

Some Useful Formulas

$$P(E_1 \text{ or } E_2) = P(E_1) + P(E_2) - P(E_1 \text{ and } E_2)$$

$$\text{Conditional Probability } P(E_1 | E_2) = \frac{P(E_1 \text{ and } E_2)}{P(E_2)}$$

$$\text{Bayes' Theorem } P(E_i | B) = \frac{P(E_i)P(B | E_i)}{\sum_{c=1}^k P(E_c)P(B | E_c)}$$

$$\text{Covariance } \sigma_{xy} = \sum [x_i - E(x)][y_j - E(y)]P(x_i y_j)$$

$$\text{Correlation Coefficient } \rho = \frac{\sigma_{xy}}{\sigma_x \sigma_y}$$

$$\text{Binomial } P(x) = \frac{n!}{x!(n-x)!} p^x q^{n-x}, \mu = E(x) = np, \sigma = \sqrt{npq}$$

$$\text{Poisson } P(x) = \frac{(\lambda t)^x e^{-\lambda t}}{x!}, \mu = \lambda t, \sigma = \sqrt{\lambda t}$$

$$\text{Hypergeometric } P(x) = \frac{C_{n-x}^{N-x} C_x^X}{C_n^N}$$

$$\text{Uniform } f(x) = \begin{cases} \frac{1}{b-a} & \text{if } a \leq x \leq b \\ 0 & \text{otherwise} \end{cases}$$

$$\text{Exponential } P(0 \leq x \leq a) = 1 - e^{-\lambda a}$$

Sampling Error = Statistic Value – Parameter Value

$$\mu_{\bar{x}} = \mu, \quad \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}, \quad \mu_{\bar{p}} = p, \quad \sigma_{\bar{p}} = \sqrt{\frac{p(1-p)}{n}}$$

$$\text{Finite Population Correction: } \frac{N-n}{N-1}$$

Confidence Interval for μ (σ Known) $\bar{x} \pm z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$

Confidence Interval for μ (σ Unknown): $\bar{x} \pm t_{\alpha/2} \frac{s}{\sqrt{n}}$

Required Sample Size $n = \frac{z_{\alpha/2}^2 \sigma^2}{e^2} = \left(\frac{z_{\alpha/2} \sigma}{e} \right)^2$

Estimating the Difference between Two Means, independent Samples:

σ_1 and σ_2 known $(\bar{x}_1 - \bar{x}_2) \pm z_{\alpha/2} \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$

σ_1 and σ_2 unknown, and large samples

$$(\bar{x}_1 - \bar{x}_2) \pm z_{\alpha/2} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

σ_1 and σ_2 unknown and equal, and small samples,

$$(\bar{x}_1 - \bar{x}_2) \pm t_{\alpha/2} s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}} \text{ where } s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

$\sigma_1 \neq \sigma_2$ unknown and small samples

$(\bar{x}_1 - \bar{x}_2) \pm t_{\alpha/2} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$ where t has the following degrees of freedom

$$d.f = \frac{(s_1^2/n_1 + s_2^2/n_2)^2}{\frac{(s_1^2/n_1)^2}{n_1 - 1} + \frac{(s_2^2/n_2)^2}{n_2 - 1}}$$

Paired Samples $\bar{d} \pm t_{\alpha/2} \frac{s_d}{\sqrt{n}}$ where $d_i = x_{1i} - x_{2i}$

Difference between two population proportions

$$(\bar{p}_1 - \bar{p}_2) \pm z_{\alpha/2} \sqrt{\frac{\bar{p}_1(1-\bar{p}_1)}{n_1} + \frac{\bar{p}_2(1-\bar{p}_2)}{n_2}}$$