Chapter Two Formulas

$$b_0 = \bar{Y} - b_1\bar{X} \qquad b_1 = \frac{\sum_{i=1}^{n} (X_i - \bar{X})(Y_i - \bar{Y})}{\sum_{i=1}^{n} (X_i - \bar{X})^2}$$

And for the normal model,

$$b_1 \sim N\left(\beta_1, \frac{\sigma^2}{\sum_{i=1}^{n} (x_i - \bar{x})^2}\right), \qquad \frac{b_1 - \beta_1}{s\{b_1\}} \sim t(n-2)$$

$$b_0 \sim N\left(\beta_0, \sigma^2\left[\frac{1}{n} + \frac{\bar{x}^2}{\sum_{i=1}^{n} (x_i - \bar{x})^2}\right]\right), \qquad \frac{b_0 - \beta_0}{s\{b_0\}} \sim t(n-2).$$

$\hat{Y}_h \sim N(E[Y_h], \sigma^2\{\hat{Y}_h\})$, where $E[Y_h] = \beta_0 + \beta_1 x_h$,

and $\sigma^2\{\hat{Y}_h\} = \sigma^2\left[\frac{1}{n} + \frac{(x_h - \bar{x})^2}{\sum_{i=1}^{n} (x_i - \bar{x})^2}\right]$. $\quad \frac{\hat{Y}_h - E[Y_h]}{s\{\hat{Y}_h\}} \sim t(n-2).$

$\hat{\hat{Y}}_{h(new)} \sim N\left(\beta_0 + \beta_1 x_h, \sigma^2\left[\frac{1}{m} + \frac{1}{n} + \frac{(x_h - \bar{x})^2}{\sum_{i=1}^{n} (x_i - \bar{x})^2}\right]\right)$, $\quad \frac{\hat{Y}_{h(new)} - \bar{Y}_{h(new)}}{s\{\hat{Y}_{h(new)}\}} \sim t(n-2)$, leading to

the PREDICTION interval $\hat{Y}_h \pm t(1-\alpha/2; n-2)s\{\hat{Y}_{h(new)}\}$

$$SSTO = \sum_{i=1}^{n} (Y_i - \bar{Y})^2 \quad SSE = \sum_{i=1}^{n} (Y_i - \hat{Y}_i)^2 \qquad SSR = \sum_{i=1}^{n} (\hat{Y}_i - \bar{Y})^2$$

dfto = n–1, dfr = p–1, dfr = n–p, MS=SS/df

$$F^* = \frac{SSE(R) - SSE(F)}{dfe_R - dfe_F} \div \frac{SSE(F)}{dfe_F} \sim F(dfe_R - dfe_F, dfe_F)$$