COMM 215 BUSINESS STATISTICS (Bowerman 8th Edition)

Chapter 2 Descriptive Statistics: Tabular and Graphical Presentations.

$$approximate\ class\ length = \frac{largest\ measurement - smallest\ measurement}{number\ of\ classes}$$

Chapter 3 Descriptive Statistics: Quantitative

Interquartile Range: $IQR = Q_3 - Q_1$

Sample Variance:

$$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$$

$$s^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n} x_i^2 - \frac{(\sum_{i=1}^{n} x_i)^2}{n}\right]$$

Chapter 4 Probability

Counting Rule for Combinations: $\binom{N}{n} = \frac{N!}{n!(N-n)!}$

Addition Rule: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

Conditional Probability: $P(A|B) = P(A \cap B)/P(B)$

The Multiplication Rule: $P\ (A \cap B) = P(B)P(A|B)$

Chapter 5 Discrete Random Variables

The Expected Value of a Discrete Random Variable:

$$\mu_x = \sum_{All\ x} xp(x)$$

Variance of a Discrete Random Variable:

$$\sigma_x^2 = \sum_{All\ x} (x - \mu_x)^2 p(x)$$

Number of ways to arrange x successes among n trials:

$$\binom{N}{n} = \frac{n!}{x!\,(n-x)!}$$

Binomial Probability Function: $P(x) = \frac{n!}{x!(n-x)!} p^x q^{n-x}$

Expected Value for the Binomial Distribution: $\mu_x = np$

Variance for the Binomial Distribution: $\sigma_x^2 = npq$

Chapter 6 Continuous Random Variables

The Standard Normal Distribution:

$$z = \frac{x - \mu}{\sigma}$$

Chapter 7 Sampling Distribution

The Sampling Distribution of $\bar{x}$

$$\mu_{\bar{x}} = \mu$$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

Sample error $\hat{p}$ of :

$$\mu_{\hat{p}} = p$$

$$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$$

Chapter 8 Confidence Intervals

z-Based confidence intervals for Population Mean: σ Known

$$\bar{x} \pm z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$$

t-Based Confidence Intervals for a Population Mean: σ Unknown

$$\bar{x} \pm t_{\alpha/2}\frac{s}{\sqrt{n}}$$

Sample Size for a Confidence Interval for μ: σ Known

$$n = \left(\frac{z_{\alpha/2}\sigma}{E}\right)^2$$

Confidence Interval for the Proportion:

$$\hat{p} \pm z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

Chapter 9 Hypothesis Testing

z-test for the mean $z = \frac{\bar{x}-\mu_0}{\sigma/\sqrt{n}}$

t-test for the mean $t = \frac{\bar{x}-\mu_0}{s/\sqrt{n}}$

z-test for proportion $z = \frac{\hat{p}-p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$

Chapter 12 Goodness-of-Fit Tests

Chi-Square goodness-of-fit test statistic

$$\chi^2 = \sum_{i=1}^{k} \frac{(f_i - E_i)^2}{E_i}$$

Chi-square contingency test statistic

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{c} \frac{\left(f_{ij} - \hat{E}_{ij}\right)^2}{\hat{E}_{ij}}$$

with $df = (r-1)(c-1)$

Chapter 13 Simple Linear Regression Analysis

Sample correlation coefficient

Simple linear regression model:

$$y = \beta_0 + \beta_1 x + \varepsilon$$

Least Squares point estimate of the slope β_1

$$b_1 = \frac{SS_{xy}}{SS_{xx}} \; where$$

$$SS_{xy} = \sum(x_i - \bar{x})(y_i - \bar{y}) = \sum x_i y_i - \frac{(\sum x_i)(\sum y_i)}{n}$$

$$SS_{xx} = \sum(x_i - \bar{x})^2 = \sum x_i^2 - \frac{(\sum x_i)^2}{n}$$

Least squares point estimate of the y-intercept β_0

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

Sum of squares residuals (Sum of squares error)

Total variation SST = $\sum(y_i - \bar{y})^2$

Explained variation SSR = $\sum(\hat{y}_i - \bar{y})^2$

Unexplained variation SSE = $\sum(y_i - \hat{y}_i)^2$

SSE = $\sum y_i^2 - b_0 \sum y_i - b_1 \sum x_i y_i$

Standard error of the estimate $s = \sqrt{\frac{SSE}{n-k-1}}$

Coefficient of Determination: $R^2 = r^2 = \frac{SSR}{SST}$

F-test for the simple linear regression model

$$F = \frac{SSR/k}{SSE/n-k-1}$$

Simple regression estimator for the standard error of the slope:

$$s_{b_1} = \frac{s}{\sqrt{SS_{xx}}}$$

Test of hypothesis for the slope: $t = \frac{b_1 - \beta_1}{s_{b_1}}$

df= n-k-1

Confidence Interval for the mean value of y

$$\hat{y} \pm t_{\alpha/2}\, s\sqrt{\frac{1}{n} + \frac{(x_0 - \bar{x})^2}{SS_{xx}}}$$

Prediction interval for an individual value of y

$$\hat{y} \pm t_{\alpha/2}\, s\sqrt{1 + \frac{1}{n} + \frac{(x_0 - \bar{x})^2}{SS_{xx}}}$$

Chapter 14 Multiple Regression

The multiple regression model:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \; + \beta_k x_k + \varepsilon$$

Standard error of the estimate:

$$s = \sqrt{\frac{SSE}{n-k-1}} = \sqrt{MSE}$$

Multiple coefficient of determination:

$$R^2 = r^2 = \frac{SSR}{SST}$$

An F-test for the linear regression model:

$$F = \frac{SSR/k}{SSE/n-k-1}$$