Chapter 12

1. For Goodness-of-fit test, the statistic is

$$\chi^2 = \sum \frac{(o_i - e_i)^2}{e_i}$$ with k – 1 degrees of freedom

o_i = Observed cell frequency
e_i = Expected cell frequency

2. For Test of Independence, the test statistic is

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{c} \frac{(o_{ij} - e_{ij})^2}{e_{ij}}$$ where

e_{ij} = (i^{th} row total)(j^{th} column total) /(sample size)

Chapter 13

1. Sample correlation coefficient

$$r = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sqrt{\sum (x-\bar{x})^2 \sum (y-\bar{y})^2}} = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{\left[n\sum x^2 - (\sum x)^2\right]\left[n\sum y^2 - (\sum y)^2\right]}}$$

2. For testing hypotheses about ρ, the test statistic

$$t_{n-2} = r \Big/ \sqrt{(1-r^2)/(n-2)}$$ has df=n-2

3. Estimated regression model

$$\hat{y}_i = b_0 + b_1 x$$

4. The Least Square Estimates are

$$b_1 = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sum (x-\bar{x})^2} = \frac{\sum xy - (\sum x \sum y)/n}{\sum x^2 - (\sum x)^2/n}$$

and

$$b_0 = \bar{y} - b_1\bar{x}$$

5. Total Sum of Squares

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

6. Regression & Error Sum of Squares

$$SSR = \sum (\hat{y}-\bar{y})^2 = b_1\left(\sum xy - \left(\sum x \sum y\right)/n\right)$$

$$SSE = \sum (y-\hat{y})^2 = SST - SSR$$

or

$$SSE = \sum y^2 - b_0\sum y - b_1\sum xy$$

7. Coefficient of Determination

R- Squared = $R^2 = \dfrac{SSR}{SST}$

$$R^2 = \frac{SST - SSE}{SST} = 1 - \frac{SSE}{SST} = r^2$$

8. Standard Error of the Estimate

$$s_\varepsilon = \sqrt{SSE/(n-k-1)}$$

9. Standard Deviation of the Slope

$$s_{b_1} = \frac{s_\varepsilon}{\sqrt{\sum (x-\bar{x})^2}} = \frac{s_\varepsilon}{\sqrt{\sum x^2 - \frac{(\sum x)^2}{n}}}$$

For testing H_0: $\beta_1 = \beta_{1o}$ vs. H_1: $\beta_1 \neq \beta_{1o}$

10. The test statistic & C.I. for the slope

$$t_{n-2} = \frac{b_1 - \beta_{1_o}}{s_{b_1}} \quad \& \quad b_1 \pm t_{\alpha/2} s_{b_1}$$

11. C.I. for the mean of y given a particular x_p

$$\hat{y} \pm t_{\alpha/2} s_\varepsilon \sqrt{\frac{1}{n} + \left[(x_p - \bar{x})^2 \Big/ \sum (x-\bar{x})^2\right]}$$

12. Prediction Interval estimate for an Individual value of y given a particular x_p

$$\hat{y} \pm t_{\alpha/2} s_\varepsilon \sqrt{1 + \frac{1}{n} + \left[(x_p - \bar{x})^2 \Big/ \sum (x-\bar{x})^2\right]}$$