Formulas

- $Y_i = \beta_0 + \beta_1 X_i + \epsilon_i$
- $\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_i$
- $\hat{\epsilon}_i = Y_i - \hat{Y}_i$
- $SSE = \sum_{i=1}^{n} \hat{\epsilon_i}^2$
- $\hat{\beta}_0 = \bar{Y} - \hat{\beta}_1 \bar{X}$
- $\hat{\beta}_1 = \dfrac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sum_{i=1}^{n}(X_i - \bar{X})^2}$
- $E[\hat{\beta}_1] = \beta_1 + corr(X_i, \epsilon_i)\frac{\sigma_\epsilon}{\sigma_X}$
- $var[\hat{\beta}_1] = \dfrac{1}{n}\dfrac{SER^2}{var[X]}$
- $R^2 = \dfrac{ESS}{TSS} = 1 - \dfrac{SSE}{TSS} = (r_{X,Y})^2$
- $ESS = \sum_{i=1}^{n}(\hat{Y}_i - \bar{Y})^2$
- $TSS = \sum_{i=1}^{n}(Y_i - \bar{Y})^2$
- $SER = \sqrt{\dfrac{SSE}{n-2}}$
- Hypothesis Test ($H_0 : \beta_1 = \beta_{1,0}$): $Z = \dfrac{\hat{\beta}_1 - \beta_{1,0}}{\sigma_{\hat{\beta}_1}}$ OR $t_{n-1} = \dfrac{\hat{\beta}_1 - \beta_{1,0}}{\sigma_{\hat{\beta}_1}}$
- Confidence Interval (β_1): $\hat{\beta}_1 \pm Z_{\frac{\alpha}{2}} SE(\hat{\beta}_1)$ OR $\hat{\beta}_1 \pm t_{\frac{\alpha}{2}} SE(\hat{\beta}_1)$