USEFUL FORMULAS

Arithmetic mean	$\overline{X} = \frac{\Sigma X}{n}$	(Formula 4.1)
Standard deviation (defining formula)	$S = \sqrt{\frac{\Sigma (X - \overline{X})^2}{n}} = \sqrt{\frac{SS}{n}}$	(Formula 5.2)
SS (calculating formula)	$SS = \Sigma X^2 - \frac{(\Sigma X)^2}{n}$	(Formula 5.3)
z score	$z = \frac{X - \overline{X}}{S}$	(Formula 6.1)
Covariance	$Cov = \frac{\Sigma(X - \overline{X})(Y - \overline{Y})}{n}$	(Formula 7.1)
Pearson r (calculating formula)	$r = \frac{\Sigma XY - \frac{(\Sigma X)(\Sigma Y)}{n}}{\sqrt{\left(\Sigma X^2 - \frac{(\Sigma X)^2}{n}\right)\left(\Sigma Y^2 - \frac{(\Sigma Y)^2}{n}\right)}}$	(Formula 7.3)
Y-on-X regression equation: Raw score formula	$Y' = \overbrace{\overline{Y} - r\left(\frac{S_Y}{S_X}\right)\overline{X}}^{\text{intercept}} + \overbrace{r\left(\frac{S_Y}{S_X}\right)}^{\text{slope}}X$	(Formula 8.4)
Regression equation: z-Score formula	$z_{Y'} = rz_X$	(Formula 8.5)
Standard error of estimate	$S_{Y \cdot X} = S_Y\sqrt{1 - r^2}$	(Formula 8.8)
Standard error of the mean	$\sigma_{\overline{X}} = \frac{\sigma}{\sqrt{n}}$	(Formula 10.2)

The test statistic z (σ known)	$z = \dfrac{\overline{X} - \mu_0}{\sigma_{\overline{X}}}$	(Formula 11.1)
General rule for a confidence interval for μ (σ known)	$\overline{X} + z_\alpha \sigma_{\overline{X}}$	(Formula 12.3)
Estimate of the population standard deviation	$s = \sqrt{\dfrac{SS}{n - 1}}$	(Formula 13.1)
Estimated standard error of the mean	$s_{\overline{X}} = \dfrac{s}{\sqrt{n}}$	(Formula 13.2)
The test statistic t	$t = \dfrac{\overline{X} - \mu_0}{s_{\overline{X}}}$	(Formula 13.3)
General rule for a confidence interval for μ (σ not known)	$\overline{X} \pm t_\alpha s_{\overline{X}}$	(Formula 13.4)
Estimate of $\sigma_{\overline{X}_1 - \overline{X}_2}$ (independent samples)	$s_{\overline{X}_1 - \overline{X}_2} = \sqrt{\dfrac{SS_1 + SS_2}{n_1 + n_2 - 2}\left(\dfrac{1}{n_1} + \dfrac{1}{n_2}\right)}$	(Formula 14.5)
t test for two independent samples	$t = \dfrac{\overline{X}_1 - \overline{X}_2}{s_{\overline{X}_1 - \overline{X}_2}}$	(Formula 14.6)
Rule for a confidence interval for $\mu_1 - \mu_2$	$(\overline{X}_1 - \overline{X}_2) \pm t_\alpha \, s_{\overline{X}_1 - \overline{X}_2}$	(Formula 14.7)
Effect size (sample estimate)	$d = \dfrac{\overline{X}_1 - \overline{X}_2}{s_{\text{pooled}}} = \dfrac{\overline{X}_1 - \overline{X}_2}{\sqrt{\dfrac{SS_1 + SS_2}{n_1 + n_2 - 2}}}$	(Formula 14.8)
t test for two dependent samples: Direct-difference method	$t = \dfrac{\overline{D}}{\sqrt{\dfrac{SS_D}{n(n-1)}}} = \dfrac{\overline{D}}{\sqrt{\dfrac{\Sigma D^2 - (\Sigma D)^2/n}{n(n-1)}}}$	(Formula 15.5)

(continued on back endpapers)

