

## Measures of Central Tendency – Mode, Median and Mean

Statistics is the branch of mathematics that examines **data sets** (a data set is a group of related numbers or measurements) for patterns that will allow you to make assumptions about the data.

The best-known statistic is the **average**, called the **mean** in mathematics. The average, or the mean, is used to determine where the middle of the numbers, or **values**, of the set could be. This is why it is called a **measure of central tendency**. It tries to determine (**measure**) where the middle (**centre**) is most likely (**tends**) to be. The mean is only one of the measures of central tendency. We will look at three different ones: the mode, the median and the mean.

Let's look at a sample data set: **1, 6, 6, 1, 5, 2, 3, 1, 4, 3**

- **Always start by putting the values (numbers) in numerical order:**

**1, 1, 1, 2, 3, 4, 4, 5, 6, 6**  
**1 2 3 4 5 6 7 8 9 10**

- **Then number the values, either above or below:**

Now we are ready to do some statistics!

**Finding the Mode:** The mode is the most frequently occurring value (number) in a data set. In our **ordered data set**, **1** occurs three times, **4** and **6** occurs twice, and **2, 3,** and **5** only occur once. So, **the mode is 1**.

Not all data sets will have a mode. If all the numbers occur the same number of times, then there is no mode. (Do not say the mode is 0 for that because 0 is a number. Say "no mode".)

**1, 2, 3, 4, 5, 6, 7, 8, 9, 10**    **no mode**

Some data sets can have more than one mode if two or more numbers occur the maximum number of times. The mode will be all those values.

**2, 3, 3, 3, 4, 5, 6, 6, 7, 7, 7, 8, 8, 9, 9**    **The modes are 3 and 7** (both occur 3 times)

**Finding the Median:** The median is the middle. Of course, there is only a middle if there is an **odd** number of values.

**1, 3, 5, 7, 9**    **median is 5**  
**1 2 3 4 5**

**0, 2, 4, 6, 8, 10, 12**    **median is 6**  
**1 2 3 4 5 6 7**

If there is an **even** number of values, the median is the **average** of the two middle values. Let's look at our sample set again.

**1, 1, 1, 2, 3, 4, 4, 5, 6, 6**  
**1 2 3 4 5 6 7 8 9 10**

To find the median in this case, determine the **average** of the two middle values by adding them and dividing by 2:

$$\text{median} = \frac{3 + 4}{2} = 3.5$$

**Finding the Mean:** The mean is the average of a full data set. I used “average of the two middle values” because it was not for all the numbers. Mostly, I will use the word *mean*.

To find the mean, add all the values in the set, then divide by the number of values. Using our sample set, the calculation looks like this:

**1, 1, 1, 2, 3, 4, 4, 5, 6, 6**  
**1 2 3 4 5 6 7 8 9 10**

$$\text{mean} = \frac{1 + 1 + 1 + 2 + 3 + 4 + 4 + 5 + 6 + 6}{10} = \frac{33}{10} = 3.3$$

There are different types of means. This one is called the **arithmetic mean**. We will learn a different mean in a few days.

**Summary:** We can now describe a set of numbers by three different measures: the **mode** tells us the most frequently occurring number or numbers; the **median** tells what the middle value is; and the **mean** balances the values of the set. Each measure has its uses and its weaknesses.

For our unordered sample set, **1, 6, 6, 1, 5, 2, 3, 1, 4, 3** we had:

**Mode = 1**

**Median = 3.5**

**Mean = 3.3**

Now, go to sheet “Probability and Statistics 2” to practice finding and using the mode.

If you have troubles, refer back to this sheet to make sure you are doing everything as directed. Don’t take short cuts.