CONSTRUCTING BOX PLOTS

The student is expected to represent numeric data graphically, including dot plots, stem-and-leaf plots, histograms, and box plots.

TELL ME MORE...

A graph helps you visualize certain characteristics of a data set. Some graphs, like dot plots, stem-and-leaf plots, or histograms, help you see the distribution of the data within the set. In other words, you can see characteristics such as which data values are more common than others or how close in value the data values are.

Other types of graphs, such as **box plots** (also called **box-and-whiskers plots**) show you how spread out the data values in the set are. Box plots have a box that shows where the middle half of the data set is. Each end has a whisker that shows you the lower fourth and upper fourth of the data set.

The football team at Ann Richards Middle School played 11 games last season. The number of points the team scored in each game is shown in the following list.

12, 28, 40, 6, 24, 16, 20, 21, 14, 22, 36

You can represent the data set with a box plot. First, you will need to determine the median, first quartile, and third quartile. To help with calculating these values, list the data set in order from least to greatest.

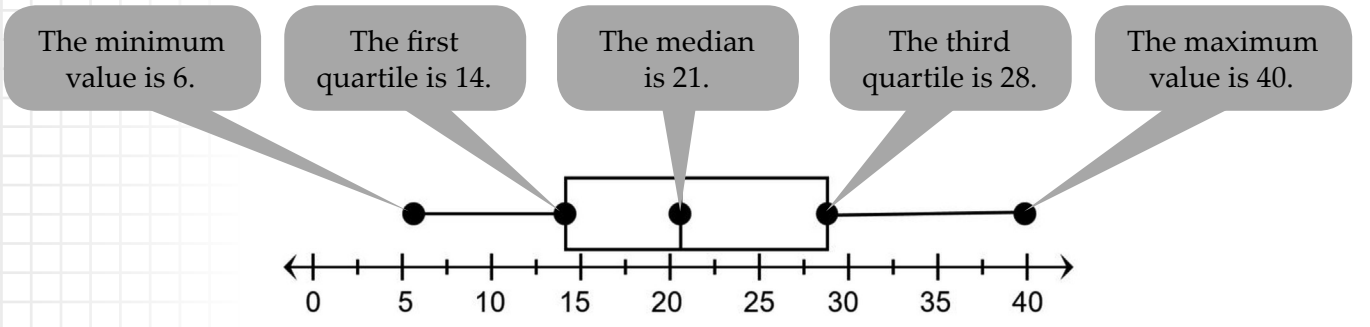
6, 12, 14, 16, 20, 21, 22, 24, 28, 36, 40

The **first quartile** is the middle value of the first half of the data (all of the numbers less than the median). In this data set, the first quartile is 14.

The **median** is the middle value when the data are ordered from least to greatest. In this data set, the median is 21.

The **third quartile** is the middle value of the second half of the data (all of the numbers greater than the median). In this data set, the third quartile is 28.

Combine these three data measures with the minimum value and the maximum value, and you can use this **five number summary** to build the box plot. Plot each value on the number line. Create a box with the first quartile as the left boundary and the third quartile as the right boundary. Draw a vertical line through the median. Connect the box with the minimum value for the left whisker. Connect the box with the maximum value for the right whisker.



EXAMPLES

EXAMPLE 1: The list shows the median home price for 9 different ZIP codes in the San Antonio metropolitan area in 2017. Create a box plot for this data set.

$76,700 $191,900 $113,700 $127,300 $189,450 $217,500 $124,075 $139,900 $214,525

STEP 1 List the data values in order from least to greatest.

- Making this ordered list will help you determine the values of the five numbers that you need to construct the box plot.

$76,700 $113,700 $124,075 $127,300 $139,900 $189,450 $191,900 $214,525 $217,500

STEP 2 Identify the median, first quartile, third quartile, minimum value, and maximum value.

- There are 9 numbers in the data set, so the middle number is the median.
- There are 9 numbers in the data set and the median divides the data set into two halves. If you exclude the median, both the first and second halves each have 4 numbers.
- The quartiles are the average of the two middle numbers in each half of the data set.

$76,700 $113,700 $124,075 $127,300 $139,900 $189,450 $191,900 $214,525 $217,500

minimum value

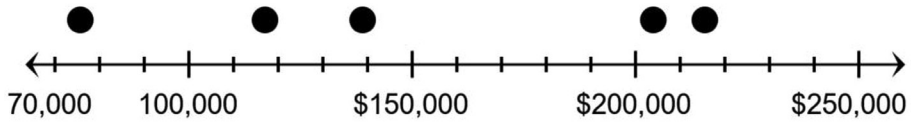
first quartile $\frac{113{,}700 + 124{,}075}{2} = 118{,}887.50$

median

third quartile $\frac{191{,}900 + 214{,}525}{2} = 203{,}212.50$

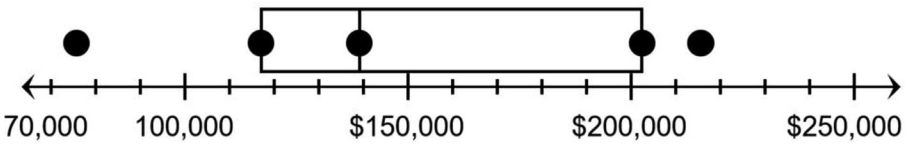
maximum value

STEP 3 Plot the five values on a number line.



