

### Measures of Central Tendency

Central tendency can be measured in several ways, means, median, mode, and midpoint. We will consider each of these separately.

#### Means

- **Arithmetic Mean** - The arithmetic mean is often referred to as the simple mean or average. This is the average that you are familiar with. It is expressed as follows:

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

where  $x_i$  is the  $i$ th variable of interest,  $n$  is the number of individuals in the sample.

- **Geometric mean** - The geometric mean is obtained by multiplying all the individuals and then taking the  $n$ th root.

$$\bar{x}_g = \sqrt[n]{\frac{\prod_{i=1}^n x_i}{n}}$$

This can be computed easily by:

$$\bar{x}_g = \exp\left(\frac{\sum_{i=1}^n \ln x_i}{n}\right)$$

where **exp** is the exponential of the result within the brackets and **ln** is the natural logarithm of  $x_i$ . This mean is useful when examining rates.

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- **Quadratic Mean** - Quadratic means is quite useful when used with diameters. It can be thought of as the diameter of the individual with average area.

$$\bar{x}_q = \sqrt{\frac{\sum_{i=1}^n x_i^2}{n}}$$

### Median

Median is the middle value in a dataset. If the data set is ordered from smallest to largest value the value that is the  $(n+1)/2$ th value in the ordered list is the median. For even numbered datasets there are two middle numbers. The median is the midpoint between these two middle numbers.

### Mode

The mode is the most frequent value in the data set. A data set can have many modes as they are just points of frequent values in the data set.

### Midrange

Midrange is the value half way between the largest value and the smallest value in the dataset. The problem with this measure is that only the largest and smallest values effect the result.

### Also See:

Chapter 3 - Measures of Central Tendency pages 25-34 in:

Phillips, J. L. 2000. How to think about statistics. W. H. Freeman and Co. New York. 202 pp. ISBN 0-7167-3654-3

Chapter 3 - Measures of Central Tendency pages 18-23 in:

Zar, J. H. 2007. Biostatistical Analysis. Prentice-Hall, Inc. Englewood Cliffs, New Jersey. 718 pp.

