10-4 Beyond the Basics

21. Confidence Intervals for β_0 and β_1 Confidence intervals for the y-intercept β_0 and slope β_1 for a regression line ($y = \beta_0 + \beta_1 x$) can be found by evaluating the limits in the intervals below.

$$b_0 - E < \beta_0 < b_0 + E$$

where

$$E = t_{\alpha/2} s_e \sqrt{\frac{1}{n} + \frac{\bar{x}^2}{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}}$$

$$b_1 - E < \beta_1 < b_1 + E$$

where

$$E = t_{\alpha/2} \cdot \frac{s_e}{\sqrt{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}}$$

The y-intercept b_0 and the slope b_1 are found from the sample data and $t_{\alpha/2}$ is found from Table A-3 by using $n - 2$ degrees of freedom. Using the 40 pairs of shoe print lengths (x) and heights (y) from Data Set 2 in Appendix B, find the 95% confidence interval estimates of β_0 and β_1.

22. Confidence Interval for Mean Predicted Value Example 1 in this section illustrated the procedure for finding a prediction interval for an *individual* value of y. When using a specific value x_0 for predicting the *mean* of all values of y, the confidence interval is as follows:

$$\hat{y} - E < \bar{y} < \hat{y} + E$$

where

$$E = t_{\alpha/2} \cdot s_e \sqrt{\frac{1}{n} + \frac{n(x_0 - \bar{x})^2}{n(\Sigma x^2) - (\Sigma x)^2}}$$

The critical value $t_{\alpha/2}$ is found with $n - 2$ degrees of freedom. Using the 40 pairs of shoe print lengths (x) and heights (y) from Data Set 2 in Appendix B, find a 95% confidence interval estimate of the mean height given that the shoe print length is 29.0 cm.

10-5 Multiple Regression

Key Concept The preceding sections of this chapter apply to a linear correlation between *two* variables; this section presents methods for analyzing a linear relationship with *more than two* variables. We focus on these key elements: (1) finding the multiple regression equation, and (2) using the value of adjusted R^2 and the P-value as measures of how well the multiple regression equation fits the sample data. Because the required calculations are so difficult, manual calculations are impractical and a threat to mental health, so in this section we emphasize the use and interpretation of results from statistical software or a TI-83/84 Plus calculator.

Part 1: Basic Concepts of a Multiple Regression Equation

As in the preceding sections of this chapter, we will consider *linear* relationships only. The following *multiple regression equation* describes linear relationships involving more than two variables.