

# Measures of the Middle and Variation

## Measures of the Center

Are used to describe the middle of the data:

- Mean
- Median
- Mode

### Mean

The **mean** of a set is the average when all the data is added together and then divided by how many numbers there are. Is thrown off by outliers.

### Mode

The **mode** of a set is the number that occurs most often. Data sets, can have more than one mode.

### Median

The **median** of the set is to find the middle number. Set must be in numerical order. Not thrown off by outliers

# of Outliers: 2

# of Old Data Points: 8

1	2	3	4	5	6	7	8
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median 4.5

$\frac{4+5}{2} = \frac{9}{2} = 4.5$

9	10	11	12	13	14	15
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median 12

## Measures of Variation

Change

Are used to describe the distribution or spread of the data

-Range- the distance between the smallest and greatest data values; thrown off by outliers

-Quartiles

-Interquartile range IQR -The best way to describe the spread of data

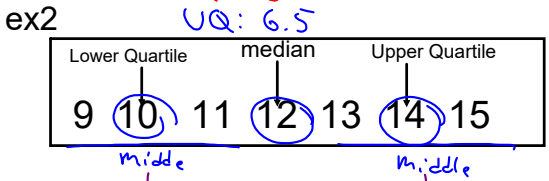
**Range-** The difference between the maximum and minimum, including outliers. This will be thrown off by outliers.

ex1  $\begin{matrix} \text{max: } 8 \\ \text{min: } 1 \\ \text{Range: } 8-1=7 \end{matrix}$       ex2  $\begin{matrix} \text{max: } 15 \\ \text{min: } 9 \\ \text{Range: } 15-9=6 \end{matrix}$

**Quartiles** The median, lower quartile and upper quartile are numbers that break the data into quarters by using medians. LQ is the median of the lower half, UQ is the median of the upper half.



Median: 4.5  
LQ: 2.5  
UQ: 6.5



**Interquartile range-** The range between quartiles to see how the main 50% of data is spread. Subtract the UQ and the LQ.

IQR

ex1  $\begin{matrix} \text{LQ: } 2.5 \\ \text{UQ: } 6.5 \\ \text{IQR} = 6.5 - 2.5 \\ = 4 \end{matrix}$       ex2  $\begin{matrix} \text{UQ: } 14 \\ \text{LQ: } 10 \\ \text{IQR} = 14 - 10 = 4 \end{matrix}$

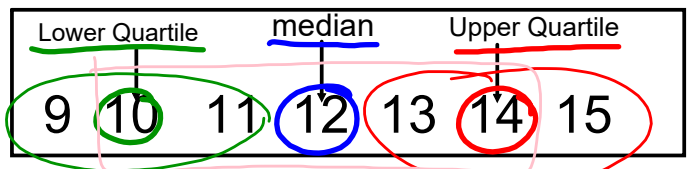
**Outliers-** values that are more than 1.5 times the value of the interquartile range. (*too high or too low compared to the rest of the values*)

First, find the **interquartile range** and **multiply it by 1.5**  $\text{IQR} \cdot 1.5$

-take that value and add it to the UQ  $\text{UQ} + \uparrow \uparrow$

-take that value and subtract it from the LQ  $\text{LQ} -$

Example:



Interquartile range is  $14 - 10 = 4$

interquartile times 1.5  $4 \times 1.5 = 6$

Upper Quartile:  $14 + 6 = 20$   
anything higher than 20 is an outlier

Lower Quartile:  $10 - 6 = 4$   
anything lower than 4 is an outlier

Find the range, mean, median, mode, the lower quartile, upper quartile, interquartile range, and outliers of the set:

Data: ~~42, 49, 53, 41, 44, 67, 61, 53, 55~~  
 41, 42, 44, 49, 53, 53, 55, 61, 67

mean:  $(41+42+44+49+53+53+55+61) / 9$

Average  
 mean: 51.6

Median: ~~42, 44, 49, 53, 55, 61, 67~~  
 Mitte median: 53

Mode: repeated? 53  
 mode: 53  
 Range: max: 67  
 min: 41  
 max - min  
 67 - 41  
 Range: 26

Quartiles:  
~~41, 42, 44, 49, 53, 53, 55, 61, 67~~

Lower Quartile  
 $\frac{42+44}{2} = 43$   
 Q1 or LQ  
 is 43

Upper Quartile  
 $\frac{55+61}{2} = 58$   
 Q3 or UQ  
 is 58

IQR = Q3 - Q1  
 58 - 43  
 IQR = 15

Outliers: IQR · 1.5  
 $15 \cdot 1.5 = 22.5$   
 $\frac{Q3 + 22.5}{58 + 22.5} = 80.5$

$\frac{Q1 - 22.5}{43 - 22.5} = 20.5$   
 No Outliers