9.2 Estimating A Population Mean

The best point estimate for a population mean (μ) is the sample mean (\overline{x}) Like the previous confidence interval, this confidence interval will be constructed from the point estimate \pm margin of error.

The t-distribution is a family of bell shaped curves where each curve is based on the degrees of freedom (df) where df = n - 1. Also, as sample size increases the t-distribution becomes more like the standard normal distribution.

The following conditions must be present in order to create a meaningful confidence interval for a population mean.

- 1. Sample size is small relative to the population (n \leq 0.05N)
- 2. The data came from a population that is normally distributed or the sample size is large (n \ge 30)

The confidence interval for the mean under these circumstances is as follows:

Ex. Find $t_{\alpha/2}$ when the confidence level is 90% and the sample size is 20.

Ex. Ten automobiles were stopped and tread depth was measured. The mean was 0.32" and the standard deviation was 0.08". Find the 95% confidence interval for the mean tread depth. The tread depth of tires is known to be normally distributed.

One last question that must be answered is, how large of a sample must we us in order to get a reliable confidence interval. As previously discuss, a minimum sample size formula is used.

Example: How large a sample is required to estimate the mean miles per gallon within 0.5 mile per gallon with 95% confidence and a sample standard deviation of s = 3.21?

3 situations that may arise.

- 1. The sample size n < 30.
- 2. The sample contains outliers.
- 3. A histogram indicates that the data is not normal but "slightly" skewed left or right instead.