INTERVAL ESTIMATION – TWO SAMPLE FORMULAS

Confidence Interval for the Difference between Two Proportions

$$(\hat{p}_1 - \hat{p}_2) - z_{\alpha/2}\sqrt{\frac{\hat{p}_1\hat{q}_1}{n_1} + \frac{\hat{p}_2\hat{q}_2}{n_2}} \prec (p_1 - p_2) \prec (\hat{p}_1 - \hat{p}_2) + z_{\alpha/2}\sqrt{\frac{\hat{p}_1\hat{q}_1}{n_1} + \frac{\hat{p}_2\hat{q}_2}{n_2}}$$

(Verify that $n\hat{p}$ *and* $n\hat{q}$ are greater than 5, for both samples. Use the sample estimators)

Confidence Interval for the Difference between Two Means in case of Independent Samples.

General Case

$$(\bar{x}_1 - \bar{x}_2) - t_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} \prec \mu_1 - \mu_2 \prec (\bar{x}_1 - \bar{x}_2) + t_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

Recommended formula to be used when both populations are normally distributed or for large samples of non-normal populations. The recommended degrees of freedom d.f. for t is the smaller of $n_1 - 1$ and $n_2 - 1$ (conservative approach).

A particular Case: Both Populations have Equal Variances

$$(\bar{x}_1 - \bar{x}_2) - t_{\alpha/2}\sqrt{s_p^2(\frac{1}{n_1} + \frac{1}{n_2})} \prec \mu_1 - \mu_2 \prec (\bar{x}_1 - \bar{x}_2) + t_{\alpha/2}\sqrt{s_p^2(\frac{1}{n_1} + \frac{1}{n_2})}$$

where $s_p^2 = \dfrac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$

Recommended formula that requires the additional assumption that $\sigma_1^2 = \sigma_2^2$. In this case de degrees of freedom is $d.f. = n_1 + n_2 - 2$

Confidence Interval for Matching Pairs

$$\bar{d} - t_{\frac{\alpha}{2}}\frac{s_d}{\sqrt{n}} \prec \mu_d \prec \bar{d} + t_{\frac{\varepsilon}{2}}\frac{s_d}{\sqrt{n}}$$

The sample consists of n matching pairs (dependent samples). Recommended formula to be used when the population of differences is normally distributed or it is a large sample of a non-normal population. The degrees of freedom here is $d.f. = n - 1$