When we discussed regression in Section 10-3, we listed four common errors that should be avoided when using regression equations to make predictions. These same errors should be avoided when using multiple regression equations. Be especially careful about concluding that a cause-effect association exists.

using TECHNOLOGY

STATDISK First enter the sample data in columns of the STATDISK Data Window. Select **Analysis,** then **Multiple Regression.** Select the columns to be included and also identify the column corresponding to the dependent (predictor) y variable. Click on **Evaluate** and you will get the multiple regression equation along with other items, including the multiple coefficient of determination R^2, the adjusted R^2, and the P-value.

MINITAB First enter the values in different columns. To avoid confusion among the different variables, enter a name for each variable in the box atop its column of data. Select the main menu item **Stat,** then select **Regression,** then **Regression** once again. In the dialog box, enter the variable to be used for the response (y) variable, and enter the variables you want included as predictor variables. Click **OK.** The display will include the multiple regression equation, along with other items, including the multiple coefficient of determination R^2, the adjusted R^2, and the P-value.

EXCEL First enter the sample data in columns. Proceed by using either XLSTAT or Excel's Data Analysis add-in.

XLSTAT Click on **XLSTAT,** then select **Modeling Data,** then **Linear Regression.** In the dialog box that appears, first enter the range of the sample values for the dependent y variable in the box identified as "Y/Dependent variable." Next, enter the range of quantitative values for all of the independent x variables in the box identified as "Y/Explanatory variable." For example, enter A1:C:55 for 55 rows of data for the x variables in columns A, B, and C. Put a checkmark next to the "Variable labels" box only if the first row of each *column* consists of names or labels. Click **OK.** A "Factors and interactions" box will appear, and you must put a checkmark next to each x variable that you want to include. After the results are displayed, look for the multiple regression equation ("Equation of the model"), the values of R^2 and adjusted R^2, and the P-value for overall significance (last column of the "Analysis of Variance" table).

Data Analysis add-in: If using Excel 2013, 2010, or 2007, click on **Data,** then click on **Data Analysis;** if using Excel 2003, click on **Tools,** then click on **Data Analysis.** Select **Regression.** In the dialog box, enter the range of values for the dependent Y-variable, then enter the range of values for the independent X-variables, which must be in adjacent columns. (Use Copy/Paste to move columns as desired.) The display will include the multiple coefficient of determination R^2, the adjusted R^2, and a list of the intercept and coefficient values used for the multiple regression equation. The P-value will be shown under the heading of *Significance F.*

TI-83/84 PLUS The TI-83/84 Plus program A2MULREG can be downloaded from the CD-ROM included with this book or from the web site www.aw.com/triola. If using the CD, select the *software* folder, then select the folder with the TI programs. The program must be downloaded to your calculator.

The sample data must first be entered as columns of matrix D, with the first column containing the values of the response (y) variable. To manually enter the data in matrix D, press 2ND x^{-1}, scroll to the right for **EDIT,** scroll down for **[D],** then press ENTER, then enter the dimensions of the matrix in the format of rows by columns. For the number of rows enter the number of sample values listed for each variable. For the number of columns enter the total number of x and y variables. Proceed to enter the sample values. If the data are already stored as lists, those lists can be combined and stored in matrix D. Press 2ND x^{-1}, select the top menu item of **MATH,** then select **List ⟶ matr,** then enter the list names with the first entry corresponding to the y variable, and also enter the matrix name of [D], all separated by commas. (For example, **List ⟶ matr(NICOT, TAR, CO, [D])** creates a matrix D with the values of NICOT in the first column, the values of TAR in the second column, and the values of CO in the third column.)

Now press PRGM, select **A2MULREG** and press ENTER ENTER ENTER, then select **MULT REGRESSION** and press ENTER. When prompted, enter the number of independent (x) variables, then enter the column numbers of the independent (x) variables that you want to include. The screen will provide a display that includes the P-value and the value of the adjusted R^2. Press ENTER to see the values to be used in the multiple regression equation. Press ENTER again to get a menu that includes options for generating confidence intervals, prediction intervals, residuals, or quitting. If you want to generate confidence and prediction intervals, use the displayed number of degrees of freedom, go to Table A-3 and look up the corresponding critical t value, enter it, then proceed to enter the values to be used for the predictor (x) variables. Press ENTER to select the **QUIT** option.

STATCRUNCH Click on **Open StatCrunch.** Enter the columns of data or open a data set. Click on **Stat,** then select **Regression,** then select **Multiple Linear.** Enter the columns to be used, then click on **Calculate.** The display will include the multiple coefficient of determination R^2 and the adjusted R^2. The intercept and coefficient values used for the multiple regression equation can be found in the second column of the top table. The P-value will be in the last column of the lower table.