

MINITAB TUTORIAL

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I. MINITAB Windows Environment

Upon entering into a MINITAB session, you will see a screen similar to Figure 1. The bottom portion of the screen is an empty spreadsheet—called a MINITAB

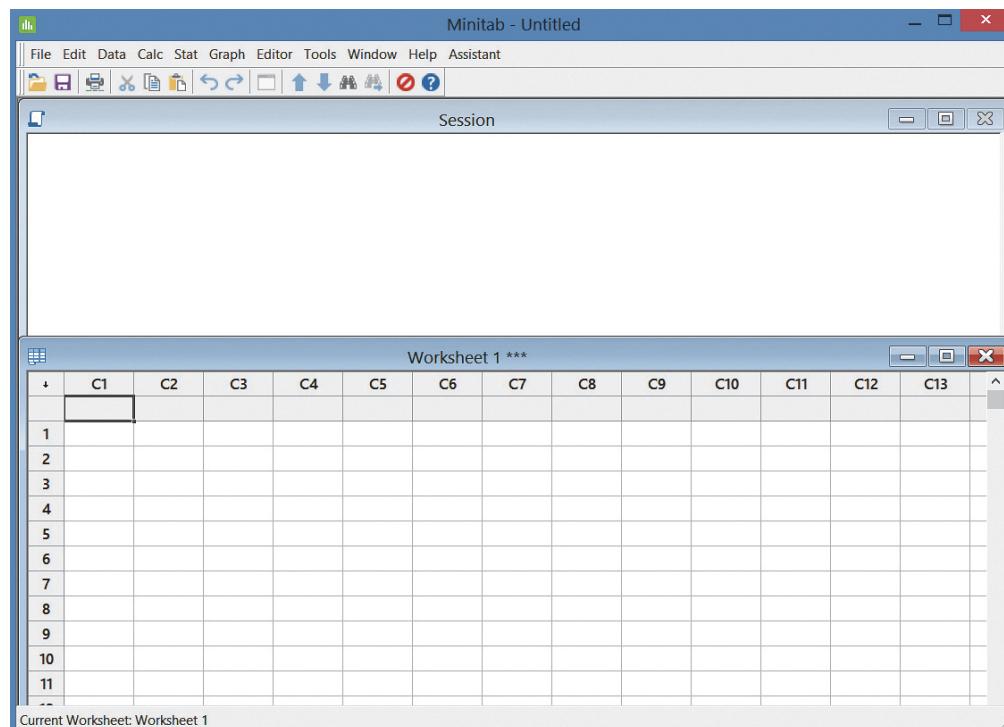


Figure 1 Initial Screen Viewed by the Minitab User

worksheet—with columns representing variables and rows representing observations (or cases). The very top of the screen is the MINITAB main menu bar, with buttons for the different functions and procedures available in MINITAB. Once you have entered data into the spreadsheet, you can analyze the data by clicking the appropriate menu buttons. The results will appear in the Session window.

2. Creating a MINITAB Data Worksheet Ready for Analysis

You can create a MINITAB data file by entering data directly into the worksheet. Figure 2 shows the length-to-width ratio data for the BONES file analyzed in Chapter 1. The variables (columns) can be named by typing in the name of each variable in the box below the column number.

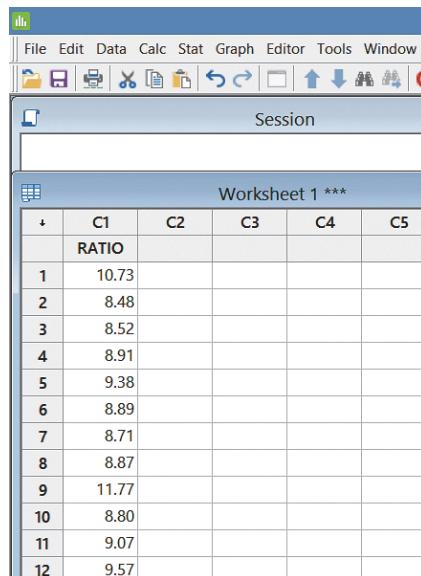
To access data already saved as a MINITAB or Excel file, select File > Open on the main menu bar, as shown in Figure 3. In the resulting dialog box (see Figure 4), select the folder where the data file resides, then select the data set (e.g., EPAGAS). After clicking Open, the data will appear in the spreadsheet.

Finally, if the data are saved in an external text file, access it by selecting File > Open on the menu bar. After you select the data file, the Open Text File dialog box will appear, as shown in Figure 5. After making the appropriate selections (e.g., field delimiter and whether the data file has column names), click OK. The MINITAB worksheet will reappear with the data from the external text file.

Reminder: The variables (columns) can be named by typing in the name of each variable in the box under the column number.

3. Listing Data

To obtain a listing (printout) of your data, click on the Data button on the MINITAB main menu bar, then click on Display Data (see Figure 6). The resulting menu, or



The screenshot shows the MINITAB interface. The main window is titled "Session". Below it is a smaller window titled "Worksheet 1 ***". The worksheet contains a header row with column labels C1 through C5. The data starts with a row labeled "RATIO". The following 12 rows contain numerical values: 10.73, 8.48, 8.52, 8.91, 9.38, 8.89, 8.71, 8.87, 11.77, 8.80, 9.07, and 9.57. The entire table is enclosed in a light gray border.

	C1	C2	C3	C4	C5
RATIO					
1	10.73				
2	8.48				
3	8.52				
4	8.91				
5	9.38				
6	8.89				
7	8.71				
8	8.87				
9	11.77				
10	8.80				
11	9.07				
12	9.57				

