax by State



1.69

Review.

2. Solve for d. $\frac{1280-80d}{32} = c$

$$d = \frac{-2c+80}{5}$$

correct 6.2 #s 11-13, 15, 16, 18, 19, 22, 23, 25

- 😊 **11.** 26.2, 30.5, 33; the median, since there is an outlier in this set
- 😊 **12.** 8.76, 8.8, no mode; the mean, since there is no outlier
- 😊 **13.** 94
- 15.** The correct range is 8 because the range is defined as the difference between the highest and lowest values.
- 😊 **16.** Since an outlier is either much larger or much smaller than most of the data, it causes the range to get larger.
- 18. a.** Plant A: 5.8, 5.8, 5.4, 1.2; Plant B: 5.6, 5.5, no mode; 2.9
- 😊 **b.** Plant A: mean as there is no outlier; Plant B: either mean or median, if you consider 7.2 to be an outlier.
- c.** The greater data values are in the bottom rows of a stem-and-leaf plot. Since more of the data are concentrated near the bottom of the plot for Plant A than for Plant B, Plant A has the greater mean.
- 😊 **19.** 18.5, 20.4, 20.4, 13.2
- 😊 **22.** 2.8 m, 2.8 m, 2.8 m and 2.9 m, 0.7 m
- 😊 **23.** No; because one salesperson earned \$150,000, the mean was \$47,500, but a better indicator might be the median, which was only \$37,500.
- ~~24. 46.4 mi/h~~ **25.** $\frac{20}{3}x$, 6x, 4x, 7x

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6-3 Box-and-Whisker Plots

Objectives To make and interpret box-and-whisker plots
To find quartiles and percentiles

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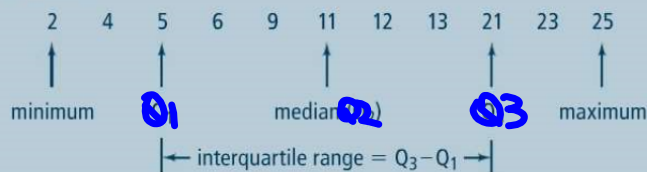
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In the Solve It, you may have looked at different parts of each data set in order to compare the two data sets.

Essential Understanding Separating data into subsets is a useful way to summarize and compare data sets.

Quartiles are values that divide a data set into four equal parts. The median (or second quartile, Q_2) separates the data into upper and lower halves. The first quartile (Q_1) is the median of the lower half of the data. The third quartile (Q_3) is the median of the upper half of the data. The **interquartile range** is the difference between the third and first quartiles.

$$\text{IQR} = Q_3 - Q_1$$



For a set of data that has an odd number of values, you do not include the median in either half when finding the first and third quartiles.

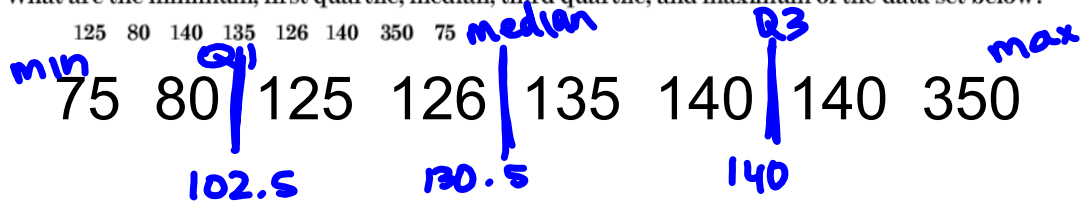
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Problem 1 Summarizing a Data Set

What are the minimum, first quartile, median, third quartile, and maximum of the data set below?



solutions

**Problem 1** Summarizing a Data Set

What are the minimum, first quartile, median, third quartile, and maximum of the data set below?

125 80 140 135 126 140 350 75

Step 1 Arrange the data in order from least to greatest.

75 80 125 126 135 140 140 350

Step 2 Find the minimum, maximum, and median.

The minimum is 75. The maximum is 350. The median is 130.5.

Step 3 Find the first quartile and the third quartile.

$$\text{first quartile (Q}_1\text{)} = \frac{80+125}{2} = 102.5$$

$$\text{third quartile (Q}_3\text{)} = \frac{140+140}{2} = 140$$

The first quartile is 102.5. The third quartile is 140.

