Some Useful Formulas

- $S = \sqrt{\dfrac{\sum (x - \bar{x})^2}{n-1}} = \sqrt{\dfrac{\sum x^2 - n(\bar{x})^2}{n-1}}$
- $P(A \text{ or } B) = P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- $P(A \cap B') = P(A) - P(A \cap B)$
- $P(A \mid B) = \dfrac{P(A \cap B)}{P(B)}, \; P(B) > 0$
- $P(A \cap B) = P(A) \times P(B \mid A) = P(B) \times P(A \mid B)$
- $P(B_j \mid A) = \dfrac{P(B_j \cap A)}{P(A)} = \dfrac{P(A \mid B_j)P(B_j)}{\sum_{i=1}^{k} P(A \mid B_i)P(B_i)}$ for $j = 1, 2, \ldots, k$
- $P(x) = \dfrac{n!}{x!(n-x)!} \pi^x (1-\pi)^{n-x}$

  $\mu = E(X) = n\pi, \quad \sigma = \sqrt{n\pi(1-\pi)}$
- $P(x) = \dfrac{(\lambda t)^x e^{-\lambda t}}{x!}, \quad \mu = \lambda t, \; \sigma = \sqrt{\lambda t}$
- $P(x) = \dfrac{C_{n-x}^{N-X} C_x^X}{C_n^N} = \dfrac{\binom{N-A}{n-x}\binom{A}{x}}{\binom{N}{n}}$
- $f(x) = \begin{cases} \dfrac{1}{b-a} & \text{if } a \le x \le b \\ 0 & \text{otherwise} \end{cases},$

  $a \le c < d \le b \quad P(c \le X \le d) = (d-c) f(x)$
- $P(0 \le x \le a) = 1 - e^{-\lambda a}$
- $\mu_{\bar{x}} = \mu, \quad \sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}}$
- $\mu_{\bar{p}} = \pi, \; \sigma_{\bar{p}} = \sqrt{\dfrac{\pi(1-\pi)}{n}},$
- $\bar{x} \pm z_{\alpha/2} \dfrac{\sigma}{\sqrt{n}}$
- $\bar{x} \pm t_{\frac{\alpha}{2}, n-1} \dfrac{s}{\sqrt{n}}$
- $n \ge \dfrac{z_{\alpha/2}^2 \sigma^2}{e^2} = \left(\dfrac{z_{\alpha/2}\,\sigma}{e}\right)^2$
- $\bar{p} \pm z_{\alpha/2} \sqrt{\dfrac{\bar{p}(1-\bar{p})}{n}}$
- $n \ge \dfrac{z_{\alpha/2}^2 \, p(1-p)}{e^2}$
- $(\bar{x}_1 - \bar{x}_2) \pm z_{\alpha/2} \sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}$
- $(\bar{x}_1 - \bar{x}_2) \pm z_{\alpha/2} \sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}$
- $(\bar{x}_1 - \bar{x}_2) \pm t_{\frac{\alpha}{2}, n_1+n_2-2} \, s_p \sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}}$, where

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

  $v = \dfrac{\left(\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}\right)^2}{\dfrac{\left(\dfrac{s_1^2}{n_1}\right)^2}{n_1-1} + \dfrac{\left(\dfrac{s_2^2}{n_2}\right)^2}{n_2-1}}$
- $\bar{d} \pm t_{\frac{\alpha}{2}, n-1} \dfrac{s_d}{\sqrt{n}}$
- $(\bar{p}_1 - \bar{p}_2) \pm z_{\alpha/2} \sqrt{\dfrac{\bar{p}_1(1-\bar{p}_1)}{n_1} + \dfrac{\bar{p}_2(1-\bar{p}_2)}{n_2}}$

  where

  $\bar{p}_1 = \dfrac{x_1}{n_1}, \qquad \bar{p}_2 = \dfrac{x_2}{n_2}$