STAT319 Final Exam Formula Sheet

$\bar{x} \equiv \frac{1}{n}\sum x; \quad s_{xx} \equiv \sum (x-\bar{x})^2 = \sum x^2 - \frac{1}{n}\left(\sum x\right)^2; \;\; s^2 \equiv \frac{s_{xx}}{n-1}.$

$P(A \cup B) = P(AB') + P(A'B) + P(AB).$

$P(A \cup B) = P(A) + P(B) - P(AB).$

$P(A \cup B) = 1 - P(A \cup B)' = \;\; 1 - P(A'B').$

$P(AB)' = P(A' \cup B').$

$P(A \mid B) = \frac{P(AB)}{P(B)}, \quad P(B) \neq 0; \quad P(AB) = P(A)P(B \mid A) = P(B)P(A \mid B)$

$P(A \mid B') = P(A) = P(A \mid B), \;\; P(AB) = P(A)P(B). \; .$

Discrete Probability Distributions

$\mu \equiv E(X) = \sum_x x\, f(x).$

$E(X^2) = \sum x^2\, f(x), \;\; \sigma^2 \equiv E(X-\mu)^2 = E(X^2) - \mu^2.$

$f(x) = \binom{n}{x} p^x q^{n-x}; \quad x = 0,1,\ldots,n; \;\; 0 < p < 1; \;\; q = 1-p; \; \mu = np, \; \sigma^2 = npq.$

$f(x) = q^x p, \;\; x = 0,1,2,\cdots; \; q = 1-p; \;\; \mu = 1/p, \; \sigma^2 = q/p^2.$

$f(x) = \binom{K}{x}\binom{N-K}{n-x} \div \binom{N}{n}, \quad \max\{0, n-(N-K)\} \le y \le \min\{n, K\}; \; \mu = np,$

$\sigma^2 = (1-c)\; npq, \;\; (N-1)\; c = n-1, \; p = (K/N), \; q = 1-p.$

$f(x) = \frac{(\lambda t)^x}{x!} e^{-\lambda t}; \; x = \; 0,1,\ldots; \; \mu = \lambda t, \; \sigma^2 = \lambda t.$

Continuous Probability Distributions

$P(a < X < b) = \int_a^b f(x)dx; \quad P(X \le k) = \int_{-\infty}^{k} f(x)dx$ where k is a particular value of x.

$\mu \equiv E(X) = \int_{-\infty}^{\infty} x\, f(x)dx.$

$E(X^2) = \int_{-\infty}^{\infty} x^2\, f(x)dx, \quad \sigma^2 \equiv V(X) = E(X^2) - \mu^2.$

$X \sim N(\mu, \sigma^2), \;\; Z = \frac{X-\mu}{\sigma} \sim N(0,1)$

$f(x) = \; \lambda\, e^{-\lambda x}, \;\; x \ge 0; \; \mu = \frac{1}{\lambda}, \;\; \sigma^2 = \frac{1}{\lambda^2}.$

Confidence Interval	Test Statistic
$\bar{x} \mp z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)$. $n = \frac{z_{\alpha/2}^2}{e^2}\sigma^2$,	$z = \frac{\bar{x}-\mu_0}{\sqrt{\sigma^2/n}}$.
$\bar{x} \mp t_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right)$	$t = \frac{\bar{x}-\mu_0}{\sqrt{s^2/n}}$
$(\bar{x}_1-\bar{x}_2) \mp z_{\alpha/2}\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}$.	$z = \frac{\bar{x}_1-\bar{x}_2-\delta_0}{\sqrt{\left(\sigma_1^2/n_1\right)+\left(\sigma_2^2/n_2\right)}}$.
$(\bar{x}_1-\bar{x}_2) \mp t_{\alpha/2}s_p\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}$, $s_p^2 = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{(n_1-1)+(n_2-1)}$, $\nu = (n_1-1)+(n_2-1)$.	$t = \frac{\bar{x}_1-\bar{x}_2-\delta_0}{s_p\sqrt{\left(1/n_1\right)+\left(1/n_2\right)}}$
$(\bar{x}_1-\bar{x}_2) \mp z_{\alpha/2}\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}$.	$t = \frac{\bar{x}_1-\bar{x}_2-\delta_0}{\sqrt{\left(s_1^2/n_1\right)+\left(s_2^2/n_2\right)}}$, $\nu = \frac{\left(s_1^2/n_1+s_2^2/n_2\right)^2}{\frac{(s_1^2/n_1)^2}{n_1-1}+\frac{(s_2^2/n_2)^2}{n_2-1}}$.
$\bar{d} \mp t_{\alpha/2}\left(\frac{s_d}{\sqrt{n}}\right)$	$t = \frac{\bar{d}}{s_d/\sqrt{n}}$
$\hat{p} \mp z_{\alpha/2}\sqrt{\hat{p}\hat{q}/n}$. $n = \frac{z_{\alpha/2}^2}{e^2}\hat{p}\hat{q}$	$z = \frac{\hat{p}-p_0}{\sqrt{p_0q_0/n}}$,
$\hat{p}_1-\hat{p}_2 \mp z_{\alpha/2}\sqrt{\frac{\hat{p}_1\hat{q}_1}{n_1}+\frac{\hat{p}_2\hat{q}_2}{n_2}}$.	$z = \frac{\hat{p}_1-\hat{p}_2}{\sqrt{\hat{p}\left(1-\hat{p}\right)\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$, $\hat{p} = \frac{x_1+x_2}{n_1+n_2}$

$$y=\beta_0+\beta_1x+\varepsilon \qquad y=\hat{\beta}_0+\hat{\beta}_1x \quad e=y-\hat{\mu}(x).$$

$$s_{xy}=\sum xy-\frac{1}{n}\left(\sum x\right)\left(\sum y\right),\ s_{xx}=\sum x^2-\frac{1}{n}\left(\sum x\right)^2,\ \hat{\beta}_0=\bar{y}-\hat{\beta}_1\bar{x}.\ \hat{\beta}_1=\frac{s_{xy}}{s_{xx}}$$

$$r=\frac{s_{xy}}{\sqrt{s_{xx}\ s_{yy}}},\ SSR=\hat{\beta}_1 s_{xy},\quad SSE=s_{yy}-SSR.$$

$$\sigma^2=SSE/(n-2)=MSE \qquad R^2=\frac{SSR}{s_{yy}}=\frac{SSR}{SST}$$

$\hat{\beta}_0 \mp t_{\alpha/2}\sqrt{\left(\frac{1}{n}+\frac{\bar{x}^2}{s_{xx}}\right)MSE}$.	$H_0:\beta_0=c:\ t=\frac{\hat{\beta}_0-c}{\sqrt{\left(\frac{1}{n}+\frac{\bar{x}^2}{s_{xx}}\right)MSE}}$.
$\hat{\beta}_1 \mp t_{\alpha/2}\sqrt{\frac{MSE}{s_{xx}}}$.	$H_0:\beta_1=c:\ t=\frac{\hat{\beta}_1-c}{\sqrt{MSE/s_{xx}}}$.
$\hat{\mu}(x) \pm t_{\alpha/2}\sqrt{\left(\frac{1}{n}+\frac{(x-\bar{x})^2}{s_{xx}}\right)MSE}$.	
$\hat{\mu}(x) \pm t_{\alpha/2}\sqrt{\left(1+\frac{1}{n}+\frac{(x-\bar{x})^2}{s_{xx}}\right)MSE}$.	