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Got It? What are the minimum, first quartile, median, third quartile, and maximum of each data set?

a. 95 85 75 85 65 60 100 105 75 85 75

60 65 75 75 75 85 85 85 95 100 105

Q1

med

Q3

How do you arrange the given data to find the required values?

b. 11 19 7 5 21 53

5 7 11 19 21 53

Q1

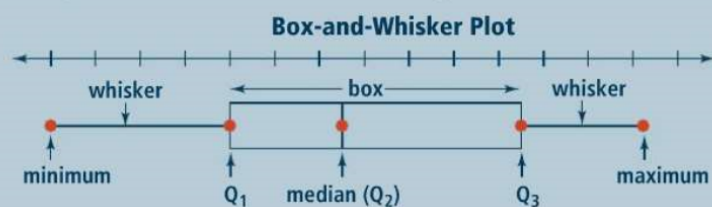
med

Q3

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pg 368 Box and whisker plots

A **box-and-whisker plot** is a graph that summarizes a set of data by displaying it along a number line. It consists of three parts: a box and two whiskers.



- The left whisker extends from the minimum to the first quartile. It represents about 25% of the data.
- The box extends from the first quartile to the third quartile and has a vertical line through the median. The length of the box represents the interquartile range. It contains about 50% of the data.
- The right whisker extends from the third quartile to the maximum. It represents about 25% of the data.

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Problem 2 Making a Box-and-Whisker Plot

Agriculture The table at the right shows the amount of crops harvested in the United States for a certain period. What box-and-whisker plot represents the data?

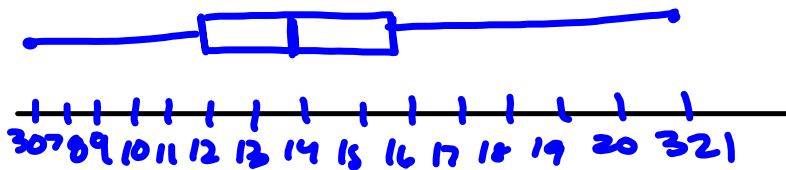
307 311 312 314 314 314 315 316 316 321



Crops Harvested

| Year | Acres (millions) | Year | Acres (millions) |
|------|------------------|------|------------------|
| 0 | 314 | 6 | 307 |
| 1 | 321 | 7 | 316 |
| 2 | 315 | 8 | 312 |
| 3 | 316 | 9 | 314 |
| 4 | 314 | 10 | 303 |
| 5 | 311 | | |

Source: U.S. Department of Agriculture



min 307
 $Q_1 = 312$
 med = 314
 $Q_3 = 316$
 max = 321

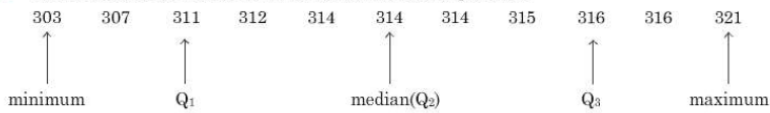
solutions



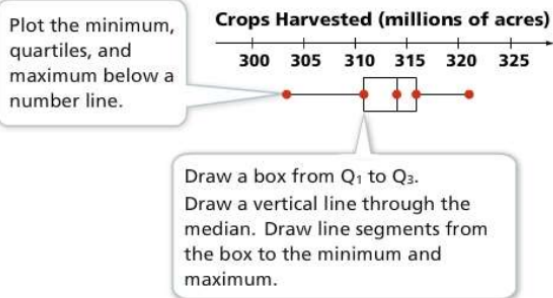
Problem 2 Making a Box-and-Whisker Plot

Agriculture The table at the right shows the amount of crops harvested in the United States for a certain period. What box-and-whisker plot represents the data?

Step 1 Order the data to find the minimum, maximum, and quartiles.



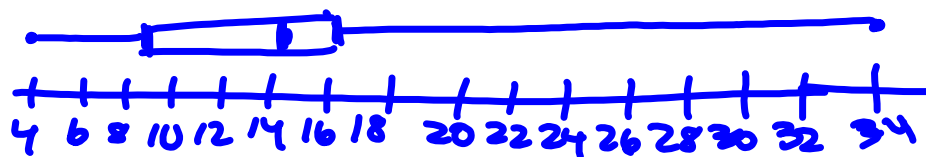
Step 2 Draw the box-and-whisker plot.



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Got It? What box-and-whisker plot represents the following monthly sales, in millions of dollars, of audio devices: 15 4 9 16 10 16 8 14 25 34?

4 8 9 10 14 | 15 16 16 25 34
 Q1 14.5 Q3.

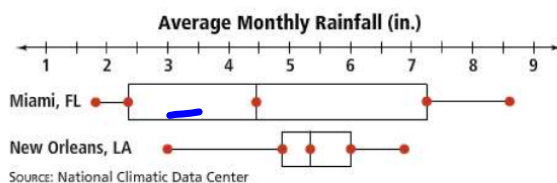


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**Problem 3** Interpreting Box-and-Whisker Plots

Weather Use the box-and-whisker plots below. What do the interquartile ranges tell you about the average monthly rainfall for each city?

