Useful Formulas

$$\overline{y} = \frac{1}{n}\sum_{i=1}^{n} y_i \qquad s = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(y_i - \overline{y})^2} \qquad r = \frac{1}{n-1}\sum_{i=1}^{n}\left(\frac{x_i - \overline{x}}{s_x}\right)\left(\frac{y_i - \overline{y}}{s_y}\right)$$

$$\hat{y} = b_0 + b_1 x \qquad b_1 = r\frac{s_y}{s_x} \qquad b_0 = \overline{y} - b_1\overline{x}$$

	Discrete Case	**Continuous Case**
$P(a \le X \le b)$	$\sum_{i:a\le x_i \le b} P(X = x_i)$	$\int_a^b f(x)\,dx$
$\mu = E[X]$	$\sum_i x_i P(X = x_i)$	$\int_{-\infty}^{\infty} x f(x)\,dx$
$\sigma^2 = \text{Var}(X)$	$\sum_i (x_i - \mu)^2 P(X = x_i)$	$\left(\int_{-\infty}^{\infty} x^2 f(x)\,dx\right) - \mu^2$

Distribution	**Probability Density Function**	$E[X]$	$\text{Var}(X)$
Binomial(n, p)	$P(X = k) = \binom{n}{k} p^k (1-p)^{n-k}$ for $k = 0, 1, \ldots, n$	np	$np(1-p)$
Poisson(λ)	$P(X = k) = e^{-\lambda}\lambda^k/k!$ for $k = 0, 1, \ldots$	λ	λ
Geometric(p)	$P(X = k) = (1-p)^{k-1}p$ for $k = 1, 2, \ldots$	$1/p$	$(1-p)/p^2$
Uniform(a, b)	$f(x) = 1/(b-a)$ for $a < x < b$	$(a+b)/2$	$(b-a)^2/12$
Exponential(λ)	$f(x) = \lambda e^{-\lambda x}$ for $x > 0$	$1/\lambda$	$1/\lambda^2$
Normal(μ, σ^2)	$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-(x-\mu)^2/2\sigma^2}$	μ	σ^2

$$E[\bar{X}] = \mu \qquad \text{SD}(\bar{X}) = \frac{\sigma}{\sqrt{n}} \qquad E[\hat{p}] = p \qquad \text{SD}(\hat{p}) = \sqrt{\frac{p(1-p)}{n}}$$

Test	**ME for Interval**	**Test Statistic**	**df**
One-proportion z-test	$z^*\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$	$Z = \frac{p - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$	N/A
One-sample t-test	$t^*\frac{s}{\sqrt{n}}$	$T = \frac{\bar{X} - \mu_0}{s/\sqrt{n}}$	$n-1$
Paired t-test	$t^*\frac{s_d}{\sqrt{n}}$	$T = \frac{\bar{d}}{s_d/\sqrt{n}}$	$n-1$
Two-sample t-test	$t^*\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$	$T = \frac{\bar{X} - \bar{Y}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$	$\min\{n_1 - 1, n_2 - 1\}$
Regression slope	$t^*\text{SE}(b_1)$	$T = \frac{b_1}{\text{SE}(b_1)}$	$n-2$