The t Distribution

The t distribution is a probability distribution that is frequently used as a sampling distribution in hypothesis testing. In some ways, it is similar to the z distribution, but it has several key differences as well.

The t distribution:

* has a total area under the curve of one
* is approximately bell-shaped, but is not normal
* has a mean of **zero**
* is centered on the mean
* is symmetrical around the mean
  + “as above, so below the mean”
  + upper tail t values are positive, lower tail t values are negative
* is a family of distributions, so you must decide which t distribution to use
  + The correct distribution to use in each case will be determined by the **degrees of freedom (df)**, which is calculated from information about the sample.

We will use the t distribution to decide whether to reject the null hypothesis for t test statistics. For the Critical Value approach, we can look up the CVs on the *t table*. For the p-value approach, we will use Excel to calculate the p-values for t test statistics (see separate handout).

Using the *t table*:

The *t table* is a table of Critical Values of t at particular tail probabilities.

* Each row of the t table corresponds to a t distribution with the given degrees of freedom (df).
* Each column of the t table refers to a different upper tail probability
* We can use the t table for lower tail Critical Values too. Because the t distribution is symmetrical around the mean of zero, a lower tail Critical Value will be the negative of the upper tail Critical Value with the same tail probability.

*Example 1.* Use the t table to look up the following:

1. The upper tail Critical Value of t at with degrees of freedom
2. The lower tail Critical Value of t at with degrees of freedom
3. The two-tailed Critical Values of t at with degrees of freedom

*Example 2.* Consider a lower tail test at the significance level with a test statistic of and degrees of freedom .

1. Use the Critical Value approach to decide whether to reject
2. Use the p-value approach to decide whether to reject

*Example 3.* Consider a two-tailed test at the significance level with a test statistic of and degrees of freedom

1. Use the Critical Value approach to decide whether to reject
2. Use the p-value approach to decide whether to reject