Testing Hypotheses

	Mean (Large Sample Size)	
Upper-Tail test	Lower –Tail Test	Two-tail Test
$H_0 : m = m_0$ $H_a : m > m_0$ $a =$______ $Z = \frac{\bar{X} - m_0}{s/\sqrt{n}}$ Reject H_0 if $Z_c > Z_a$	$H_0 : m = m_0$ $H_a : m < m_0$ $a =$______ $Z = \frac{\bar{X} - m_0}{s/\sqrt{n}}$ Reject H_0 if $Z_c < -Z_a$	$H_0 : m = m_0$ $H_a : m \neq m_0$ $a =$______ $Z = \frac{\bar{X} - m_0}{s/\sqrt{n}}$ Reject H_0 if $\lvert Z_c \rvert > Z_{a/2}$

	Mean (Small Sample Size)	
Upper-Tail test	Lower –Tail Test	Two-tail Test
$H_0 : m = m_0$ $H_a : m > m_0$ $a =$______ $t = \frac{\bar{X} - m_0}{s/\sqrt{n}}$ Reject H_0 if $t_c > t_{a,(n-1)}$	$H_0 : m = m_0$ $H_a : m < m_0$ $a =$______ $t = \frac{\bar{X} - m_0}{s/\sqrt{n}}$ Reject H_0 if $t_c < -t_{a,(n-1)}$	$H_0 : m = m_0$ $H_a : m \neq m_0$ $a =$______ $t = \frac{\bar{X} - m_0}{s/\sqrt{n}}$ Reject H_0 if $\lvert t_c \rvert > t_{a/2,(n-1)}$

	Differences Between Means (Large Sample Sizes)	
Upper-Tail test	Lower –Tail Test	Two-tail Test
$H_0 : m_1 = m_2$ $H_a : m_1 > m_2$ a =______ $Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$ Reject H_0 if $Z_c > Z_a$	$H_0 : m_1 = m_2$ $H_a : m_1 < m_2$ a =______ $Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$ Reject H_0 if $Z_c < -Z_a$	$H_0 : m_1 = m_2$ $H_a : m_1 \neq m_2$ a =______ $Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$ Reject H_0 if $\lvert Z_c \rvert > Z_{a/2}$

	Differences Between Means (Small Sample Sizes)	
Upper-Tail test	Lower –Tail Test	Two-tail Test
$H_0 : m_1 = m_2$ $H_a : m_1 > m_2$ a =______ $t = \frac{\bar{X}_1 - \bar{X}_2}{s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$ $s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$ Reject H_0 if $t_c > t_{a,(n_1+n_2+-2)}$	$H_0 : m_1 = m_2$ $H_a : m_1 < m_2$ a =______ $t = \frac{\bar{X}_1 - \bar{X}_2}{s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$ $s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$ Reject H_0 if $t_c < -t_{a,(n_1+n_2+-2)}$	$H_0 : m_1 = m_2$ $H_a : m_1 \neq m_2$ a =______ $t = \frac{\bar{X}_1 - \bar{X}_2}{s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$ $s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$ Reject H_0 if $\lvert t_c \rvert > t_{a/2,(n_1+n_2+-2)}$

	Differences Between Means Paired Data	
Upper-Tail test	Lower –Tail Test	Two-tail Test
$H_0 : m_D = 0$ $H_a : m_D > 0$ a =______ $t = \frac{\bar{D} - m_0}{s_D / \sqrt{n}}$ Reject H_0 if $t_c > t_{a,(n-1)}$	$H_0 : m_D = 0$ $H_a : m_D < 0$ a =______ $t = \frac{\bar{D} - m_0}{s_D / \sqrt{n}}$ Reject H_0 if $t_c < -t_{a,(n-1)}$	$H_0 : m_D = 0$ $H_a : m_D \neq 0$ a =______ $t = \frac{\bar{D} - m_0}{s_D / \sqrt{n}}$ Reject H_0 if $\lvert t_c \rvert > t_{a/2,(n-1)}$

	Proportion (Large Sample Size)	
Upper-Tail test	Lower –Tail Test	Two-tail Test
$H_0 : p = p_0$ $H_a : p > p_0$ a =______ $Z = \frac{x - np_0}{\sqrt{np_0(1 - p_0)}}$ Reject H_0 if $Z_c > Z_a$	$H_0 : p = p_0$ $H_a : p < p_0$ a =______ $Z = \frac{x - np_0}{\sqrt{np_0(1 - p_0)}}$ Reject H_0 if $Z_c < -Z_a$	$H_0 : p = p_0$ $H_a : p \neq p_0$ a =______ $Z = \frac{x - np_0}{\sqrt{np_0(1 - p_0)}}$ Reject H_0 if $\lvert Z_c \rvert > Z_{a/2}$

	Differences Between Proportions (Large Sample Size)	
Upper-Tail test	Lower –Tail Test	Two-tail Test
$H_0 : p_1 = p_2$ $H_0 : p_1 > p_2$ a =______ $Z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$ where $\hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$, $\hat{p}_1 = \frac{x_1}{n_1}$, and $\hat{p}_2 = \frac{x_2}{n_2}$ Reject H_0 if $Z_c > Z_a$	$H_0 : p_1 = p_2$ $H_0 : p_1 < p_2$ a =______ $Z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$ where $\hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$, $\hat{p}_1 = \frac{x_1}{n_1}$, and $\hat{p}_2 = \frac{x_2}{n_2}$ Reject H_0 if $Z_c < -Z_a$	$H_0 : p_1 = p_2$ $H_0 : p_1 \neq p_2$ a =______ $Z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$ where $\hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$, $\hat{p}_1 = \frac{x_1}{n_1}$, and $\hat{p}_2 = \frac{x_2}{n_2}$ Reject H_0 if $\lvert Z_c \rvert > Z_{a/2}$

Differences Among Proportions (Large Sample Size)
$H_0 : p_1 = p_2 = ... = p_k$ $H_0 :$ At least one p_i is different a =______ $c^2 = \sum\sum \frac{(O-E)^2}{E}$ where $E = \frac{RowTotal \times ColumnTotal}{GrandTotal}$ Reject H_0 if $c^2 \geq c^2_{a,(d.f.)}$ where $d.f. = (2-1)(k-1) = k-1$