Statistics Formula Sheet 2

Means
One Population Mean

Test Type	H_0 **and** H_A	**Test Statistic**	**Table**
One-Sided Hypothesis Test	$H_0 : \eta = \# \; H_A : \eta > \#$	$z = \frac{y-\eta}{\sigma} \; t = \frac{y-\overline{y}}{s}$	z table: normal distribution / t table: t-distribution
Two-Sided Hypothesis Test	$H_0 : \eta = \# \; H_A : \eta \neq \#$	$z = \frac{y-\eta}{\sigma} \; t = \frac{y-\overline{y}}{s}$	z table: normal distribution / t table: t-distribution

do not forget to double p

Two Population Means (unpaired)

Test Type	H_0 **and** H_A	**Test Statistic**	**Table**
One-Sided Hypothesis Test	$H_0 : \eta_B - \eta_A = 0 \Rightarrow \eta_B = \eta_A \; H_A : \eta_B - \eta_A > 0 \Rightarrow \eta_B > \eta_A$	$z = \frac{(\overline{y}_B - \overline{y}_A) - (\eta_B - \eta_B)}{\sigma \sqrt{\frac{1}{n_B} + \frac{1}{n_A}}}$ $t = \frac{(\overline{y}_B - \overline{y}_A) - (\eta_B - \eta_B)}{s \sqrt{\frac{1}{n_B} + \frac{1}{n_A}}}$	z table: normal distribution / t table: t-distribution
Two-Sided Hypothesis Test	$H_0 : \eta_B - \eta_A = 0 \Rightarrow \eta_B = \eta_A \; H_A : \eta_B - \eta_A \neq 0 \Rightarrow \eta_B \neq \eta_A$	$z = \frac{(\overline{y}_B - \overline{y}_A) - (\eta_B - \eta_B)}{\sigma \sqrt{\frac{1}{n_B} + \frac{1}{n_A}}}$ $t = \frac{(\overline{y}_B - \overline{y}_A) - (\eta_B - \eta_B)}{s \sqrt{\frac{1}{n_B} + \frac{1}{n_A}}}$	z table: normal distribution / t table: t-distribution

do not forget to double p

Notes:

- One must assume that the two populations are independent of each other.
- One must assume that the variances of the populations are equal.

Two Population Means (paired)

Test Type	H_0 and H_A	Test Statistic	Table
One-Sided Hypothesis Test	$H_0 : \delta = 0$ $H_A : \delta > 0$	$\overline{d} = \sum_{i=1}^{n} \frac{(x_i - y_i)}{n}$ $t = \frac{\overline{d}-\delta}{s_{\overline{d}}} = \frac{\overline{d}-\delta}{\frac{s}{\sqrt{n}}}$	t table: t-distribution
Two-Sided Hypothesis Test	$H_0 : \delta = 0$ $H_A : \delta \neq 0$	$\overline{d} = \sum_{i=1}^{n} \frac{(x_i - y_i)}{n}$ $t = \frac{\overline{d}-\delta}{s_{\overline{d}}} = \frac{\overline{d}-\delta}{\frac{s}{\sqrt{n}}}$	t table: t-distribution

do not forget to double p

Variances

One Population Variance

Test Type	H_0 and H_A	Test Statistic	Table
One-Sided Hypothesis Test	$H_0 : \sigma^2 = \#$ $H_A : \sigma^2 > \#$	$\dot{s}^2 = \frac{\sum_{i=1}^{n}(y-\eta)^2}{N} \sim \frac{\sigma^2\chi^2}{N} \sim \frac{\sigma^2}{N}\chi^2_N / s^2 = \frac{\sum_{i=1}^{n}(y-\overline{y})^2}{n-1} \sim \frac{\sigma^2}{n-1}\chi^2_{n-1}$	Chi-squared: χ^2 distribution
Two-Sided Hypothesis Test	?	?	Chi-squared: χ^2 distribution

do not forget to double p

Two Population Variances

Test Type	H_0 and H_A	Test Statistic	Table
One-Sided Hypothesis Test	$H_0 : \sigma_A^2 = \sigma_B^2 \Rightarrow \frac{\sigma_A^2}{\sigma_B^2} = 1$ $H_A : \sigma_A^2 > \sigma_B^2 \Rightarrow \frac{\sigma_A^2}{\sigma_B^2} > 1$	$\frac{s_A^2}{s_B^2}$	F distribution

Y matrix (data) = A matrix (grand average) + T matrix ($\overline{y}$ - grand average) + R matrix (residue)

D matrix = Y matrix - A matrix = T matrix + R matrix

Analysis of Variance (ANOVA) Table

Source	**Sum of Squares**	**Degrees of Freedom**	**Mean Square**
Between (T)	S_T = Sum of Squares	$\nu_T = \#$ of columns - 1	$S_T^2 = \frac{S_T}{\nu_T}$
Within (R)	S_R = Sum of Squares	$\nu_R = \Sigma(n-1)$ for each column	$S_R^2 = \frac{S_R}{\nu_R}$
Total (D)	S_D = Sum of Squares $= S_T + S_R$	$\nu_D = \nu_T + \nu_R$	X

F	**P**	**Analysis**
$\frac{S_T^2}{S_R^2}$		

Confidence Interval Formulas

Population Mean: η

$\overline{y} \pm z_{\frac{\infty}{2}} \frac{\sigma}{\sqrt{n}}$	σ known
$\overline{y} \pm t_{\frac{\infty}{2}} \frac{s}{\sqrt{n}}$	σ unknown

Difference in Population Means: $\eta_B - \eta_A$

$(\overline{y}_B - \overline{y}_A) \pm z_{\frac{\infty}{2}} \sigma \sqrt{\frac{1}{n_A} + \frac{1}{n_B}}$	σ known
$(\overline{y}_B - \overline{y}_A) \pm t_{\frac{\infty}{2}} s \sqrt{\frac{1}{n_A} + \frac{1}{n_B}}$	σ unknown

Mean of Paired Differences: δ

$\overline{d} \pm z_{\frac{\infty}{2}} \frac{\sigma}{\sqrt{n}}$	σ known
$\overline{d} \pm t_{\frac{\infty}{2}} \frac{S_d}{\sqrt{n}}$	σ known