Figure 2 Data Entered into a MINITAB Worksheet

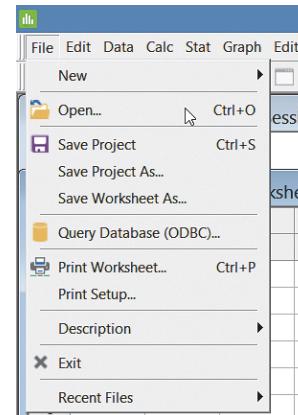


Figure 3 Accessing a Data File

Figure 4 Selecting a MINITAB or Excel Data File

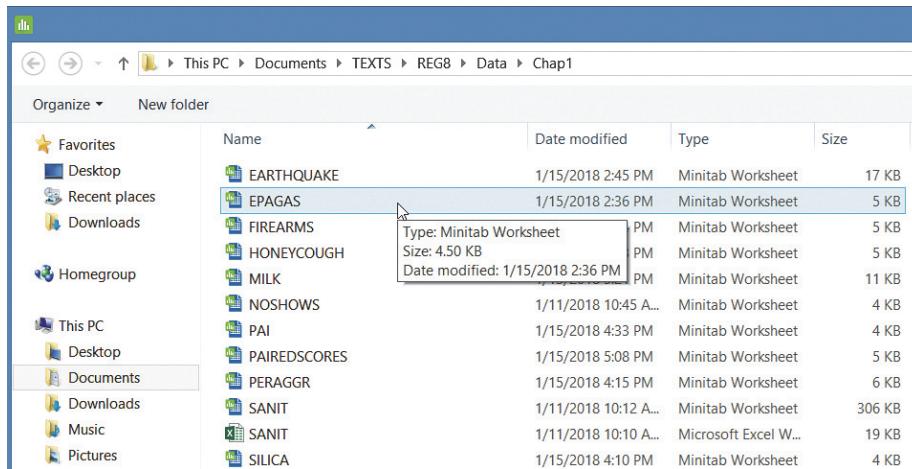
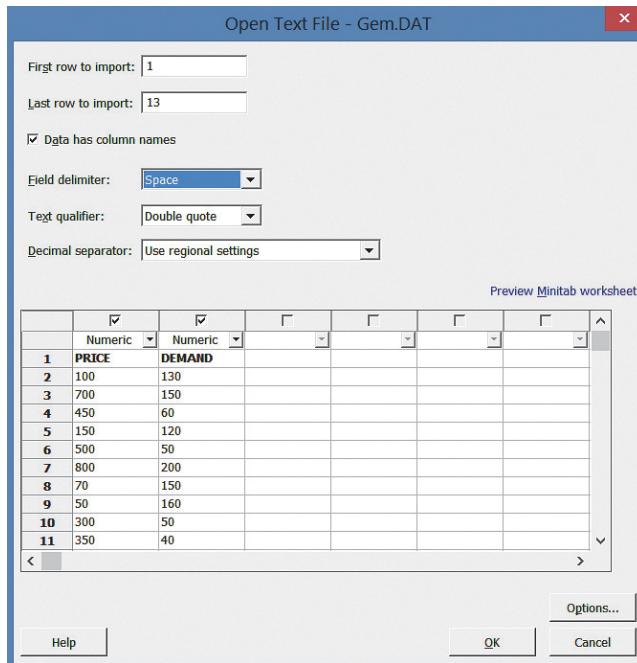


Figure 5 Opening a Text File



dialog box, appears as in Figure 7. Enter the names of the variables you want to print in the Columns, constants, and matrices to display box (you can do this by simply clicking on the variables), then click OK. The printout will be displayed in the Session window.

4. Graphing Data

To obtain graphical descriptions of your data (e.g., bar charts, histograms, scatter-plots, etc.), click on the Graph button on the MINITAB menu bar. The resulting menu list appears as shown in Figure 8. Several of the options covered in this text are (bar) Chart, (scatter) Plot, Histogram, (normal) Probability Plot, and Stem-and-Leaf (display). Click on the graph of your choice to view the appropriate dialog box. For

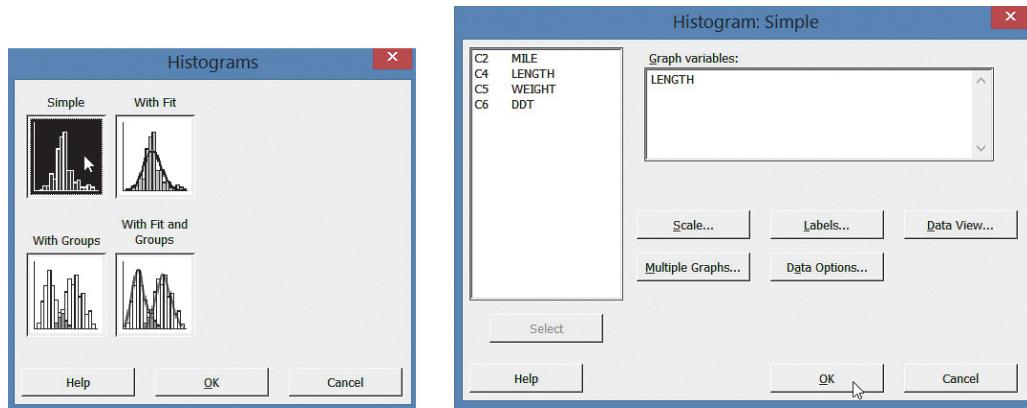
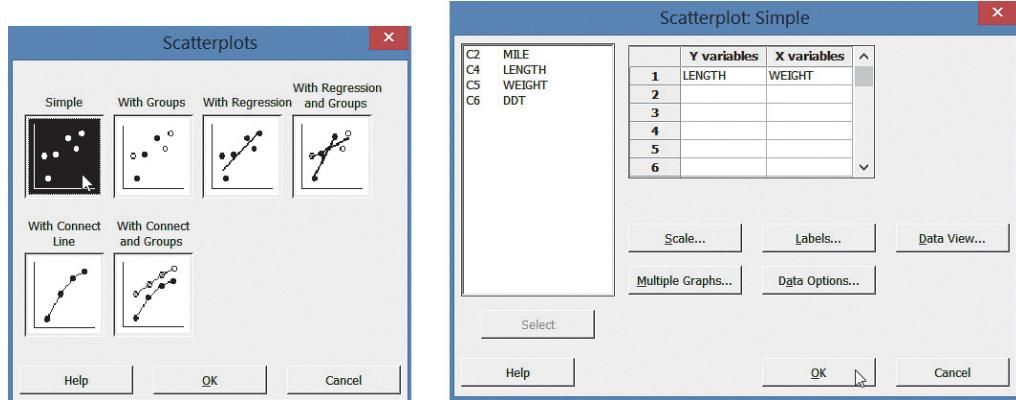
The screenshot shows the MINITAB software interface. The Data menu is open, and the 'Display Data...' option is selected. To the right, a 'Display Data' dialog box is displayed, listing four columns: C1 (AGE), C2 (NUMBIDS), C3 (PRICE), and C4 (AGE-BID). The AGE column contains values 1651, 1380, 889, 1350, 936, 2002, 1872, 1320, 1233, 1017, and 2055.

Column	Variable	Value
C1	AGE	1651
C2	NUMBIDS	1380
C3	PRICE	889
C4	AGE-BID	1350
		936
		2002
		1872
		1320
		1233
		1017
		2055

Figure 6 Menu Options for Listing Data**Figure 7** Display Data Dialog Box**Figure 8** Menu Options for Graphing Data

The screenshot shows the MINITAB software interface. The Graph menu is open, and the 'Histogram...' option is selected. A tooltip for 'Histogram' is displayed, stating: 'Examine the shape and spread of your data by using bars to show the frequency of data within each interval. Works best with moderate to large samples (n > 20.)'. To the left, a 'Data Display' table is shown with columns C1-T and C2. The data includes rows for RIVER and MILE, with values ranging from 1 to 275.

