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# KEY DEFINATIONS

## POPULATION

* A population is the complete set of individuals, objects, or events that we are interested in studying or making conclusions about. It includes all members of a specific group that share certain characteristics or attributes. The population is the entire target group that you want to generalize your findings to.
* For example, if we want to study the average height of all adults in a country, the population will consist of every adult in that country.
* The Population is denoted by “N”

## SAMPLE

* **A sample, on the other hand, is a subset or a smaller representative group selected from the population. It is chosen in a way that it provides a reasonable and unbiased representation of the population.**
* Collecting data from the entire population is often impractical or time-consuming, so researchers select a sample to estimate or make inferences about the characteristics of the population.
* Continuing with the previous example, instead of measuring the height of every adult in the country, researchers may select a sample of, say, 1000 adults. The sample should be selected in a way that it is representative of the entire population in terms of age, gender, geographic location, etc.
* The goal of taking a sample is to generalize or draw conclusions about the population based on the characteristics observed in the sample. Statistical analysis techniques are then applied to the sample data to estimate population parameters or test hypotheses.
* It's important to note that the quality and representativeness of the sample play a crucial role in the accuracy and reliability of the conclusions made about the population. **Various sampling techniques, such as random sampling or stratified sampling, are used to ensure the sample is unbiased and representative**.

## PARAMETERS

* In statistics, parameters are numerical values that describe characteristics of a population. They are used to summarize and describe the distribution of data in a population or to make inferences about the population based on a sample.

**HERE ARE TWO COMMON TYPES OF PARAMETERS:**

1. **Population Mean (μ):** The population mean represents the average value of a variable in the entire population. It is calculated by summing up all the values in the population and dividing by the total number of individuals in the population. The symbol μ (mu) is used to denote the population mean.
2. **Population Standard Deviation (σ):** The population standard deviation measures the variability or spread of data in the population. It quantifies how much individual data points deviate from the population mean. It is calculated by taking the square root of the average squared deviation of each data point from the population mean. The symbol σ (sigma) is used to denote the population standard deviation.

Parameters are typically unknown and need to be estimated from sample data. This is done by using statistics, which are numerical values calculated from sample data. The most common statistics used to estimate population parameters are:

1. Sample Mean (x̄): The sample mean is an estimate of the population mean. It is calculated by summing up all the values in the sample and dividing by the total number of observations in the sample. The symbol x̄ (x-bar) is used to denote the sample mean.

2. Sample Standard Deviation (s): The sample standard deviation is an estimate of the population standard deviation. It measures the variability or spread of data in the sample. It is calculated by taking the square root of the average squared deviation of each data point from the sample mean. The symbol s is used to denote the sample standard deviation.

By using sample statistics, we can make inferences about population parameters through statistical techniques, such as hypothesis testing or confidence intervals.

It's important to note that parameters describe the entire population, while statistics describe only the sample from which they were calculated. The goal of statistics is to estimate or make inferences about population parameters based on sample data.

**AN EXAMPLE TO ILLUSTRATE PARAMETERS AND STATISTICS:**

Suppose you want to estimate the average income of all employees working in a company. In this case:

- The population parameter would be the population mean (μ), which represents the average income of all employees in the company.

- The population standard deviation (σ) would measure the variability or spread of income across all employees in the company.

Since it is impractical to collect data from all employees, you decide to take a sample of 100 employees from the company. You collect their income data and calculate the following statistics:

- The sample mean (x̄) would be the average income of the 100 employees in your sample.

- The sample standard deviation (s) would measure the variability or spread of income among the 100 employees in your sample.

By estimating the population parameters using the sample statistics, you can make inferences about the population. For example, based on your sample, you can estimate that the average income of all employees in the company (population mean) is $60,000 with a standard deviation of $10,000.

Additionally, you can use statistical techniques to determine the level of confidence in your estimation. For instance, you might calculate a 95% confidence interval for the population mean, which would provide a range within which you can be 95% confident that the true population mean lies.

In summary, parameters describe characteristics of a population, such as the population mean and standard deviation. Statistics, on the other hand, are derived from sample data and estimate the population parameters, such as the sample mean and standard deviation.

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