Distributions

Standard Normal Distribution

The **standard normal distribution** is a special case of the [normal distribution](http://stattrek.com/Help/Glossary.aspx?Target=Normal%20distribution). It is the distribution that occurs when a [normal random variable](http://stattrek.com/Help/Glossary.aspx?Target=Normal%20random%20variable) has a **mean of zero and a standard deviation of one**.

## Standard Score (aka, z Score)

The normal random variable of a standard normal distribution is called a **standard score** or a **z-score**. Every normal random variable *X* can be transformed into a *z* score via the following equation:

*z* = (*X* - μ) / σ

where *X* is a normal random variable, μ is the mean mean of *X*, and σ is the standard deviation of *X*.

A **standard normal distribution table** shows a [cumulative probability](http://stattrek.com/Help/Glossary.aspx?Target=Cumulative%20probability) associated with a particular z-score

 P(Z > a) = 1 - P(Z < a).

P(a < Z < b) = P(Z < b) - P(Z < a).

# Student's t Distribution

The **t distribution** (aka, **Student’s t-distribution**) is a probability distribution that is used to estimate population parameters when the sample size is small and/or when the population variance is unknown.

According to the [central limit theorem](http://stattrek.com/Help/Glossary.aspx?Target=Central_limit_theorem), the [sampling distribution](http://stattrek.com/Help/Glossary.aspx?Target=Sampling_distribution) of a statistic (like a sample mean) will follow a [normal distribution](http://stattrek.com/Help/Glossary.aspx?Target=Normal%20distribution), as long as the sample size is sufficiently large

**t statistic** (also known as the **t score**), whose values are given by:

t = [ x - μ ] / [ s / sqrt( n ) ]

where x is the sample mean, μ is the population mean, s is the standard deviation of the sample, and n is the sample size. The distribution of the *t* statistic is called the **t distribution** or the **Student t distribution**.

The t distribution can be used with any statistic having a bell-shaped distribution (i.e., approximately normal). The [central limit theorem](http://stattrek.com/Help/Glossary.aspx?Target=Central_limit_theorem) states that the sampling distribution of a statistic will be normal or nearly normal, if any of the following conditions apply.

degrees of freedom are equal to n - 1.

It depends on where you are using it. Basically the number of df = n - # parameters you are estimating.   
  
Forexample:   
  
a) Usual one-sample test of mean: estimate mu with X-bar => df = n - 1   
b) Estimate linear regression: estimate intercept and slop => df = n - 2