	C1-T	C2
10	RIVER	3
11	LCM	3
12	LCM	3
13	SCM	1
14	SCM	1
15	SCM	1
16	SCM	1
17	SCM	1
18	SCM	1
19	TRM	275
20	TRM	275
21	TRM	275
22	TRM	275
23	TRM	275
24	TRM	275

**Figure 9** Histogram Dialog Boxes**Figure 10** Scatterplot Dialog Boxes

example, the dialog boxes for a histogram and scatterplot are shown, respectively, in Figures 9 and 10. Make the appropriate variable selections and click OK to view the graph.

5. Descriptive Statistics and Correlations

To obtain numerical descriptive measures for a quantitative variable (e.g., mean, standard deviation, etc.), click on the Stat button on the main menu bar, then click on Display Descriptive Statistics (see Figure 11). The resulting dialog box appears in Figure 12a.

Select the quantitative variables you want to analyze and place them in the Variables box. (As an option, you can create histograms and dot plots for the data by clicking the Graphs button and making the appropriate selections.) Click on OK to view the descriptive statistics printout.

To obtain Pearson product moment correlations for pairs of quantitative variables, click on the “Stat” button on the main menu bar, then click on Basic Statistics,

Figure 11 Menu Options for Descriptive Statistics

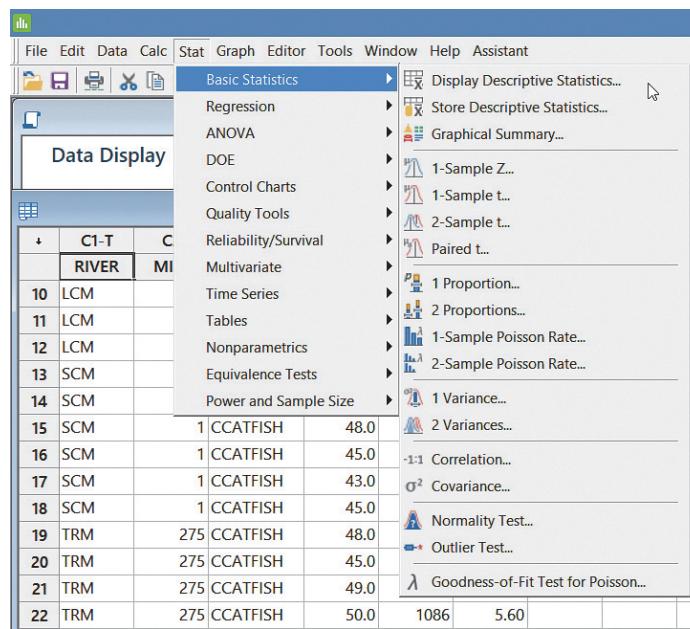
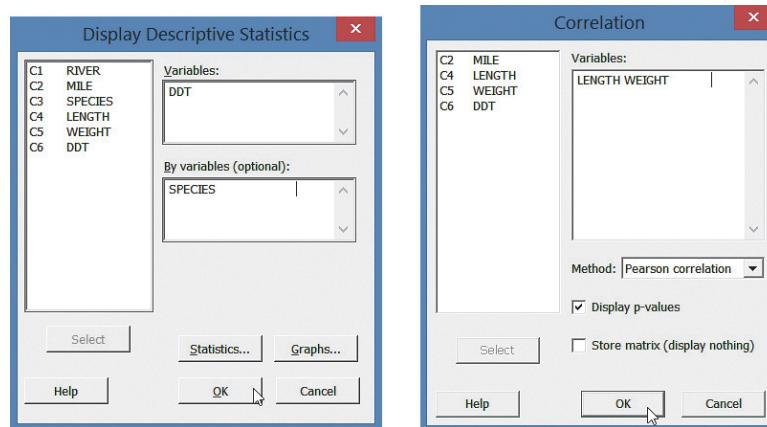


Figure 12 Descriptive Statistics and Correlation Dialog Boxes



and then click on “Correlation” (see Figure 11). The resulting dialog box appears in Figure 12b. Enter the variables of interest in the Variables box, then click OK to obtain a printout of the correlations.

6. Hypothesis Tests

To conduct tests of hypotheses of population parameters (e.g., means, variances, proportions), click on the Stat button on the MINITAB menu bar, then click on Basic Statistics. The resulting menu appears as shown in Figure 13. Click on the test of interest to view the appropriate dialog box, make the appropriate menu selections, and then click OK to view the results. For example, the dialog boxes for a 1-Sample *t*-test for a population mean are shown in Figure 14. In Figure 14a, specify the quantitative variable to be tested in the Variables box and the null hypothesis value in the Test mean box. To specify the confidence level for a confidence interval

Figure 13 Menu Options for Hypothesis Tests for a Population Mean

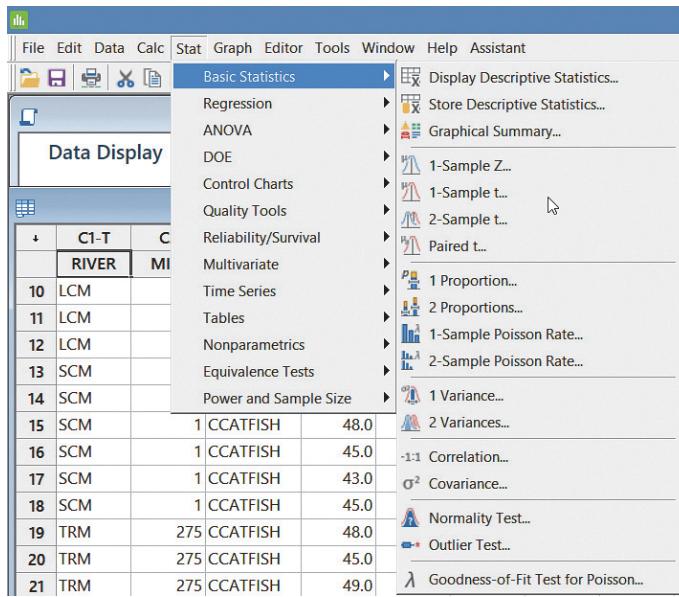
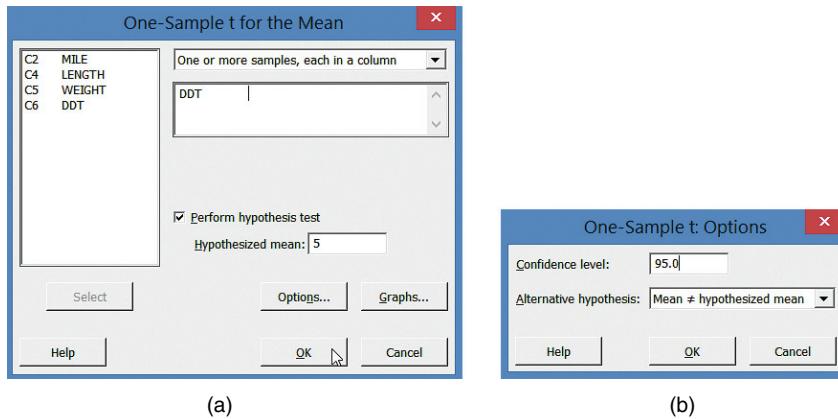


Figure 14 Test for a Mean Dialog Boxes



for the mean and to select the form of the alternative hypothesis, click on Options and make the selections as shown in Figure 14b. Click OK to return to the 1-Sample t dialog box (Figure 14a), then click OK again to view the test results.

