Formulas for Linear Regression

$$\mathrm{SS}_{xy} = \sum xy - \frac{(\sum x)(\sum y)}{n} = \sum (x_i - \bar{x})(y_i - \bar{y})$$

$$\mathrm{SS}_{xx} = \sum x^2 - \frac{(\sum x)^2}{n} = \sum (x_i - \bar{x})^2$$

$$\mathrm{SS}_{yy} = \sum y^2 - \frac{(\sum y)^2}{n} = \sum (y_i - \bar{y})^2$$

$$\mathrm{SSE} = \sum (y_i - \hat{y}_i)^2 = \mathrm{SS}_{yy} - \frac{\mathrm{SS}_{xy}^2}{\mathrm{SS}_{xx}}$$

Linear Regression Line

$$y = \beta_0 + \beta_1 x$$

where

$$\beta_1 = \frac{\mathrm{SS}_{xy}}{\mathrm{SS}_{xx}} = \frac{n\sum xy - (\sum x)(\sum y)}{n\sum x^2 - (\sum x)^2}$$

and

$$\beta_0 = \bar{y} - \beta_1 \bar{x} = \frac{(\sum x^2)(\sum y) - (\sum x)(\sum xy)}{n\sum x^2 - (\sum x)^2}$$

Regression Coefficients of Correlation and Determination

$$r = \frac{\mathrm{SS}_{xy}}{\sqrt{\mathrm{SS}_{xx}\mathrm{SS}_{yy}}}$$

$$r^2 = \frac{\mathrm{SS}_{xy}^2}{\mathrm{SS}_{xx}\mathrm{SS}_{yy}} = 1 - \frac{\mathrm{SSE}}{\mathrm{SS}_{yy}}$$