Formulas:

Descriptive Statistics	**Descriptive Parameters**
mean of a sample $\bar{x} = \frac{\sum x}{n}$	mean of a population $\mu = \frac{\sum x}{N}$
proportion of a sample $\hat{p} = \frac{successes}{events}$	proportion of a population $\theta = \frac{successes}{events}$
standard deviation of a sample $Sx = \sqrt{\frac{\sum \left(x - \bar{x}\right)}{n - 1}}$	standard deviation of a population $\sigma = \sqrt{\frac{\sum (x - \mu)^2}{n}}$
standard deviation of a sample proportion $\sigma_{\hat{p}} = \sqrt{\frac{\hat{p}(1 - \hat{p})}{n}}$	standard deviation of a population proportion $\sigma_{\theta} = \sqrt{\frac{\theta(1 - \theta)}{n}}$
standard deviation of sample means $\sigma_{\bar{x}} = \frac{Sx}{\sqrt{n}}$	standard deviation of sample means $\sigma_{\mu} = \frac{\sigma}{\sqrt{n}}$

Probability:

$P(X > a) = 1 - P(X < a)$

$P(a < X < b) = P(X < b) - P(X < a)$

Z Scores In a generalized form

standardized test statistic = (statistic - parameter) / (standard deviation of statistic)

Some examples of standardized test statistic (z-scores):

$Z = \frac{x - \mu}{\sigma}$ $Z = \frac{x - \bar{x}}{S_x}$

Formulas for Confidence Intervals:

Confidence Interval for Population Proportion $\hat{p} \pm Z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$	Constraints (Technical Conditions that must be met): 1. Data must be from a Simple Random Sample 2. $n \times \hat{p} \geq 10$ $n(1-\hat{p}) \geq 10$
Confidence Interval for Population Means (large sample) $\bar{x} \pm Z^* (\frac{Sx}{\sqrt{n}})$	Constraints (Technical Conditions that must be met): 1. Data must be from a Simple Random Sample 2. Population normally distributed and n is at least 30 OR n is at least 50.
Confidence Interval for Population Means (small sample) $\bar{x} \pm t^* (\frac{Sx}{\sqrt{n}})$	Constraints (Technical Conditions that must be met): 1. Data must be from a Simple Random Sample 2. Population normally distributed or $n \geq 30$ 3. df = n - 1

Formulas for Tests of Significance:

Large Sample Test for a Proportion $Ho: \theta = \_\_$ $z = \frac{\hat{p} - \theta}{\sigma_\theta}$	Constraints (Technical Conditions that must be met): 1. Data must be from a Simple Random Sample 2. $n \times \theta \geq 10$ $n(1-\theta) \geq 10$
Sample Test for a Mean $Ho: \mu = \_\_$ $t = \frac{\bar{x} - \mu}{\sigma_\mu}$	Constraints (Technical Conditions that must be met): 1. Data must be from a Simple Random Sample 2. Population normally distributed and n is at least 30 OR n is at least 50. 3. df = n - 1

Large Sample Test for Difference of Proportions $Ho: \theta_1 = \theta_2$ $z = \dfrac{\hat{p}_1 - \hat{p}_2}{\sqrt{\dfrac{\hat{p}(1-\hat{p})}{n_1} + \dfrac{\hat{p}(1-\hat{p})}{n_2}}}$ where $\hat{p}_1 = \dfrac{x_1}{n_1}$ and $\hat{p}_2 = \dfrac{x_2}{n_2}$ and $\hat{p} = \dfrac{x_1 + x_2}{n_1 + n_2}$	Constraints (Technical Conditions that must be met): 1. The two samples are independently selected simple random samples from the populations of interest. 2. That $n_1 \hat{p} \geq 5$ and $n_1(1-\hat{p}) \geq 5$ and $n_2 \hat{p} \geq 5$ and $n_2(1-\hat{p}) \geq 5$ 3. df = n_1-1 or n_2-1 whichever one is smaller
Large Sample Test for a Difference of Population Means $Ho: \mu_1 = \mu_2$ $t = \dfrac{\bar{x}_1 - \bar{x}_2}{\sqrt{\dfrac{Sx_1^2}{n_1} + \dfrac{Sx_2^2}{n_2}}}$	Constraints (Technical Conditions that must be met): 1. The two samples are independently selected simple random samples from the populations of interest. 2. Either that both populations are large (30 or larger) or that both populations are normally distributed. 3. df = n_1-1 or n_2-1 , whichever one is smaller
Chi-Square Test - Goodness of Fit $\chi^2 = \sum \dfrac{(Observed - Expected)^2}{Expected}$ df = n - 1	Constraints (Technical Conditions that must be met): 1. The observations are a simple random sample from the population of interest. 2. All expected values are five or larger.
Chi-Square Test - Independence $\chi^2 = \sum_{i,j} \dfrac{(Observed_{i,j} - Expected_{i,j})^2}{Expected_{i,j}}$ df = (r - 1) (c - 1)	Constraints (Technical Conditions that must be met): 1. The observations are a simple random sample from the population of interest. 2. All expected counts in the contingency table are five or larger.
F-Test Testing Two Population Standard Deviations. $Ho: \sigma_1 = \sigma_2$ $F = \dfrac{Sx_1^2}{Sx_2^2}$ df = n_1-1 , n_2 - 1	Constraints (Technical Conditions that must be met): 1. The observations are from simple random samples from the population of interest. 2. The sample data are independent. 3. The populations are normally distributed. 4. Place the sample with the larger standard deviation in the numerator.