7. Simple Linear Regression and Multiple Regression

To conduct a regression analysis of a general linear model, click on the Stat button on the MINITAB menu bar, then click on Regression, and click on Regression again, as shown in Figure 15. The resulting dialog box appears as shown in Figure 16.

Specify the quantitative dependent variable in the Responses box, quantitative independent variables in the Continuous predictors box, and qualitative independent variables in the Categorical predictors box. (Minitab will automatically create dummy variables for any categorical predictors.) *Note:* If your model includes interaction and/or squared terms, click the Model button, then make the appropriate selections, as shown in Figure 17.

Figure 15 Menu Options for Least Squares Regression

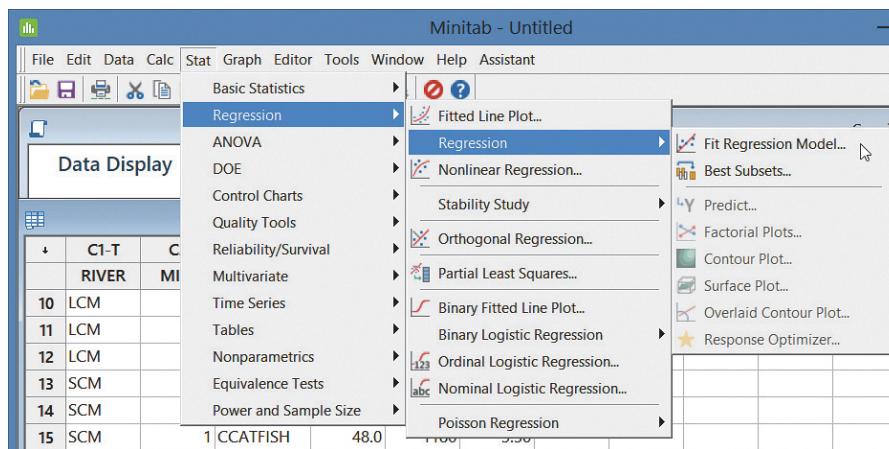
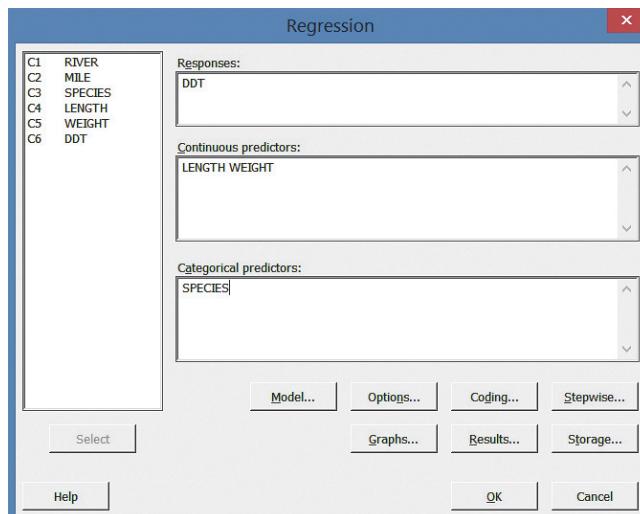


Figure 16 Regression Dialog Box



Residual plots are obtained by clicking the Graphs button (on the Regression dialog box, Figure 16) and making the appropriate selections on the resulting menu. To return to the main Regression dialog box from any of these optional screens, click OK. Click OK on the Regression dialog box to view the linear regression results.

Once you have obtained the regression results, you can request prediction intervals for a future value of y or confidence intervals for the mean of y . From the Main menu, select Stat > Regression > Regression > Predict (as shown in Figure 18). On the resulting Predict dialog box, specify the values of the independent variables used for prediction (as shown in Figure 19). Click OK to obtain the prediction/confidence intervals.

8. Stepwise Regression

To conduct a stepwise regression analysis, click on Stat > Regression > Regression > Fit Regression Model (see Figure 15). On the resulting dialog box, specify the dependent variable (in the Responses box) and the independent variables (in either the Continuous or Categorical predictors box), then click on Stepwise

