10-5 Beyond the Basics

17. Testing Hypotheses About Regression Coefficients If the coefficient β_1 has a nonzero value, then it is helpful in predicting the value of the response variable. If $\beta_1 = 0$, it is not helpful in predicting the value of the response variable and can be eliminated from the regression equation. To test the claim that $\beta_1 = 0$ use the test statistic $t = (b_1 - 0)/s_{b_1}$. Critical values or *P*-values can be found using the *t* distribution with $n - (k + 1)$ degrees of freedom, where k is the number of predictor (x) variables and n is the number of observations in the sample. The standard error s_{b_1} is often provided by software. For example, the Minitab display in Example 1 shows that $s_{b_1} = 0.1289$ (found in the column with the heading of SE Coeff and the row corresponding to the first predictor variable of the height of the mother). Use the sample data in Table 10-4 and the Minitab display in Example 1 to test the claim that $\beta_1 = 0$. Also test the claim that $\beta_2 = 0$. What do the results imply about the regression equation?

18. Confidence Interval for a Regression Coefficient A confidence interval for the regression coefficient β_1 is expressed as

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

where

$$E = t_{\alpha/2} s_{b_1}$$

The critical t score is found using $n - (k + 1)$ degrees of freedom, where k, n, and s_{b_1} are described in Exercise 17. Use the sample data in Table 10-4 and the Minitab display in Example 1 to construct 95% confidence interval estimates of β_1 (the coefficient for the variable representing height of the mother) and β_2 (the coefficient for the variable representing height of the father). Does either confidence interval include 0, suggesting that the variable be eliminated from the regression equation?

19. Dummy Variable Refer to Data Set 7 in Appendix B and use the sex, age, and weight of the bears. For sex, let 0 represent female and let 1 represent male. (In Data Set 7, males are already represented by 1, but for females change the sex values from 2 to 0.) Letting the response (y) variable represent weight, use the variable of age and the dummy variable of sex to find the multiple regression equation. Use the equation to find the predicted weight of a bear with the characteristics given below. Does sex appear to have much of an effect on the weight of a bear?

a. Female bear that is 20 years of age

b. Male bear that is 20 years of age

10-6 Nonlinear Regression

Key Concept Whereas all preceding sections of this chapter deal with *linear* relationships only, this section is a brief introduction to methods for finding some *nonlinear* functions that fit sample data. Much of the value in this section comes with the clear recognition that not all in the world is linear. Because the calculations required for the nonlinear functions of this section are quite complex, we focus on the use of technology for finding a mathematical model (or function) that "fits" or describes real-world data.

Shown on the next page are the five basic generic models considered in this section. (The cubic and quartic models are among the alternatives not included in this section.) Each of the five models is given with a generic formula along with an example of a specific function and its graph.