Formulas

Sample Mean $\overline{X} = \frac{\sum_i X_i}{n}$, Population Mean $\mu = \frac{\sum_i X_i}{N}$ **(4.3)**

Variance $\sigma^2 = \frac{\sum_i x_i^2}{N} = \frac{\sum_i (X_i - \mu)^2}{N}$, $s^2 = \frac{\sum_i (X_i - \overline{X})^2}{(n-1)} = \frac{\sum_i x_i^2}{\nu}$ **(5.4–5.5)**

z-Score $z_i = \frac{X_i - \mu}{\sigma} = \frac{x_i}{\sigma}$ **(6.2)**

Skewness Index $\gamma_1 = \frac{\Sigma_i z_i^3}{N}$ **(6.8)**

Covariance $s_{XY} = \frac{\sum_i x_i y_i}{n-1} = \frac{\sum_i (X_i - \overline{X})(Y_i - \overline{Y})}{n-1}$ **(7.1)**

Sample Correlation Coefficient $r = \frac{s_{XY}}{s_X s_Y}$; Parameter $\rho = \frac{\sigma_{XY}}{\sigma_X \sigma_Y}$ **(7.2)**

Disattenuated Correlation Coefficient $r_{X_\infty Y_\infty} = \frac{r_{XY}}{\sqrt{r_{XX} r_{YY}}}$ **(7.7)**

Variance of a Sum $s_{X+Y}^2 = s_X^2 + s_Y^2 + 2r_{XY} s_X s_Y$ **(7.8)**

Variance of a Difference $s_{X-Y}^2 = s_X^2 + s_Y^2 - 2r_{XY} s_X s_Y$ **(7.11)**

Predicted z-Score $\hat{z}_{Y_i} = r\, z_{X_i}$ **(8.1)**

Regression Equation $\hat{Y}_i = bX_i = c$ **(8.2)**

Residual $e_i = Y_i - \hat{Y}_i = Y_i - (bX_i + c)$ **(8.3)**

Variance Error of Estimate $\sigma_{Y.X}^2 = \sigma_Y^2(1-\rho^2)$, $\sigma_{Y.X} = \sigma_Y\sqrt{(1-\rho^2)}$, $s_{Y.X}^2 = s_Y^2(1-r^2)$ **(8.8–8.10)**

Partial Correlation $r_{12.3} = \frac{r_{12} - r_{13} r_{23}}{\sqrt{(1-r_{13}^2)(1-r_{23}^2)}}$ **(8.12)**

Multiple Correlation $R_{Y.12}^2 = \frac{r_{Y1}^2 + r_{Y2}^2 - 2r_{Y1} r_{Y2} r_{12}}{1 - r_{12}^2}$ **(8.19)**

Bias Correction for $R_{Y.12}^2$ $\text{adj}\, R_{Y.12\cdots m}^2 = R_{Y.12\cdots m}^2 - \left(1 - R_{Y.12\cdots m}^2\right)\left(\frac{m}{n-m-1}\right)$ **(8.21)**

Eta Squared $\hat{\eta}_{Y.X}^2 = 1 - \frac{SS_{\text{within}}}{SS_{\text{total}}}$ **(8.23)**

Standard Error of the Mean $\sigma_{\overline{X}} = \frac{\sigma}{\sqrt{n}}$, $s_{\overline{X}} = \frac{s}{\sqrt{n}}$ **(10.1, 11.5)**

Confidence Intervals Using $\sigma_{\overline{X}}$ $.68CI = \overline{X} \pm \sigma_{\overline{X}}$, $.90CI = \overline{X} \pm 1.645\sigma_{\overline{X}}$, $.95CI = \overline{X} \pm 1.96\sigma_{\overline{X}}$ **(10.2–10.4)**