USEFUL FORMULAS

Rule for a confidence interval for μ_D	$\overline{D} \pm t_\alpha s_{\overline{D}}$	(Formula 15.6)
Standard error of r ($\rho = 0$)	$s_r = \sqrt{\dfrac{1 - r^2}{n - 2}}$	(Formula 16.2)
The test statistic t (for testing $\rho = 0$)	$t = \dfrac{r}{s_r}$	(Formula 16.3)
Within-groups sum of squares: One-way ANOVA	$SS_{\text{within}} = \sum^{\text{all scores}} (X - \overline{X})^2$ $= \sum^{\text{all scores}} X^2 - \left[\dfrac{(\Sigma X_1)^2}{n_1} + \dfrac{(\Sigma X_2)^2}{n_2} + \cdots + \dfrac{(\Sigma X_k)^2}{n_k}\right]$	(Formulas 18.1 and 18.11)
Between-groups sum of squares: One-way ANOVA	$SS_{\text{between}} = \sum^{\text{all scores}} (\overline{X} - \overline{\overline{X}})^2$ $= \left[\dfrac{(\Sigma X_1)^2}{n_1} + \dfrac{(\Sigma X_2)^2}{n_2} + \cdots + \dfrac{(\Sigma X_k)^2}{n_k}\right] - \dfrac{\left(\sum^{\text{all scores}} X\right)^2}{n_{\text{total}}}$	(Formulas 18.3 and 18.12)
Total sum of squares: One-way ANOVA	$SS_{\text{total}} = \sum^{\text{all scores}} (X - \overline{\overline{X}})^2$ $= \sum^{\text{all scores}} X^2 - \dfrac{\left(\sum^{\text{all scores}} X\right)^2}{n_{\text{total}}}$	(Formulas 18.5 and 18.13)
Within-groups variance estimate	$s^2_{\text{within}} = \dfrac{SS_{\text{within}}}{n_{\text{total}} - k}$	(Formula 18.8)
Between-groups variance estimate	$s^2_{\text{between}} = \dfrac{SS_{\text{between}}}{k - 1}$	(Formula 18.9)
F ratio for one-way ANOVA	$F = \dfrac{s^2_{\text{between}}}{s^2_{\text{within}}}$	(Formula 18.10)

Critical HSD for Tukey's test	$$\text{HSD} = q\sqrt{\frac{s^2_{\text{within}}}{n_{\text{group}}}}$$	(Formula 18.14)
Rule for confidence interval for $\mu_i - \mu_j$	$$\overline{X}_i - \overline{X}_j \pm \text{HSD}$$	(Formula 18.16)
Within-groups sum of squares: Two-way ANOVA	$$SS_{\text{within}} = \sum^{\substack{\text{all}\\\text{scores}}} X^2 - \frac{\sum^{\substack{\text{all}\\\text{cells}}}\left(\sum^{\text{cell}} X\right)^2}{n_{\text{cell}}}$$	(Formula 19.3)
Sum of squares: Factor A	$$SS_{\text{A}} = \frac{(\Sigma X_{\text{A}_1})^2 + (\Sigma X_{\text{A}_2})^2 + \cdots}{n_{\text{A}}} - \frac{\left(\sum^{\substack{\text{all}\\\text{scores}}} X\right)^2}{n_{\text{total}}}$$	(Formula 19.5)
Sum of squares: Factor B	$$SS_{\text{B}} = \frac{(\Sigma X_{\text{B}_1})^2 + (\Sigma X_{\text{B}_2})^2 + \cdots}{n_{\text{B}}} - \frac{\left(\sum^{\substack{\text{all}\\\text{scores}}} X\right)^2}{n_{\text{total}}}$$	(Formula 19.7)
Sum of squares: The A × B interaction	$$SS_{\text{A} \times \text{B}} = SS_{\text{total}} - (SS_{\text{within}} + SS_{\text{A}} + SS_{\text{B}})$$	(Formula 19.9)
Chi-square	$$\chi^2 = \Sigma\left[\frac{(f_{\text{o}} - f_{\text{e}})^2}{f_{\text{e}}}\right]$$	(Formula 20.1)
Chi-square for a 2 × 2 table	$$\chi^2 = \frac{n(AD - BC)^2}{(A + B)(C + D)(A + C)(B + D)}$$	(Formula 20.7)
Mann–Whitney test statistic for larger samples	$$z = \frac{\Sigma R_1 - .5[n_1(n_1 + n_2 + 1)]}{\sqrt{\frac{n_1 n_2(n_1 + n_2 + 1)}{12}}}$$	(Formula 21.1)
Kruskal–Wallis test statistic: H	$$H = \frac{12}{n_{\text{total}}(n_{\text{total}} + 1)}\left[\frac{(\Sigma R_1)^2}{n_1} + \frac{(\Sigma R_2)^2}{n_2} + \cdots + \frac{(\Sigma R_k)^2}{n_k}\right] - 3(n_{\text{total}} + 1)$$	(Formula 21.2)
Spearman rank correlation	$$r_{\text{ranks}} = 1 - \frac{6\Sigma D^2}{n(n^2 - 1)}$$	(Formula 21.3)