# Hypothesis Testing 101

This page contains general information. For more information on what the hypotheses look like and how to calculate the test statistics, see the other documents.

**Null Hypothesis:**

- The claim that the sample observations happen by chance
- Usually a statement of "no change" or "no difference" (i.e. equals)
- Contains symbols about the population
- Denoted $H_o$

**Alternative Hypothesis**

- Our hypothesis, or what we want to prove
- Claim that we are trying to find evidence for
- Denoted $H_a$

*Information on concluding which is true the null or alternative hypothesis see below

**Null Value:** the value being tested

**One-sided (one-tailed):** when the alternative hypothesis states that the parameter is greater than, larger than, above, smaller than, less than, or below the null value

**Two-sided (two-tailed):** when the alternative hypothesis states that the parameter is not equal to or is different than the null value

**Test Statistic:**

- The calculated value of z, t, etc
- Measures how far the data deviates from what we expect

**P-value:**

- The probability (assuming $H_o$ is true) that the test statistic would take a value as extreme or more extreme than what was actually observed.
- Measures the strength of the support for the null hypothesis

**Interpretation of p-value**

Example: Interpret what p value of 0.04 means.

If Ho was true, a sample as contrary to Ho as our sample would occur by chance alone only 4% of the time if the experiment was repeated again and again.

In other words, a value as large as the statistic (e.g. sample mean, sample proportion) would only occur by chance in 4% of all samples when the null hypothesis is true.

**Significance level:**

- the level we compare our p-vale to
- denoted $\alpha$
- $\alpha = 0.05$ (or 5%) unless stated otherwise
- probability of a type 1 error

**Significance:**

- does not mean important
- means not likely to happen by chance

**Type I Error:** Reject $H_o$ when $H_o$ is true

**Type II Error:** Fail to Reject $H_o$ when $H_a$ is true

**Power of the test:** 1- probability of a type II error


**Choosing the Null or Alternative Hypothesis**

**When the p-value is less than or equal to $\alpha$**

- We *reject* the null hypothesis
- The data is statistically significant at the $\alpha$ level
- Significant Evidence for the alternative hypothesis

**When the p-value is greater than $\alpha$**

- We *fail to reject* the null hypothesis
- The data is not statistically significant at the $\alpha$ level
- No evidence for the alternative hypothesis

For more information:

http://www.stattrek.com/hypothesis-test/hypothesis-testing.aspx?Tutorial=Stat

http://www.stattrek.com/hypothesis-test/hypothesis-testing.aspx

http://www.statisticssolutions.com/resources/directory-of-statistical-analyses/hypothesis-testing