ANOVA formulas:

\[ \text{SST} = \sum_{i=1}^{n} n_i (\bar{X}_i - \bar{X})^2, \quad \text{SSE} = \sum_{i=1}^{n} (n_i - 1)s_i^2 \]

\[ \text{MST} = \frac{\text{SST}}{p-1}, \quad \text{MSE} = \frac{\text{SSE}}{n-p} \]

Regression Formulas:

\[ \hat{\beta}_1 = \frac{SS_{xy}}{SS_{xx}}, \quad \hat{\beta}_0 = \bar{Y} - \hat{\beta}_1 \bar{X}, \quad SS_{xy} = \sum X_i Y_i - \frac{(\sum X_i)(\sum Y_i)}{n}, \]

\[ SS_{xx} = \sum X_i^2 - \frac{(\sum X_i)^2}{n}, \quad SS_{yy} = \sum Y_i^2 - \frac{(\sum Y_i)^2}{n}, \]

\[ \text{MSE} = \frac{\text{SSE}}{n-2} \quad \text{where SSE} = SS_{yy} - \hat{\beta}_1 SS_{xy}, \quad s = \sqrt{\text{MSE}} = \sqrt{\frac{\text{SSE}}{n-2}} \]

Test statistic for test of \( H_0: \beta_1 = 0 \): \( t = \frac{\hat{\beta}_1}{s / \sqrt{SS_{xx}}} \), CI for \( \beta_1 \): \( \hat{\beta}_1 \pm t_{a/2} (s / \sqrt{SS_{xx}}) \)

\[ r = \frac{SS_{xy}}{\sqrt{SS_{xx} SS_{yy}}}, \quad r^2 = 1 - \frac{\text{SSE}}{SS_{yy}} \]

\( (1 - \alpha)100\% \) Confidence Interval for \( E(Y) \) at \( X = x_p \):

\[ \hat{Y} \pm (t_{a/2})(s) \sqrt{\frac{1}{n} + \frac{(x_p - \bar{x})^2}{SS_{xx}}} \]

\( (1 - \alpha)100\% \) Prediction Interval for \( Y \) at \( X = x_p \):

\[ \hat{Y} \pm (t_{a/2})(s) \sqrt{1 + \frac{1}{n} + \frac{(x_p - \bar{x})^2}{SS_{xx}}} \]

Test statistic, test for multinomial probabilities: \( \sum \frac{(n_i - E(n_i))^2}{E(n_i)} \), where \( E(n_i) = np_{i,0} \)

Test statistic, test for independence: \( \sum \frac{(n_y - \hat{E}(n_y))^2}{\hat{E}(n_y)} \), where \( \hat{E}(n_y) = r_{1j} c_j / n \).