Statistical Inference – Hypothesis Testing

Step 1: State the Hypotheses – Must Give Both

a) **Null Hypothesis**
- H_0: parameter = hypothesized value (The parameter describes the population, not the sample.)
- Null hypothesis usually states that there is nothing different.

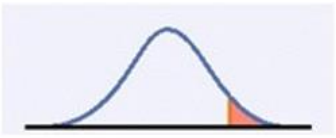
b) **Alternative Hypothesis (What We Want to Prove)**
- H_1: values of the parameter we consider plausible when we reject the null hypothesis
- Three possibilities: Want to prove that the parameter is bigger, is smaller, is different
  - **1-sided alternatives** $H_1: \text{param} > \text{number}$ OR $H_1: \text{param} < \text{number}$
  - **2-sided alternative** $H_1: \text{param} \neq \text{number}$

Step 2: The Model: Two possible models for the sampling distribution of the statistic
- **Sample Proportions** use the **Normal Model**
- **Sample Means** use the ***t*-Model**

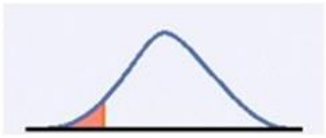
Step 3: The Test and P-Value

a) **The Test Name**
- For **sample proportions** the test is called a **1-Proportion *z*-Test**.
- For **sample means** the test is called a **1-Sample *t*-Test**.

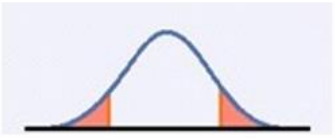
b) **Calculate the P-value**: Assume the Null Hypothesis is true and find the probability of getting the statistic or something more extreme (based on one-sided or two-sided alternatives)
- For **sample proportions**, use **1-PropZTest**
  You can also use NormalCDF. NormalCDF does not require you to calculate the **test statistic** z. Only calculate z if the problem tells you to do this.
- For **sample means**, use **T-Test**
  You can also use tCDF, but you first need to compute the **test statistic** t: $t = \dfrac{\bar{x} - \mu}{s/\sqrt{n}}$



P-Value for $H_1: \text{param} > \text{number}$



P-Value for $H_1: \text{param} < \text{number}$



P-Value for $H_1: \text{param} \neq \text{number}$

Step 4: Conclusion

a) If the P-value is small (less than the selected α **Alpha Level**) then "Reject the Null Hypothesis and Accept the Alternative Hypothesis" and "There is significant evidence for the Alternative Hypothesis,"

b) If the P-value is large (greater than the selected α **Alpha Level**) then "Fail to Reject the Null Hypothesis" or state "There is insufficient evidence to reject the Null Hypothesis".

Errors (These don't always occur – they are possible.)
- **Type I Error** – The null hypothesis is true but we mistakenly reject it. This can only occur if H_0 True
- **Type II Error** – The null hypothesis is false but we fail to reject it. This can only occur if H_0 False

	H_0 True	**H_0 False**
Reject H_0	Type I Error	OK (The test was correct)
Fail to Reject H_0	OK (The test was correct)	Type II Error