

Mean, Weighted Average and Expectation

Mean

In mathematics and statistics, the **arithmetic mean** is the sum of a collection of numbers divided by the count of numbers in the collection. The collection is often a set of results from an experiment, an observational study, or a survey. The term "**arithmetic mean**" is preferred in some mathematics and statistics contexts because it helps distinguish it from other types of means, such as geometric and harmonic.

Average is a non-specific term for a measure of **central tendency** and now includes different types of mean but also **median** and **mode**.

Weighted Average

The **weighted arithmetic mean** is similar to an ordinary arithmetic mean (the most common type of average), except that instead of each of the data points contributing equally to the final average, some data points contribute more than others. The notion of weighted mean plays a role in descriptive statistics and also occurs in a more general form in several other areas of mathematics.

If all the weights are equal, then the **weighted mean** is the same as the **arithmetic mean**. While **weighted means** generally behave in a similar fashion to arithmetic means, they do have a few counterintuitive properties, as captured for instance in Simpson's paradox.

Expectation

In probability theory, the **expected value** (also called **expectation** or **first moment**) is a generalisation of the **weighted average**. Informally, the expected value is the mean of the possible values a random variable can take, weighted by the probability of those outcomes. Since it is obtained through arithmetic, the expected value sometimes may not even be included in the sample data set; it is not the value you would "expect" to get in reality.

The expected value of a random variable with a finite number of outcomes is a weighted average of all possible outcomes.

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