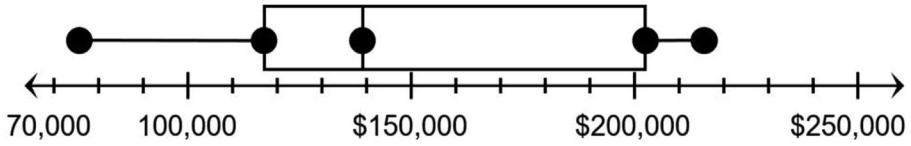
STEP 4 Construct the box.

- Draw a rectangle with the left side being the first quartile and the right side being the third quartile.
- Draw a vertical line through the median



STEP 5 Construct the whiskers.

- Connect the minimum value to the box at the first quartile.
- Connect the maximum value to the box at the third quartile.



YOU TRY IT!

Adriana wants to purchase an e-book of her favorite novel. The table shows some prices she found online.

Price	Price
$8.68	$10.50
$17.19	$14.84
$20.16	$9.94
$11.95	

On the number line below, label each tick mark with a whole number so that the data values will all appear along the number line.

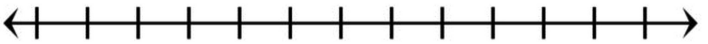
List the data values in order from least to greatest.

Minimum value:_____ Maximum value: _____

First quartile:_____ Median: _____

Third quartile: _____

Construct the box and whiskers.



EXAMPLE 2: The National Weather Services uses the Dallas/Fort Worth International Airport as the official weather station for the Dallas/Fort Worth metropolitan area. In 2017, the following monthly rainfall totals, in inches, were recorded. Create a box plot to display the data set.

4.39 2.33 1.06 3.38 0.7 8.44 4.12 4.24 0.47 2.12 0.81 4.56

STEP 1 List the data values in order from least to greatest.

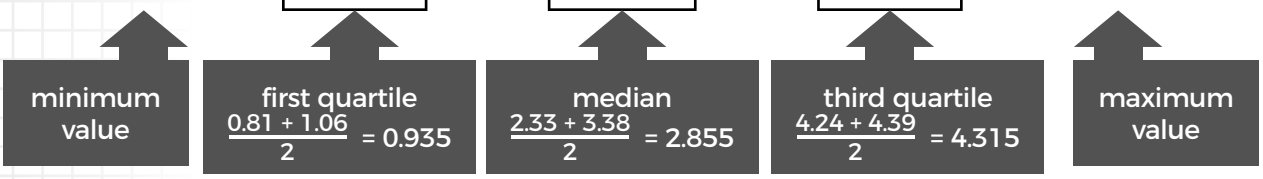
- Making this ordered list will help you determine the values of the five numbers that you need to construct the box plot.

0.47 0.7 0.81 1.06 2.12 2.33 3.38 4.12 4.24 4.39 4.56 8.44

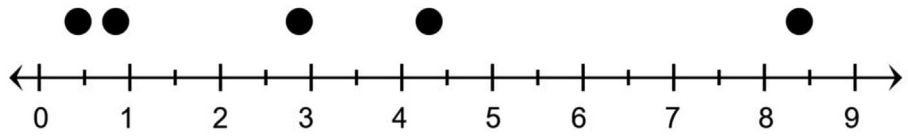
STEP 2 Identify the median, first quartile, third quartile, minimum value, and maximum value.

- There are 12 numbers in the data set, so median is the average of the middle two numbers, 2.33 and 3.38.
- The first half of the data set contains six numbers, so the first quartile is the average of the middle two of these numbers.
- The second half of the data set contains six numbers, so the third quartile is the average of the middle two of these number.

0.47 0.7 0.81 1.06 2.12 2.33 3.38 4.12 4.24 4.39 4.56 8.44

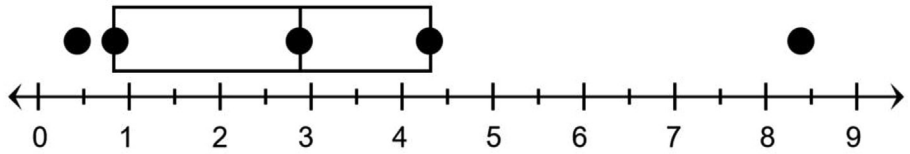


STEP 3 Plot the five values on a number line.



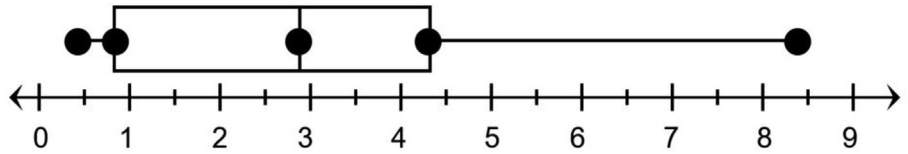
STEP 4 Construct the box.

