***Regarding Unit 1 Bonus Calculations Assignments:***

***Standard Errors for Simple Linear Regression:***

Source: Chatterjee, p. 37

*Standard Error of Model (which is the square root of MSE):*

$$s = \sqrt{\frac{SSE}{n-2}} =$$

*Standard Error for intercept:*

$$\mathrm{SE}(b_0) = s\sqrt{\frac{1}{n} + \frac{\bar{x}^2}{\sum_{1=1}^{n}(x_i - \bar{x})^2}}$$

*Standard Error for slope:*

$$\mathrm{SE}(b_1) = \frac{s}{\sqrt{\sum_{1=1}^{n}(x_i - \bar{x})^2}} :$$

***Regression Error Metrics:***

**Definitions**

Source: Chatterjee, p 69

The **Adjusted R-Squared** quantity, $R_a^2$, is used to determine goodness of fit. It is defined as:

$$R_a^2 = 1 - \frac{(n-1)}{(n-p-1)} \times (1 - R^2) = 1 - \frac{(n-1)}{(n-p-1)} \times \left(\frac{SSE}{SST}\right)$$

$R_a^2$ can be used to compare models having different number of predictor variables, since it adjusts for the unequal number of variables in the different models. Models with higher $R_a^2$ values are preferred.

Source: Chatterjee, p 305

The **Akaike Information Criteria** (AIC) balances the goodness of fit (accuracy) and the complexity of the model. AIC is a function of the residuals sum of squares (SSE) for the regression equation, the number of observations *n*, and the number of parameters used in the model *p*:

$$\text{AIC} = n\ ln\left(\frac{SSE}{n}\right) + 2p$$

AIC penalizes the model that uses a higher number of variables, and is only meaningful when comparing the AIC of various models. Models with smaller AIC values are preferred.

The Akaike Information Criteria with correction for sample size (AICC) is the bias corrected modification of AIC to avoid overfitting:

$$\text{AICC} = \text{AIC} + \frac{2(p+2)(p+3)}{n-p-3}$$

where *n* denotes the sample size and *p* denotes the number of parameters. Models with smaller AICC values are preferred.

The **Bayes Information Criteria** (BIC) is a modification of AIC:

$$\text{BIC} = n\ ln\left(\frac{SSE}{n}\right) + p\ \ln(n)$$

BIC applies a more severe penalty for using a large number of regression coefficients, thereby controlling overfitting the model. Specifically, BIC applies a more severe penalty for n > 8 (compared to AIC). Models with smaller BIC values are preferred.