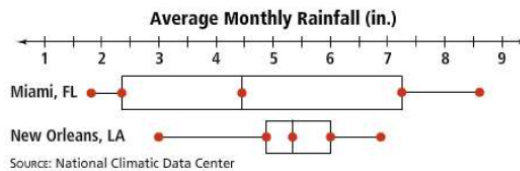


solutions



Problem 3 Interpreting Box-and-Whisker Plots

Weather Use the box-and-whisker plots below. What do the interquartile ranges tell you about the average monthly rainfall for each city?



Think

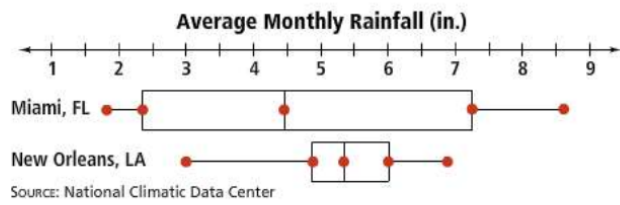
Why is the interquartile range useful?

It represents the middle of the data set, so it is not affected by the minimum, maximum, or any outliers.

The box for Miami is longer, so Miami has the greater interquartile range. This greater range means the middle 50% of Miami's monthly rainfalls vary more widely than those of New Orleans.

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Got It? Use the box-and-whisker plots from Problem 3. What do the medians tell you about the average monthly rainfalls for Miami and New Orleans?



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pg 369 - Percentiles

Percentiles separate data sets into 100 equal parts. The **percentile rank** of a data value is the percentage of data values that are less than or equal to that value.

35" - 72%
27" - 42%

62%
16%

6% weight
14% height

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**Problem 4** Finding a Percentile Rank

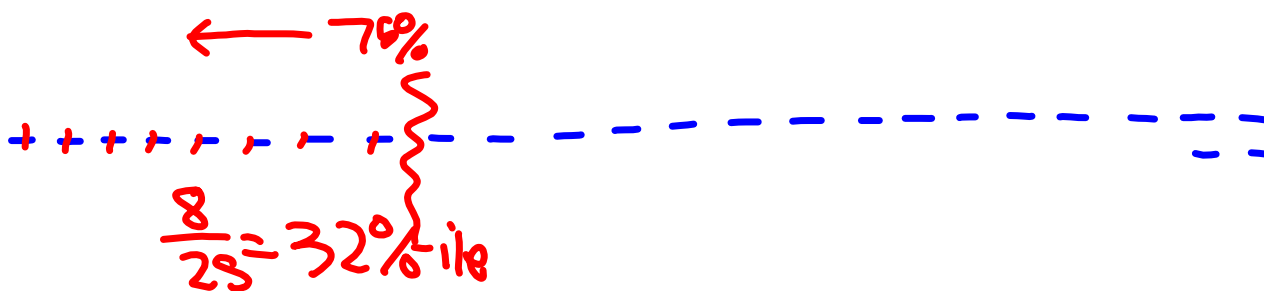
Multiple Choice Of 25 test scores, eight are less than or equal to 75. What is the percentile rank of a test score of 75?

(A) 8

(B) 17

(C) 32

(D) 75



solution

**Problem 4** Finding a Percentile Rank

Multiple Choice Of 25 test scores, eight are less than or equal to 75. What is the percentile rank of a test score of 75?

(A) 8

(B) 17

(C) 32

(D) 75

Write the ratio of the number of test scores less than or equal to 75 compared to the total number of test scores.

$$\frac{8}{25}$$

Rewrite the fraction as a percent.

$$\frac{8}{25} = 0.32$$

$$= 32\%$$

Think

How else could you find the percentile rank?

You could solve the proportion $\frac{8}{25} = \frac{p}{100}$ for p .

The percentile rank of 75 is 32. The correct answer is C.

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Of 60 students who take the ACT, 9 have scores greater than 27. What is the percentile rank of a score of 27?

$$\begin{array}{ccccccc} & 51 & & 9 & & & 36 \\ & & & | & & & \\ \frac{0}{60} = & & & 27 & & & \\ 1.7\% & & & & & & \\ & \frac{51}{60} = 85\% & & & & & \\ 1. & & & & & & \end{array}$$

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- Got It?** a. Of the 25 scores in Problem 4, there are 15 scores less than or equal to 85. What is the percentile rank of 85?

How can you write a proportion to solve this problem?

0 15 85 10 100

$\frac{15}{25} = \frac{3}{5} = 60\%$

- b. Reasoning** Is it possible to have a percentile rank of 0? Explain.

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6.3 #s 8-16, 19-22