STAT 308 - Perry - Formula Sheet

1 Chapter 5

$$\text{SSX} = \sum_{i=1}^{n} x_i^2 - n\bar{x}^2 \qquad \text{SSY} = \sum_{i=1}^{n} y_i^2 - n\bar{y}^2 \qquad \text{SSXY} = \sum_{i=1}^{n} x_i y_i - n\bar{x}\bar{y}$$

$$\hat{\beta}_1 = \frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sum_{i=1}^{n}(x_i-\bar{x})^2} = \frac{\text{SSXY}}{\text{SSX}} \qquad \hat{\beta}_0 = \bar{y} - \hat{\beta}_1\bar{x}$$

$$s_x^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i-\bar{x})^2 \qquad s_y^2 = \frac{1}{n-1}\sum_{i=1}^{n}(y_i-\bar{y})^2 \qquad \text{SSE} = \text{SSY} - \hat{\beta}_1\text{SSXY}$$

$$S_{Y|X}^2 = \text{MSE} = \frac{1}{n-2}\sum_{i=1}^{n}(y_i-\hat{y}_i)^2 = \frac{1}{n-2}\text{SSE} \qquad S_{\hat{\beta}_1} = \frac{S_{Y|X}}{\text{SSX}}$$

$$S_{\hat{\beta}_0} = S_{Y|X}\sqrt{\frac{1}{n} + \frac{\bar{x}^2}{\text{SSX}}} \qquad S_{\hat{Y}(x_0)} = S_{Y|X}\sqrt{\frac{1}{n} + \frac{(x_0-\bar{x})^2}{\text{SSX}}}$$

Confidence Intervals:

$$\hat{\beta}_1 \pm t_{(n-2),1-\alpha/2} S_{\hat{\beta}_1} \qquad \hat{\beta}_0 \pm t_{(n-2),1-\alpha/2} S_{\hat{\beta}_0} \qquad \mu_{Y|X_0} : \hat{y}(x_0) \pm t_{(n-2),1-\alpha/2} S_{\hat{Y}(x_0)}$$

Prediction Intervals:

$$\hat{y}(x_0) \pm t_{(n-2),1-\alpha/2} S_{Y|X}\sqrt{1 + \frac{1}{n} + \frac{(x_0-\bar{x})^2}{\text{SSX}}}$$

2 Chapter 6

$$r = \frac{\text{SSXY}}{\sqrt{\text{SSX SSY}}} = \hat{\beta}_1\frac{s_x}{s_y} \qquad r^2 = \frac{\text{SSY - SSE}}{\text{SSY}} = \frac{\text{SSR}}{\text{SSY}}$$

$$H_0 : \rho = 0, t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} \text{ with } df = n-2$$

confidence interval:

$$L_z = \frac{1}{2}\ln\left(\frac{1+r}{1-r}\right) - \frac{z_{1-\alpha/2}}{\sqrt{n-3}} \qquad U_z = \frac{1}{2}\ln\left(\frac{1+r}{1-r}\right) + \frac{z_{1-\alpha/2}}{\sqrt{n-3}}$$

$$L_\rho = \frac{e^{2L_z}-1}{e^{2L_z}+1} \qquad U_\rho = \frac{e^{2U_z}-1}{e^{2U_z}+1}$$

3 Chapter 8 and Matrices

Matrix solution: $\hat{\beta} = (X^T X)^{-1} X^T Y$

4 Chapter 9

$$F = \frac{MSR}{MSE} \qquad F = \frac{R^2/k}{(1-R^2)/(n-k-1)}$$

Partial F test: $F = \dfrac{\dfrac{SSR(k)-SSR(p)}{k-p}}{MSE(k)}$

5 Chapter 14

High Leverage $h_i > 2(k+1)/n$

High Cook's D : $d_i > 1$

$$VIF = \frac{1}{1-R^2} \qquad C_p = \frac{SSE(p)}{MSE(k)} - (n-2(p+1)) = (k-p)F_p + (2p-k+1)$$

6 Chapter 22

logit = log(Odds) $= \beta_0 + \sum_{i=1}^{k} \beta_i x_i$

Odds $= e^{\beta_0 + \sum_{i=1}^{k} \beta_i x_i}$

$Pr(Y=1) = \dfrac{e^{\beta_0 + \sum_{i=1}^{k} \beta_i x_i}}{1 + e^{\beta_0 + \sum_{i=1}^{k} \beta_i x_i}}$

Odds Ratio $= \dfrac{\text{Odds}_A}{\text{Odds}_B}$