STAT211 Final Exam Formula Sheet

Descriptive Statistics

- Sample Mean $\bar{X} = \frac{\sum x_k}{n}$ or $\frac{\sum x_i^* f_i}{\sum f_i}$
- Sample Variance $s^2 = \frac{\sum (x_i - \bar{X})^2}{n-1} = \frac{\sum x_i^2 - \frac{1}{n}\left(\sum x_i\right)^2}{n-1}$ or $\frac{\sum x_i^{*2} f_i - \left(\sum x_i^* f_i\right)^2 / n}{n-1}$
- Percentiles: $R_\alpha = \frac{\alpha}{100}(n+1) = i.d \quad P_\alpha = X_{(i)} + d\left(X_{(i+1)} - X_{(i)}\right)$

Probability

- $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- $P(A|B) = \frac{P(A \cap B)}{P(B)}$, $P(B) > 0$
- $P(B_j | A) = \frac{P(B_j \cap A)}{P(A)} = \frac{P(A|B_j)P(B_j)}{\sum_{i=1}^{k} P(A|B_i)P(B_i)}$ for $j = 1,2,...,k$

Random Variables

- $E(X) = \sum xp(x)$ *or* $E(X) = \int xf(x)dx$
- $\sigma^2 = \sum x^2 p(x) - \mu^2$ *or* $\sigma^2 = \int x^2 f(x)dx - \mu^2$

Statistical Distributions

a. $P(x) = \frac{n!}{x!(n-x)!} \pi^x (1-\pi)^{n-x}$, $x = 0,1,2,...,n$

$\mu = E(X) = n\pi, \quad \sigma = \sqrt{n\pi(1-\pi)}$

b. $P(x) = \frac{e^{-\lambda}\lambda^x}{x!}$, $x = 0,1,2,\ldots$

$\mu = \lambda$, $\sigma = \sqrt{\lambda}$,

c. $P(x) = \frac{C_{n-x}^{N-X} C_x^X}{C_n^N} = \frac{\binom{N-A}{n-x}\binom{A}{x}}{\binom{N}{n}}$

d. $f(x) = \begin{cases} \frac{1}{b-a} & if \quad a \le x \le b \\ 0 & otherwise \end{cases}$,

e. $P(0 \le x \le a) = 1 - e^{-\lambda a}$

Confidence Interval Estimation

f. $\bar{x} \pm z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$, $\quad n = \left(\frac{z_{\alpha/2}\ \sigma}{e} \right)^2$

g. $\bar{x} \pm z_{\alpha/2} \frac{s}{\sqrt{n}}$, $\quad n = \left(\frac{z_{\alpha/2}\, s}{e} \right)^2$

h. $\bar{x} \pm t_{\alpha/2,f} \frac{s}{\sqrt{n}}$, the number of degrees of freedom $f = n - 1$

i. $\left(\overline{x_1} - \overline{x_2} \right) \pm z_{\alpha/2} \sqrt{\frac{\sigma_1^{\ 2}}{n_1} + \frac{\sigma_2^{\ 2}}{n_2}}$

j. $\left(\overline{x_1} - \overline{x_2} \right) \pm z_{\alpha/2} \sqrt{\frac{s_1^{\ 2}}{n_1} + \frac{s_2^{\ 2}}{n_2}}$

k. $\left(\bar{x}_1 - \bar{x}_2 \right) \pm t_{\frac{\alpha}{2},\ f} \quad s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$, $\quad s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$

l. $\left(\bar{x}_1 - \bar{x}_2 \right) \pm t_{\frac{\alpha}{2},v} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}, v = \frac{\left(\frac{s_1^{\ 2}}{n_1} + \frac{s_2^{\ 2}}{n_2} \right)^2}{\frac{\left(\frac{s_1^{\ 2}}{n_1} \right)^2}{n_1 - 1} + \frac{\left(\frac{s_2^{\ 2}}{n_2} \right)^2}{n_2 - 1}}$

m. $\bar{d} \pm t_{\frac{\alpha}{2},\ n-1} \frac{s_d}{\sqrt{n}}$

n. $p \pm z_{\alpha/2} \sqrt{\frac{p(1-p)}{n}}$, $n = \frac{z_{\alpha/2}^2\, p(1-p)}{e^2}$, $n_{\max} = \frac{z_{\alpha/2}^2}{4e^2}$

o. $\left(p_1 - p_2 \right) \pm z_{\alpha/2} \sqrt{\frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}}$