Confidence Intervals Using $s_{\overline{X}}$ $.95CI = \overline{X} \pm {}_{.975}t_v s_{\overline{X}}$, where $v = n-1$, $(1-\alpha)CI = \overline{X} \pm {}_{1-\alpha/2}t_v s_{\overline{X}}$ **(11.8–11.9)**

t-Tests $t = \dfrac{\overline{X}-\mu}{s_{\overline{X}}}$; $t = \dfrac{(\overline{X}_1-\overline{X}_2)-(\mu_1-\mu_2)}{s_{\overline{X}_1-\overline{X}_2}}$ **(11.6, 12.1)**

Variance Within Groups $s_W^2 = \dfrac{SS_W}{v_W} = \dfrac{\Sigma x_1^2+\Sigma x_2^2}{v_1+v_2} = \dfrac{\Sigma x_1^2+\Sigma x_2^2}{(n_1-1)+(n_2-1)}$ **(12.3)**

Variance Error of the Difference in Two Independent Means $s^2_{\overline{X}_1-\overline{X}_2} = s_W^2\left(\dfrac{1}{n_1}+\dfrac{1}{n_2}\right)$ **(12.4)**

Variance Error of the Difference in Two Paired Means $s^2_{\overline{X}_1-\overline{X}_2} = s^2_{\overline{X}_1}+s^2_{\overline{X}_2}-2rs_{\overline{X}_1}s_{\overline{X}_2}$ **(12.10)**

Quasi *t*-Test $t' = \dfrac{\overline{X}_1-\overline{X}_2}{\sqrt{s^2_{\overline{X}_1}+s^2_{\overline{X}_2}}}$ **(12.8)**

Effect Size $\Delta = \dfrac{\mu_E-\mu_C}{\sigma}$, $\hat{\Delta} = \dfrac{\overline{X}_E-\overline{X}_C}{\hat{\sigma}}$ **(12.7A–B)**

Variance of a Proportion $\sigma^2 = \pi(1-\pi)$ **(13.2)**

Standard Error of a Proportion $\sigma_p = \sqrt{\dfrac{(1-f)\pi(1-\pi)}{n}}$ **(13.7)**

Chi-square Goodness of Fit Test $\chi^2 = n_\bullet \sum_j \dfrac{(p_j-\pi_j)^2}{\pi_j}$ **(13.10)**

t-Test of *r* $t = \dfrac{r-\rho}{s_r}$, $s_r = \sqrt{\dfrac{1-r^2}{n-2}} = \sqrt{\dfrac{1-r^2}{v}}$ **(14.1–14.2)**

Noncentrality ANOVA Parameter $\phi = \sqrt{\dfrac{\sum_j n_j\alpha_j^2}{J\sigma_\varepsilon^2}}$, $\phi = \sqrt{\dfrac{n\sum_j \alpha_j^2}{J\sigma_\varepsilon^2}}$, $\phi = \dfrac{\Delta}{2}\sqrt{n}$ **(15.22–15.24)**

Bartlett's Test of H_0 $\chi^2 = v_W \text{Ln} s_W^2 - \sum_j v_j \text{Ln} s_j^2$ **(16.11)**

The Studentized Range Statistic $q = \dfrac{\overline{X}_1-\overline{X}_J}{s_{\overline{X}}}$, $s_{\overline{X}} = \sqrt{\dfrac{MS_{\text{error}}}{n}}$ **(17.2–17.3)**

Definition of a Contrast $\psi = \sum_j c_j\mu_j = c_1\mu_1+c_2\mu_2+\ldots+c_J\mu_J$ **(17.7)**

The Standard Error of a Contrast $s_{\hat{\psi}} = \sqrt{\left(\dfrac{MS_e}{n}\right)\sum_j c_j^2}$; $t = \dfrac{\hat{\psi}}{s_{\hat{\psi}}}$ **(17.8, 17.9)**

The Bonferroni Inequality $\alpha_\Sigma \le \alpha_1+\alpha_2+\ldots+\alpha_C$ **(17.10)**

Spearman-Brown Formula for Reliability $\rho'_{XX} = \dfrac{L\rho_{XX}}{1+(L-1)\rho_{XX}}$ **(20.3)**