Formulae Sheet

$\bar{x} = \frac{\Sigma_{i=1}^{n} x_i}{n}$ $\qquad$ $s^2 = \frac{\Sigma_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$

$P(A^c) = 1 - P(A)$ $\qquad$ $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{P(B|A)P(A)}{P(B|A)P(A) + P(B|A^c)P(A^c)}$

Linear combination of random variables X and Y and fixed numbers a and b:

$E[aX + bY] = aE[X] + bE[Y]$
$Var(aX + bY) = a^2 Var(X) + b^2 Var(Y)$ if X and Y are independent.

Discrete Random Variables

Let X be a discrete random variable with a pmf of $f(x)$ then

$$E[X] = \sum_x x f(x)$$

$$Var(X) = E[(X - E[X])^2] = \sum_x (x - E[X])^2 f(x) = E[X^2] - (E[X])^2$$

pmf	$E(X)$	$Var(X)$
$\pi^x(1-\pi)^{1-x}$	π	$\pi(1-\pi)$
$\binom{n}{x}\pi^x(1-\pi)^{n-x}$	$n\pi$	$n\pi(1-\pi)$
$(1-\pi)^x\pi$	$\frac{1-\pi}{\pi}$	$\frac{1-\pi}{\pi^2}$
$\frac{\lambda^x}{x!}e^{-\lambda}$	λ	λ

Continuous Random Variables

Let X be a continuous random variable with a pdf of $f(x)$ then

$$E[X] = \int_{x \in \Omega_x} x f(x)\, dx$$

$$Var(X) = E[(X - E[X])^2] = \int_{x \in \Omega_x} (x - E[X])^2 f(x)\, dx = E[X^2] - (E[X])^2$$

pdf	$E(X)$	$Var(X)$
$\lambda e^{-\lambda x}$	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$
$\frac{1}{b-a}$	$\frac{b+a}{2}$	$\frac{(b-a)^2}{12}$

point estimate	**critical value**	**standard error**
p	z^*	$\sqrt{\frac{p(1-p)}{n}}$
$p_1 - p_2$	z^*	$\sqrt{\frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}}$
$\bar{x}$	t^*_{df}	$\sqrt{\frac{s^2}{n}}$
$\bar{x}_1 - \bar{x}_2$	t^*_{df}	$\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$

$p_{pooled} = \frac{p_1 n_1 + p_2 n_2}{n_1 + n_2}$

$y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \epsilon_i$