Figure 17 Regression Model Terms Dialog Box

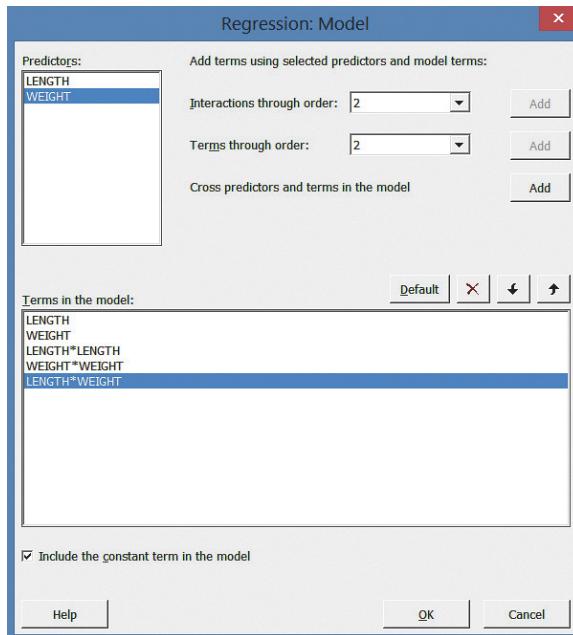


Figure 18 Menu Options for Prediction/Confidence Intervals

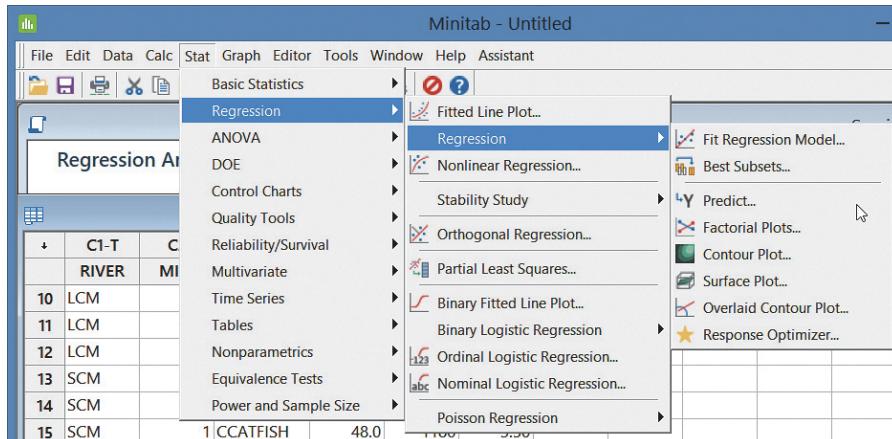


Figure 19 Predict Dialog Box

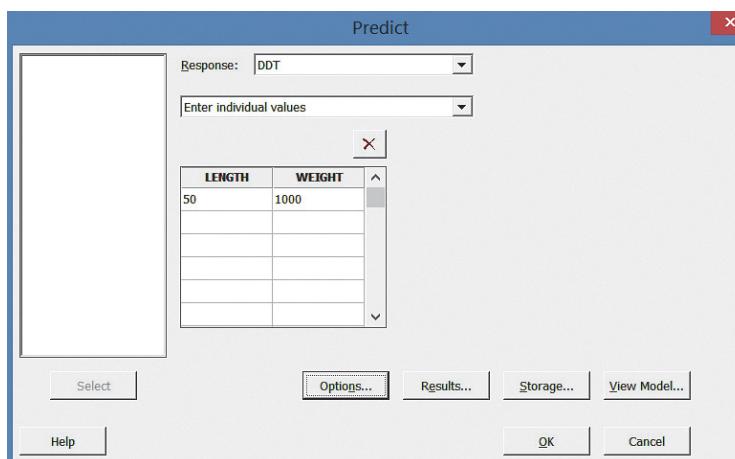


Figure 20 Regression Dialog Box for Stepwise Regression

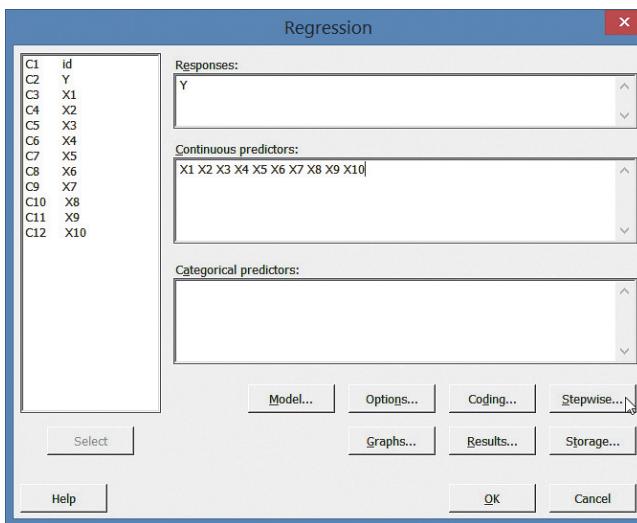
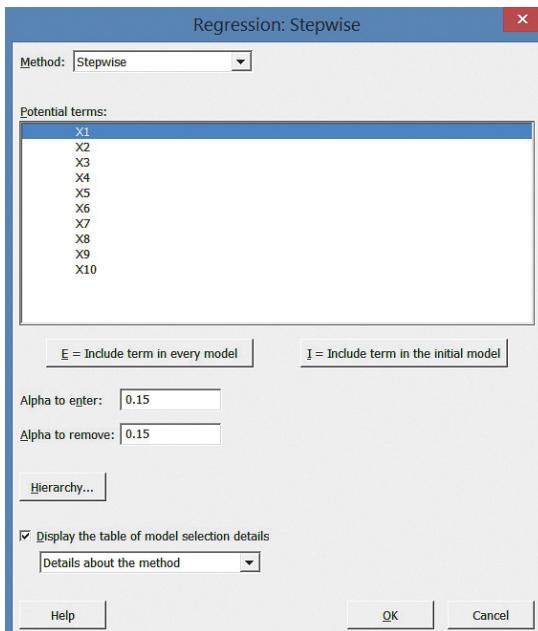


Figure 21 Stepwise Regression Dialog Box



(see Figure 20). The resulting dialog box appears in Figure 21. Select the method (e.g., stepwise, forward or backward elimination) at the top, then choose the value of α to use in the analysis. (The default is $\alpha = .15$.) Click OK to view the stepwise regression results.

To conduct an all-possible-regressions selection analysis, click on Stat > Regression > Regression > Best Subsets (see Figure 18). Specify the dependent variable in the Response box and the independent variables in the Free Predictors box shown on the resulting menu. Click OK to view the all-possible-regression selection results.

9. Residual Analysis and Influence Diagnostics

To conduct a residual analysis, click on the Stat button on the MINITAB main menu bar, then click on Regression, and then click on Regression again (see Figure 15).

Figure 22 Residual Plots Dialog Box

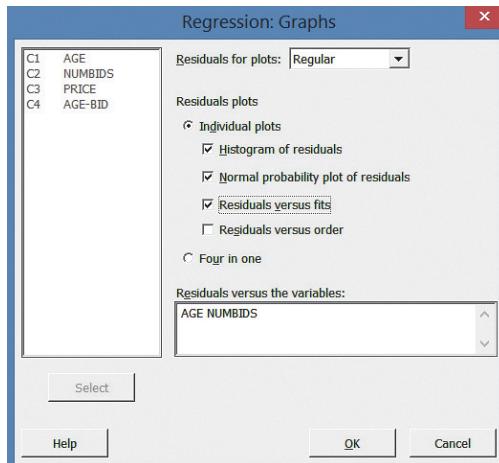
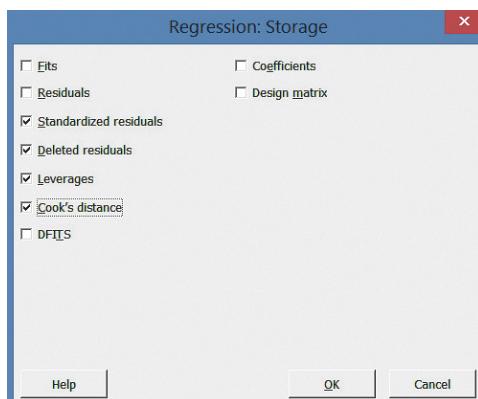


Figure 23 Regression Residuals Storage Dialog Box



The resulting dialog box appears in Figure 16. Specify the dependent variable in the Response box and the independent variables in the model in the Continuous and Categorical Predictors box. To produce residual plots, click on the Graphs button. The resulting menu appears as shown in Figure 22.

To produce a histogram, select Histogram of residuals; to produce a normal probability plot, select Normal plot of residuals; to produce a plot of residuals against predicted values, select Residuals versus fits; and to produce a plot of residuals against one or more of the independent variables, put the independent variables to be plotted in the Residuals versus the variables box. Click OK to view the plots.

To produce influence diagnostics, click on the Storage button in the Regression dialog box (Figure 16). The resulting menu appears as shown in Figure 23.

Click the influence diagnostics you want to save (e.g., Cook's distance and Hi [leverages]), then click OK to return to the Regression dialog box. Now click OK. The influence diagnostics will appear as additional columns on the MINITAB worksheet.

