Confidence Intervals

- Proportions: \( \hat{p} \) and \( p \)
  - \( \hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \)

- Means: \( \bar{x} \) and \( \mu \)
  - \( \bar{x} \pm t^* \frac{S_x}{\sqrt{n}} \)

Hypothesis Tests

- Proportions: \( \hat{p} \) and \( p \)
  - z-score: \( z = \frac{\hat{p} - p_0}{\sqrt{p_0(1-p_0)/n}} \)
  - \( t = \frac{\bar{x} - \mu_0}{S_x/\sqrt{n}} \)

- Means: \( \bar{x} \) and \( \mu \)
  - t-score: \( t = \frac{\bar{x} - \mu_0}{S_x/\sqrt{n}} \)
REQUIREMENTS/CONDITIONS

Requirements to use confidence intervals for proportions:

1. The sample proportion \( \hat{p} \) must be obtained from a Simple Random Sample (SRS).
2. The number of successes in the sample is at least 5, preferably at least 10, i.e., \( np \geq 10 \).
3. The number of failures in the sample is at least 5, preferably at least 10, i.e., \( n(1-\hat{p}) \geq 10 \).
4. The population size is at least ten times the sample size \( n \).

Requirements for conducting a hypothesis test about a population proportion:

1. The sample proportion \( \hat{p} \) must be obtained from a random sample.
2. \( np_0 \geq 10 \), where \( p_0 \) is the assumed population proportion from \( H_0 \).
3. \( n(1-p_0) \geq 10 \), where \( p_0 \) is the assumed population proportion from \( H_0 \).
4. The population size is at least ten times the sample size \( n \).

Requirements for using t-distributions:

1. SRS: The sample mean must be chosen from a random sample.
2. Sufficiently large sample size:
   a. CASE: \( n < 15 \). The data should be very close to a Normal model. Do not use t-methods if there is strong skewness or outliers.
   b. CASE: \( 15 \leq n < 40 \). t-methods should work as long as the data is unimodal and reasonably symmetric (make a histogram). t-methods should not be used in the presence of outliers or strong skewness.
   c. CASE: \( 40 \leq n \). t-methods can be used even in the presence of strong skewness or a few outliers. In this case t-methods are called “Robust.”