# *Confidence Intervals MATH 1442*

**Note:** All procedures include the assumption that the sample is a **random sample.** The confidence intervals shown are computed using a confidence level 1-$\alpha$ and significance level $\alpha$

*Confidence intervals for the **mean***

*Assumptions using the normal (z) distribution:*

1) The population is normally distributed or the sample size is greater than 30
2) The value of the population standard deviation ($\sigma$) is known

$$\bar{x} - z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}} < \mu < \bar{x} + z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$$

*Assumptions using the t distribution:*

1) The population is normally distributed or the sample size is greater than 30
2) The value of the population standard deviation ($\sigma$) is unknown

$$\bar{x} - t_{\alpha/2} \cdot \frac{s}{\sqrt{n}} < \mu < \bar{x} + t_{\alpha/2} \cdot \frac{s}{\sqrt{n}}$$

When the population is not normally distributed and the sample size is less or equal to 30 a nonparametric method is needed

*Confidence intervals for **proportions***

*Assumptions*

1) The data comes from a binomial distribution (requirements for a binomial distribution)
2) There are at least 5 successes and at least five failures (equivalent to the requirement $np \geq 5$ and $nq \geq 5$ )

$$\hat{p} - z_{\alpha/2} \cdot \sqrt{\frac{\hat{p}\hat{q}}{n}} < p < \hat{p} + z_{\alpha/2} \cdot \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

*Confidence intervals for the **variance** and **standard deviation***

*Assumptions:*

1) The data comes from a normal distribution (strict assumption)

For the variance

$$\frac{(n-1)s^2}{\chi^2_{\alpha/2,n-1}} < \sigma^2 < \frac{(n-1)s^2}{\chi^2_{1-\alpha/2,n-1}}$$

For the standard deviation

$$\sqrt{\frac{(n-1)s^2}{\chi^2_{\alpha/2,n-1}}} < \sigma < \sqrt{\frac{(n-1)s^2}{\chi^2_{1-\alpha/2,n-1}}}$$