10. Logistic Regression

To conduct a logistic regression analysis for a two-level (binary) dependent qualitative variable, click on the Stat button on the MINITAB main menu bar, then

Figure 24 Menu Options for Logistic Regression

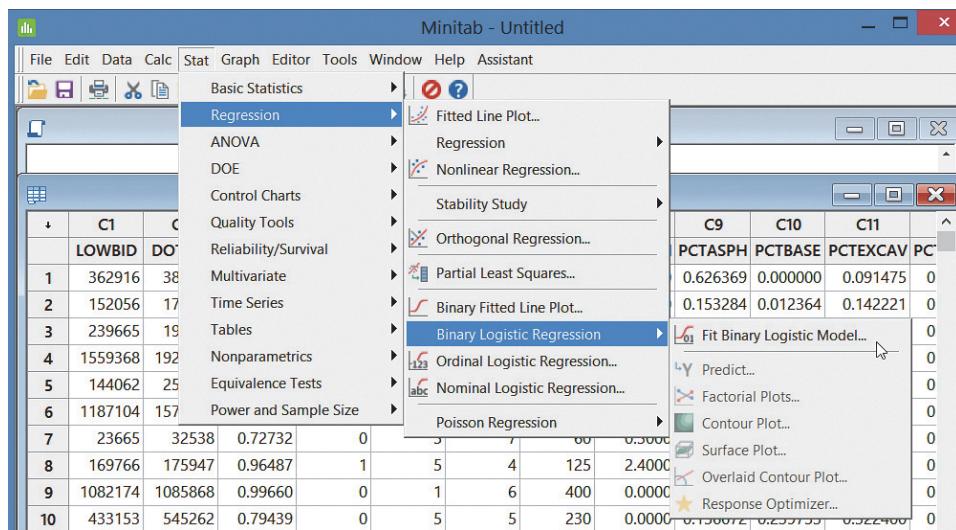
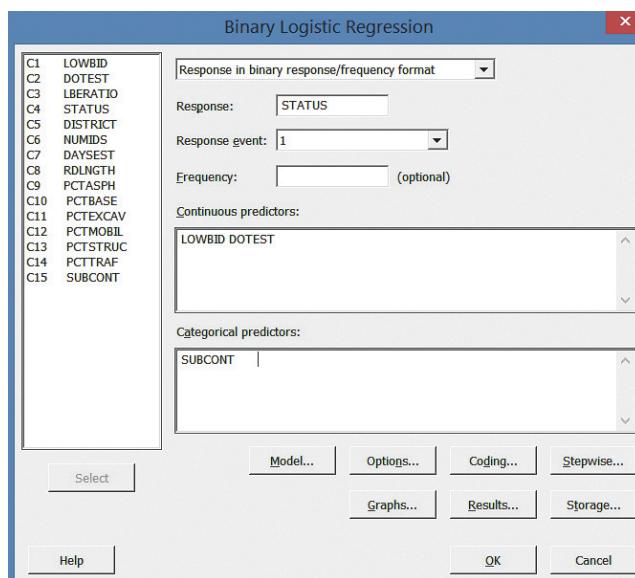


Figure 25 Logistic Regression Dialog Box

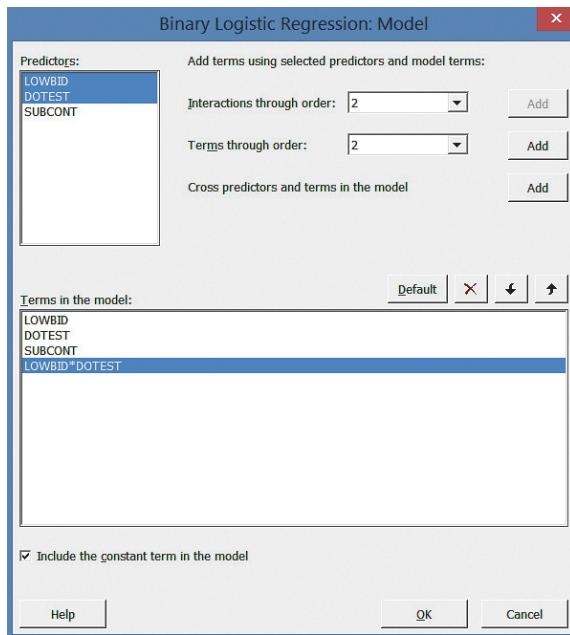


click on Regression, and finally click on Binary Logistic Regression, as shown in Figure 24. The resulting dialog box appears in Figure 25.

Specify the dependent variable in the Response box. In the Response Event box, specify the level of the dependent variable that you desire to model the probability of. Specify Continuous and Categorical predictors in the appropriate boxes. To add interactions and higher-order terms to the model, click Model, then specify these terms in the resulting dialog box, as shown in Figure 26. After making the variable selections, click the OK button twice to view the logistic regression results.

To use the logistic model to make predictions of the event probability, select Stat > Regression > Binary Logistic Regression > Predict. Specify the values of the independent variables in the resulting dialog box, then click OK.

Figure 26 Logistic Regression Model Dialog Box



11. Poisson Regression

To run a Poisson regression, from the Main Menu select Stat > Regression > Poisson Regression > Fit Poisson Model, as shown in Figure 27. In the resulting dialog box (see Figure 28), specify the dependent variable in the Response box and Continuous and Categorical predictors in the appropriate boxes.

To add interactions and higher-order terms to the model, click Model, then specify these terms in the resulting dialog box (similar to Figure 26). After making

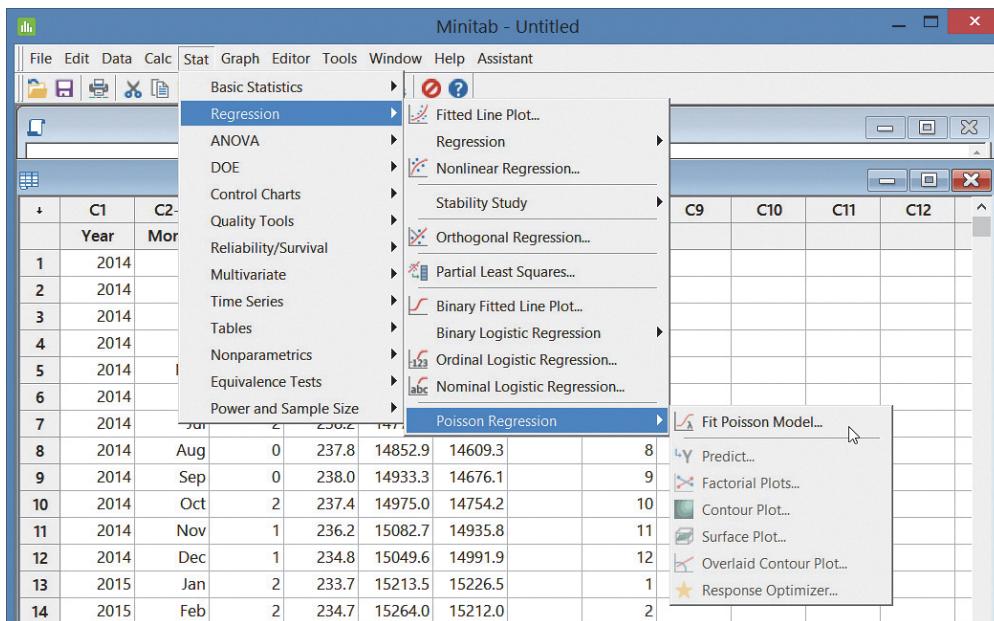
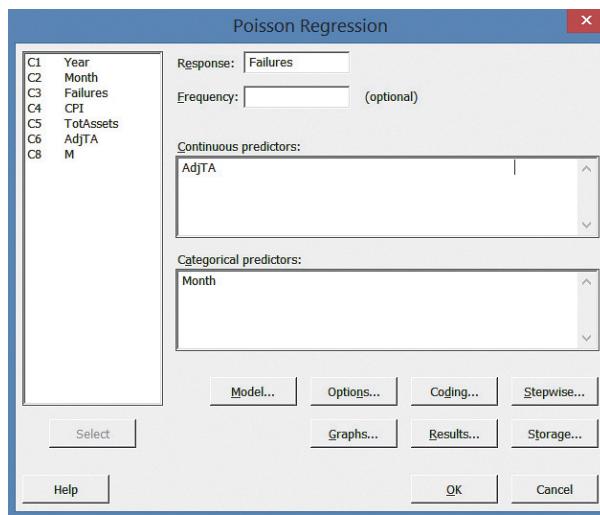


