$$\sum_{i=1}^{n} \hat{e}_i^2 = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$$

$$\hat{\beta}_1 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n} (x_i - \bar{x})^2}$$

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}$$

$$\begin{aligned} \hat{e}_i &= y_i - \hat{y}_i \\ &= y_i - (\hat{\beta}_0 + \hat{\beta}_1 x_i) \\ &= y_i - \hat{\beta}_0 - \hat{\beta}_1 x_i \end{aligned}$$

$$s_e^2 = \frac{1}{n-2} \sum_{i=1}^{n} \hat{e}_i^2 = \frac{RSS}{n-2}$$

where $RSS = \sum_{i=1}^{n} \hat{e}_i^2$ is the *residual sum of squares*.

$$s_{\hat{\beta}_1} = \frac{s_e}{\sqrt{\sum_{i=1}^{n} (x_i - \bar{x})^2}}$$

$$t = \frac{\text{estimate} - \text{null}}{\text{std. error}}$$

$$s_{\hat{\beta}_1} = s_e / \sqrt{\sum_{i=1}^{n} (x_i - \bar{x})^2}.$$

```
> confint(model1)
                 2.5 %     97.5 %
(Intercept) 24.8300345 62.4009555
x            0.2557407  0.7284774
```

$$t = \frac{\hat{\beta}_1}{s_{\hat{\beta}_1}}.$$

$$PE(\hat{y}_0) = s_e \sqrt{1 + \frac{1}{n} + \frac{(x_0 - \bar{x})^2}{\sum_{i=1}^{n} (x_i - \bar{x})^2}}.$$

$$\hat{y}_0 \pm t_{(1-\frac{\alpha}{2}, n-2)} \times PE(\hat{y}_0)$$

$$r = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n} (x_i - \bar{x})^2 \sum_{i=1}^{n} (y_i - \bar{y})^2}}$$

$$= \frac{s_{xy}}{s_x s_y}$$

$$TSS = \sum_{i=1}^{n} (y_i - \bar{y})^2$$

$$RSS = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$$

$$R^2 = \frac{ESS}{TSS} = 1 - \frac{RSS}{TSS}$$

$$\mathrm{logit}(p) = \log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x$$

$$p = \frac{\exp(\beta_0 + \beta_1 x)}{1 + \exp(\beta_0 + \beta_1 x)}$$

$$z = \frac{\hat{\beta}_1}{s_{\hat{\beta}_1}}$$

$$Y = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k + e$$

$$\mu_Y = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k$$

$$\sum_{i=1}^{n}(y_i - \hat{y}_i)^2$$

$$RSS = \sum_{i=1}^{n} \hat{e}_i^2$$

$$s_e^2 = \frac{RSS}{n-k-1}$$