FORMULAS:

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

$$s = \sqrt{s^2}$$

$${}_nP_n = n(n-1)(n-2)...3\cdot 2\cdot 1 = n!$$

$${}_nP_r = \frac{n!}{(n-r)!}$$

$$P = \frac{n!}{r!s!t!}$$

$${}_nC_r = \binom{n}{r} = \frac{n!}{r!(n-r)!}$$

$$(A \cup B)^c = A^c \cap B^c$$

$$P(E) = \frac{n(E)}{n(S)}$$

$$P(E^c) = 1 - P(E)$$

$$P(E \cup F) = P(E) + P(F) - P(E \cap F)$$

$$P(E \mid F) = \frac{P(E \cap F)}{P(F)}$$

$$\mu_X = E[X] = x_1 p_1 + x_2 p_2 + \cdots + x_n p_n$$

$$\sigma_X^2 = Var[X] = (x_1 - \mu_X)^2 p_1 + (x_2 - \mu_X)^2 p_2 + \cdots + (x_n - \mu_X)^2 p_n$$

$$= \sum (x_i - \mu_X)^2 p_i$$

$$\sigma_X^2 = Var[X] = E[X^2] - (E[X])^2$$

$$E[W] = E[aX + b] = aE[X] + b$$

$$\sigma_W^2 = Var[W] = Var[aX + b] = a^2 Var[X]$$

$$E[X+Y] = E[X] + E[Y]$$

$$\sigma_{X+Y}^2 = Var[X+Y] = Var[X] + Var[Y]$$

$$E[X-Y] = E[X-Y] = E[X] - E[Y]$$

$$\sigma_{X-Y}^2 = Var[X-Y] = Var[X] + Var[Y]$$

$$P(X = k) = \binom{n}{k} p^k (1-p)^{n-k}$$

$$P(X \geq k) = 1 - P(X \leq (k-1))$$

$$\mu = E\left[X \right] = np$$

$$\sigma^2 = np(1-p)$$

$$P(X = n) = (1-p)^{n-1} p$$

$$P(X > n) = (1-p)^n$$

$$E[X] = \mu = \frac{1}{p}$$

$$\sigma^2 = \frac{1-p}{p^2}$$

Hypothesis tests:

Test	Null Hypothesis	Test Statistic
One-sample z-test for means	$\mu = \mu_o$	$z = \dfrac{\bar{x} - \mu_o}{\dfrac{\sigma}{\sqrt{n}}}$
One-sample t-test for means	$\mu = \mu_o$	$t = \dfrac{\bar{x} - \mu_o}{\dfrac{s}{\sqrt{n}}}$; df = n–1
Matched Pairs t-test	$\mu_D = \mu_{D_0}$	$t = \dfrac{\bar{x}_D - \mu_D}{s/\sqrt{n}}$; df = n – 1
One-sample z-test for proportions	$p = p_o$	$z = \dfrac{\hat{p} - p}{\sqrt{\dfrac{p(1-p)}{n}}}$
Two-sample t-test for means	$\mu_1 - \mu_2 = 0$ or $\mu_1 = \mu_2$	$t = \dfrac{\bar{x}_1 - \bar{x}_2}{\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}}$; df=min(n1,n2)-1
Two-sample z-test for proportion	$p_1 - p_2 = 0$ or $p_1 = p_2$	$z = \dfrac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\left(\dfrac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \dfrac{\hat{p}_2(1-\hat{p}_2)}{n_2}\right)}}$
χ^2 Goodness of fit test	no change	$\chi^2 = \sum \dfrac{(\text{observed} - \text{expected})^2}{\text{expected}}$

Confidence Intervals

One-sample z-test: $\overline{x} \pm z^* \frac{\sigma}{\sqrt{n}}$

Two-proportion z-test: $(\hat{p}_1 - \hat{p}_2) \pm z^* \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$

One-sample t-test: $\overline{x} \pm t^* \frac{s}{\sqrt{n}}$

One-proportion z-test: $\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

Two-sample z-test: $(\overline{x}_1 - \overline{x}_2) \pm z^* \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$

Two-sample t-test: $(\overline{x}_1 - \overline{x}_2) \pm t^* \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$