Figure 27 Menu Options for Poisson Regression

Figure 28 Poisson Regression Dialog Box



the variable selections, click the OK button twice to view the Poisson regression results.

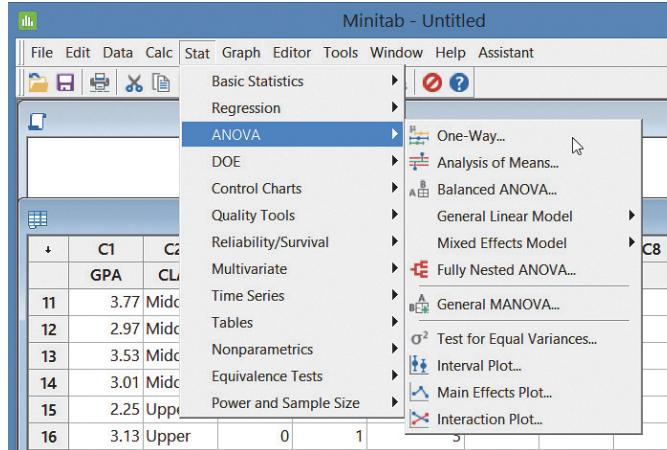
To use the Poisson model to make predictions of the event probability, select Stat > Regression > Poisson Regression > Predict. Specify the values of the independent variables in the resulting dialog box, then click OK.

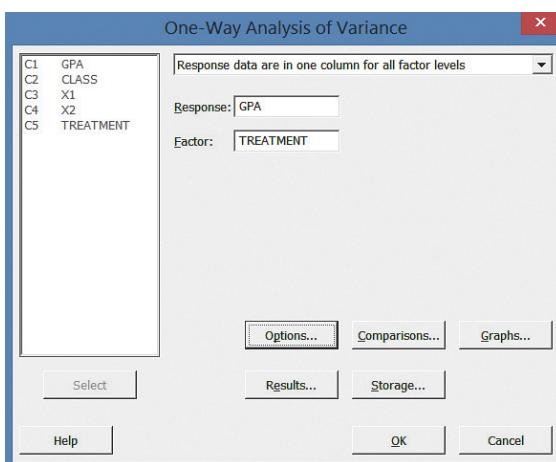
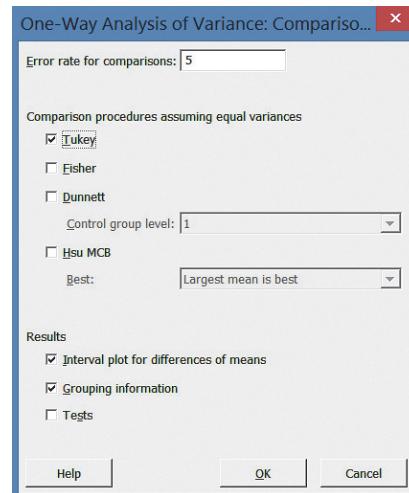
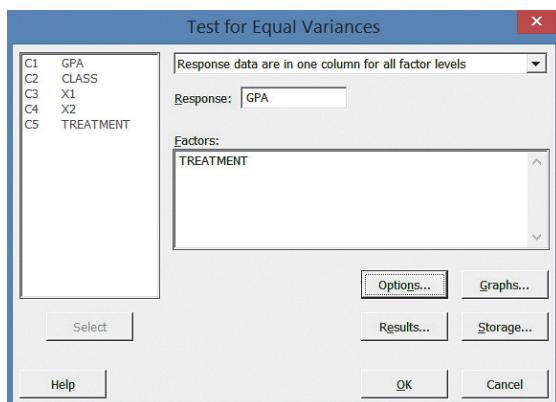
12. One-Way Analysis of Variance

To conduct a one-way ANOVA for a completely randomized design, click on the Stat button on the MINITAB main menu bar, then click on ANOVA, and finally click on One-Way, as shown in Figure 29. The resulting dialog box appears in Figure 30.

Specify the dependent variable in the Response box and the qualitative variable that represents the single factor in the Factor box. To perform multiple comparisons of treatment means, click the Comparisons button to obtain the dialog box shown in Figure 31. On this box, select the comparison method (e.g., Tukey) and the comparison-wise error rate percentage (e.g., specify 5 for a 5% significance level).

Figure 29 Menu Options for 1-Way ANOVA



**Figure 30** 1-Way ANOVA Dialog Box**Figure 31** Multiple Comparisons of Means Dialog Box**Figure 32** Test for Equal Variances Dialog Box

Click OK to return to the One-Way ANOVA dialog box (Figure 30). Click OK to view the ANOVA results.

To perform a test of equality of variances, click the Stat button on the MINITAB main menu bar, then click ANOVA, and finally click Test for Equal Variances (see Figure 29). The dialog box shown in Figure 32 appears. Specify the dependent variable in the Response box and the qualitative variable that represents the single factor in the Factors box. Specify the Confidence level, then click OK to view the test results.

13. Analysis of Variance for Factorial Designs

To conduct an ANOVA for general multi-factor designs, on the main menu bar click on Stat > ANOVA > General Linear Model > Fit General Linear Model, as shown in Figure 33.

