Richard McCormick STA 471 – Exam 1 Formula Sheet October 5th, 2023

$$r_{xy} = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}} \qquad Z = \frac{X_i - X^2}{S_x} \qquad S_x^2 = \frac{1}{n-1}\sum_{i=1}^{n}(Y_i - \bar{Y})^2$$

Standard Variance

$$S_{xy} = \sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y}) \qquad S_y = \sqrt{S_x^2}$$

Standard Deviation

$$= \sum_{i=1}^{n}(X_i \cdot Y_i) - \frac{(\sum_{i=1}^{n} X_i)(\sum_{i=1}^{n} Y_i)}{n} \qquad b_1 = \frac{S_{xy}}{S_{xx}}$$

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

Conf. Int.

$$b_0 \pm t_{n-2}(1 - \frac{\alpha}{2})\, s\sqrt{\frac{1}{n} + \frac{\bar{x}^2}{S_{xx}}}$$

$$b_1 \pm t_{n-2}(1 - \frac{\alpha}{2})\frac{s}{\sqrt{S_{xx}}}$$

$$t^{(1)} = \frac{b_1}{s/\sqrt{S_{xx}}} \qquad s^2 = \frac{RSS}{n-2}$$

$$RSS = TSS - SS_{reg}$$

$$F = \frac{MS(lof)}{MS(pe)}$$

$$TSS = S_{yy}$$

$$SS_{reg} = \frac{S_{xy}^2}{S_{xx}}$$

Source	df	SS	MS
Lack of Fit	m - 2	SSlof	SSlof/m-2
Pure Error	n - m	SS_{pe}	$SS_{pe}/(n-m)$

$$SS_{pe} = \sum_{i=1}^{m}\sum_{j=1}^{n}(Y_{ij} - \bar{Y})^2$$

$$SS_{lof} = \sum_{i=1}^{m} n_i(\bar{Y}_i - \hat{Y}_i)^2$$

$$RSS = SS(pe) + SS(lof)$$

(1) $E(\varepsilon_i = 0)$
(2) $V(\varepsilon_i) = \sigma^2$ - constant
(3) $\varepsilon_1, \varepsilon_2, \varepsilon_3, \ldots,$ are indepent
(4) ε_i is normally distributed

$$W = \frac{\left[\sum_{i=1}^{n} a_i e_{(i)}\right]^2}{\sum_{i=1}^{n} e_i^2}$$

$$Y_0 = \beta_0 + \beta_1 X_0 + \varepsilon_0 = b_0 + b_1 X_0$$

Prediction Int.

$$\hat{Y}_0 \pm t_{n-2}(1 - \frac{\alpha}{2})\, se(\hat{Y}_0) = (b_0 + b_1 X_0) \pm t_{n-2}(1 - \frac{\alpha}{2})\, s\sqrt{1 + \frac{1}{n} + \frac{(X_0 - \bar{X})^2}{S_{xx}}}$$