- Draw a rectangle with the left side being the first quartile and the right side being the third quartile.
- Draw a vertical line through the median.



STEP 5 Construct the whiskers.

- Connect the minimum value to the box at the first quartile.
- Connect the maximum value to the box at the third quartile.

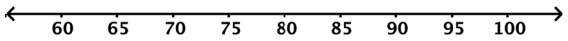


PRACTICE

1. Listed below are the scores of some restaurant health inspections.

65, 85, 90, 85, 100, 90, 75, 80, 95, 100

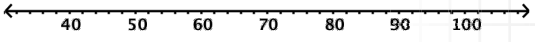
Represent the data using a box plot. A number line is drawn for you.



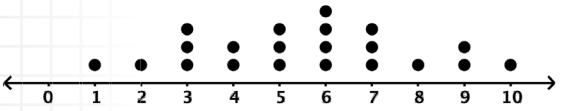
2. Monica plotted her tip earnings for last week using a box plot. The statistical summary of the plot is shown below.

Lowest Amount	$38
First Quartile Amount	$45
Median Amount	$72
Third Quartile Amount	$98
Highest Amount	$102

Represent Monica's data using a box plot.

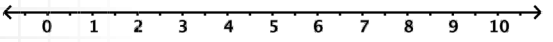


3. The dot plot shows the number of books read in the last 10 days by students in Mr. Lee's reading class.

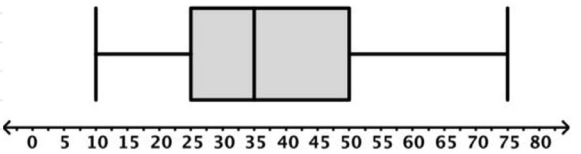


• represents 1 book

Represent this data using a box and whisker plot.



4. A box plot of the ages of customers participating in a survey is shown below.



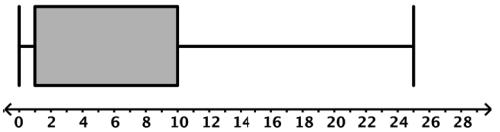
What are the following values from the data represented in the box plot?

Minimum Age	
First Quartile Age	
Median Age	
Third Quartile Age	
Maximum Age	

5. Beto is making a box plot of data collected from data recorded about the age of 10 pennies. The data is shown in the table.

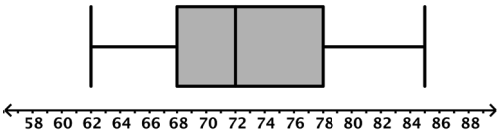
0	2	10	4	1
3	25	1	16	0

Beto has drawn the plot below.



What mistake has Beto made in drawing the box plot?

6. The box and whisker plot shown represents the daily high temperature at a beach during the month of May.



Which 5 number summary was used to create the box plot?

A Minimum = 68,
First Quartile = 62, Median = 72,
Third Quartile = 85,
Maximum = 78

B Minimum = 85,
First Quartile = 78, Median = 72,
Third Quartile = 68,
Maximum = 62

C Minimum = 62,
First Quartile = 72, Median = 78,
Third Quartile = 68,
Maximum = 85

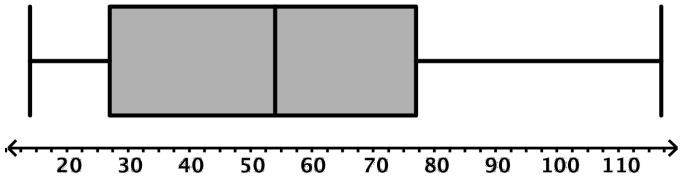
D Minimum = 62,
First Quartile = 68, Median = 72,
Third Quartile = 78,
Maximum = 85

7. The numbers of pizzas made by Paulo's Pizza Kitchen each day for the last week is shown.

77, 99, 112, 117, 85, 63, 68

Which box plot best represents these data?

F



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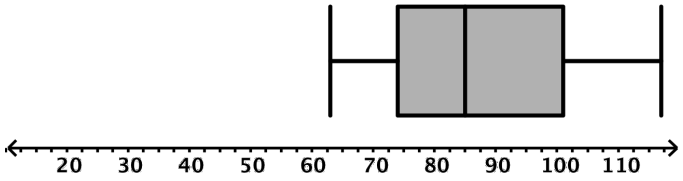

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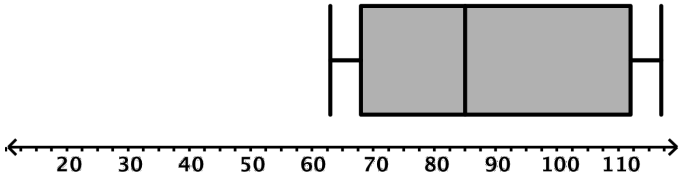

J