Formula Sheet

Descriptive Statistics

- $\bar{x} = \frac{\sum x}{n}$ or $\bar{x} = \frac{\sum xf}{\sum f}$
- $s = \sqrt{\frac{\sum x^2 - n\bar{x}^2}{n-1}}$ or $s = \sqrt{\frac{\sum x^2 f - n\bar{x}^2}{n-1}}$
- $R_\alpha = \frac{\alpha(n+1)}{100}$ & $P_\alpha = X_{(i)} + d\left(X_{(i+1)} - X_{(i)}\right)$

Probability

- $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- $P(A|B) = \frac{P(A \cap B)}{P(B)}, P(B) > 0$
- $P\left(A_j \middle| B\right) = \frac{P\left(A_j \cap B\right)}{P(B)} = \frac{P(A_j)P\left(B \middle| A_j\right)}{\sum_{i=1}^{k} P(A_i)P\left(B \middle| A_i\right)}, \quad j = 1, 2, \ldots, k$

Random Variables

- $\mu = E(X) = \sum xP(X = x)$ or $\mu = E(X) = \int xf(x)dx$
- $\sigma^2 = E(x - \mu)^2 = E(x)^2 - \left(E(X)\right)^2$
- $P(X = x) = C_x^n \pi^x (1 - \pi)^{n-x}, \ x = 0, 1, 2, \ldots, n, \ \mu = n\pi$ & $\sigma = \sqrt{n\pi(1 - \pi)}$
- $P(X = x) = \frac{C_x^K C_{n-x}^{N-K}}{C_n^N}, \ x = 0, 1, 2, \ldots, min\{K, n\}, \ \mu = n\frac{K}{N}$ & $\sigma = \sqrt{n\frac{K}{N}\left(1 - \frac{K}{N}\right)}\sqrt{\frac{N-n}{N-1}}$
- $P(X = x) = \frac{(\lambda t)^x e^{-\lambda t}}{x!}, x = 0, 1, 2, \ldots; \quad \mu = \lambda t$ & $\sigma = \sqrt{\lambda t}$
- $f(x) = \frac{1}{b-a}, \quad a \le x \le b; \quad \mu = \frac{b+a}{2}$ & $\sigma = \sqrt{\frac{(b-a)^2}{12}}$
- $f(x) = \lambda e^{-\lambda x}, \quad x > 0; \quad \mu = \frac{1}{\lambda}$ & $\sigma = \frac{1}{\lambda}$
- $f(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$

Estimation

- $\bar{x} \pm z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$, or $\bar{x} \pm z_{\frac{\alpha}{2}} \frac{s}{\sqrt{n}}$, or $\bar{x} \pm t_{\frac{\alpha}{2}, n-1} \frac{s}{\sqrt{n}}$, or $\bar{p} \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$
- $n \ge \left(\frac{z_{\alpha/2}}{e}\sigma\right)^2$, or $n \ge \left(\frac{z_{\alpha/2}}{e}\right)^2 \pi(1 - \pi)$
- $(\bar{x}_1 - \bar{x}_2) \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$
- $(\bar{x}_1 - \bar{x}_2) \pm z_{\frac{\alpha}{2}} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$
- $(\bar{x}_1 - \bar{x}_2) \pm t_{\frac{\alpha}{2}} s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$ where $s_p = \sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1 + n_2 - 2}}$
- $(\bar{x}_1 - \bar{x}_2) \pm t_{\frac{\alpha}{2}} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$ where $d.f = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2 - 1}}$
- $(\bar{p}_1 - \bar{p}_2) \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\bar{p}_1(1-\bar{p}_1)}{n_1} + \frac{\bar{p}_2(1-\bar{p}_2)}{n_2}}$