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| **Statistical Hypotheses** | |
| A statistical hypothesis is an assumption about a population parameter. This assumption may or may not be true. Hypothesis testing refers to the procedures used by statisticians to accept or reject statistical hypotheses. The best way to determine whether it is true would be to examine the entire population. If sample data are not consistent with the statistical hypothesis, the hypothesis is rejected. | |
| **Null Hypothesis** | **Alternative Hypothesis** |
| It is denoted by **Ho**, is the hypothesis that sample observations result purely from chance  **Example:**  Suppose we wanted to determine whether a coin was fair and balanced  **Ho** might would result in half flips in Heads and Tails  **Ho: P = 0.5** | It is denoted by **Ha**, is the hypothesis that sample observations are influenced by some non-random cause  **Example:**  Suppose we wanted to determine whether a coin was fair and balanced  **Ha** might be that the number of Heads and Tails would be very different  **Ha: P ≠ 0.5** |

**Confidence Intervals Estimations:**

* There is a tremendously handy relationship between confidence intervals and hypothesis testing.
* When a 95% confidence interval is made, all values in the interval are considered reasonable values for the parameter being estimated
* If the value of the parameter specified by the **Ho** is contained in the 95% interval then the null hypothesis cannot be rejected at the 0.05 level
* If the value specified by the **Ho** is not in the interval then it can be rejected at the 0.05 level

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| **Decision Errors** | |
| Two types of errors can result from a hypothesis test. | |
| **Type I Error (False Positive)** | **Type II Error (False Negative)** |
| It occurs when the researcher rejects a **Ho** when it is true  These are more serious than Type II errors because researchers choose a low level and makes it very unlikely  The probability of committing a Type I error is called the significance level  This probability is also called alpha, and is often denoted by α | It occurs when the researcher fails to reject a **Ho** that is false  **Example:**  Like an alarm that fails to sound when there is a fire.  The probability of committing a Type II error is called Beta, and is often denoted by β  The probability of not committing a Type II error is called the Power of the test |

**References:**

* Minitab Blog Editor (08 March, 2017) Which Statistical Error Is Worse: Type 1 or Type 2? retrieved from https://blog.minitab.com/blog/understanding-statistics/which-statistical-error-is-worse-type-1-or-type-2
* Charles Zaiontz, Null and Alternative Hypothesis retrieved from https://www.real-statistics.com/hypothesis-testing/null-hypothesis/

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| **Decision Rules** | | |
| The analysis plan includes decision rules for rejecting the null hypothesis | | |
| **P-value** | **Region of Acceptance** | **Region of Rejection** |
| The strength of evidence in support of a **Ho** is measured by the P-value  If the P-value is less than the significance level, we reject the null hypothesis | It is defined so that the chance of making a Type I error is **=** significance level  If the test statistic falls within the region of acceptance, the **Ho** is not rejected | The set of values outside the region of acceptance is called the region of rejection  If the test statistic falls within the region of rejection, the **Ho** is rejected |

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| **Hypothesis Tests** | |
| Statisticians follow a strict process to determine whether to reject a **Ho**, based on sample data. It consists of 4 steps. They are:   * State the hypotheses * Formulate an analysis plan * Analyze sample data described in the analysis plan * Interpret results | |
| **One-Tailed** | **Two-Tailed** |
| In this the region of rejection is on only one side either left or right, of the sampling distribution, is called a one-tailed test  **Example**:  Suppose the **Ho** states that the **Ha** would be that  The region of rejection would consist of a range of numbers located on the right side of sampling distribution | In this the region of rejection is on both sides of the sampling distribution, is called a two-tailed test  **Example:**  Suppose the **Ho** states that the **Ha** would be that  The region of rejection would consist of a range of numbers located on both sides of sampling distribution |