The resulting dialog box appears in Figure 34. Specify the dependent variable in the Responses box and the factors in the Factors box. To add higher-order terms (e.g., interactions) to the ANOVA model, click on Model, then specify the terms

Figure 33 Menu Options for Factorial ANOVA

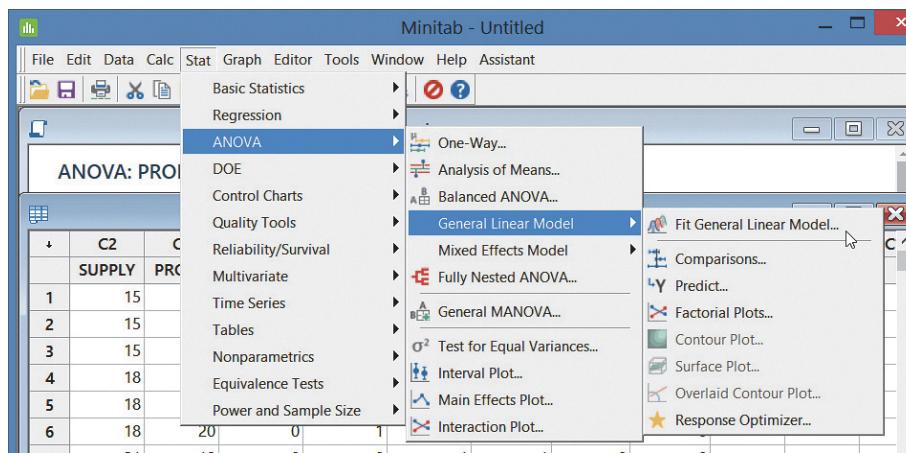
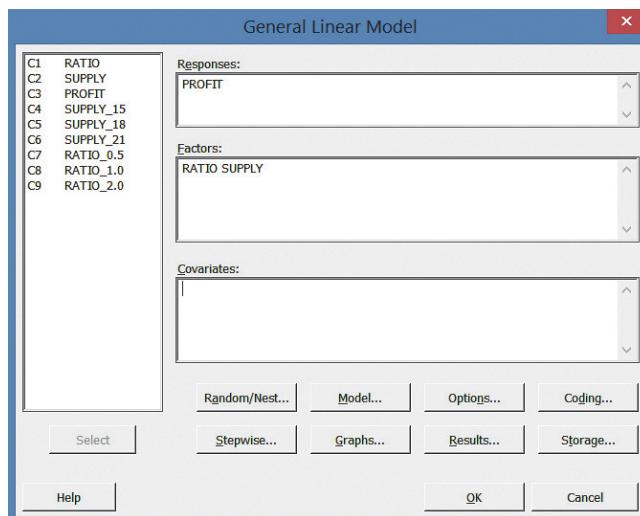


Figure 34 ANOVA General Linear Model Dialog Box



as shown in Figure 35. (Note: Interaction terms are indicated by placing an asterisk between the variables that are to be interacted [e.g., RATIO * SUPPLY].) Click OK twice to view the ANOVA results.

To run multiple comparisons of means for the designed experiment, on the main menu bar click on Stat > ANOVA > General Linear Model > Comparisons (see Figure 33). The dialog box shown in Figure 36 appears. Select the comparison method (e.g., Tukey) in the “Method” box, then specify the effects (main effects or interaction) to be compared in the “Choose terms for comparisons” box. Click OK to run and view the results.

14. Time Series Forecasting

To conduct the Durbin–Watson test for autocorrelated errors in a model for time series data, first specify the model to be fit. That is, click on Stat > Regression > Regression > Fit Regression Model (see Figure 15). Specify the dependent and independent variables in the model on the resulting dialog box (see Figure 16.) Once the model has been specified, click on the Results button on the Regression dialog box to obtain the menu shown in Figure 37.

Figure 35 Specifying Terms in the ANOVA General Linear Model

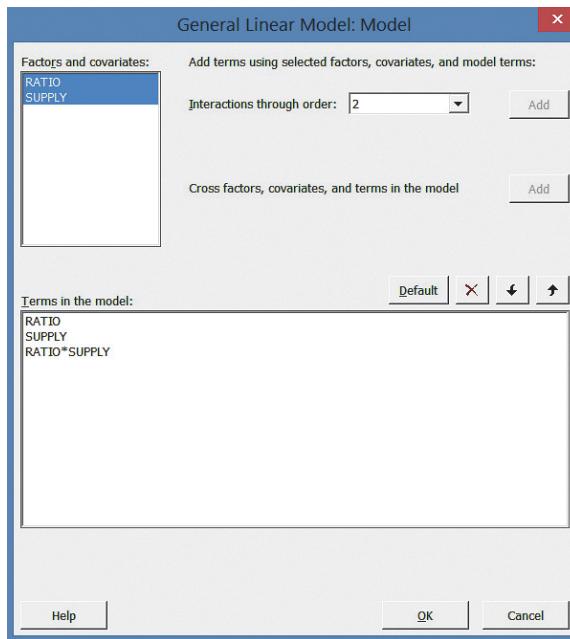
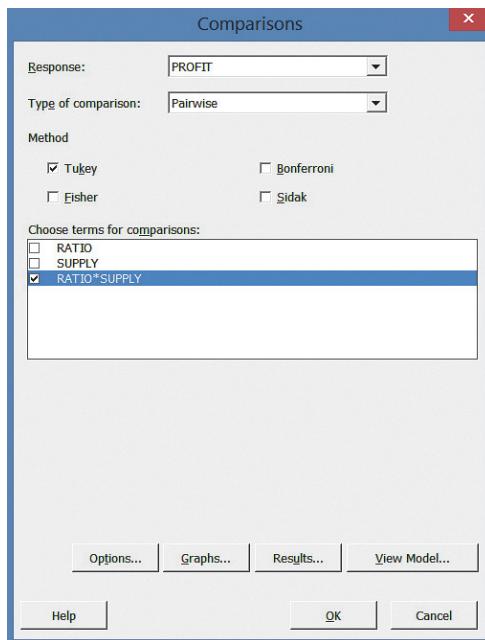


Figure 36 ANOVA Multiple Comparisons Dialog Box



Check the Durbin–Watson statistic box, then click OK to return to the Regression dialog box. Click OK to view the results.

To produce forecasts using moving averages, exponential smoothing, or the Holt–Winters method, click the Stat button on the MINITAB main menu bar, then

Figure 37 Regression Results Dialog Box

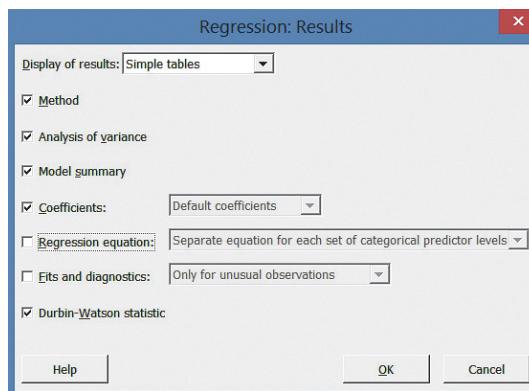


Figure 38 Menu Options for Time Series Forecasting

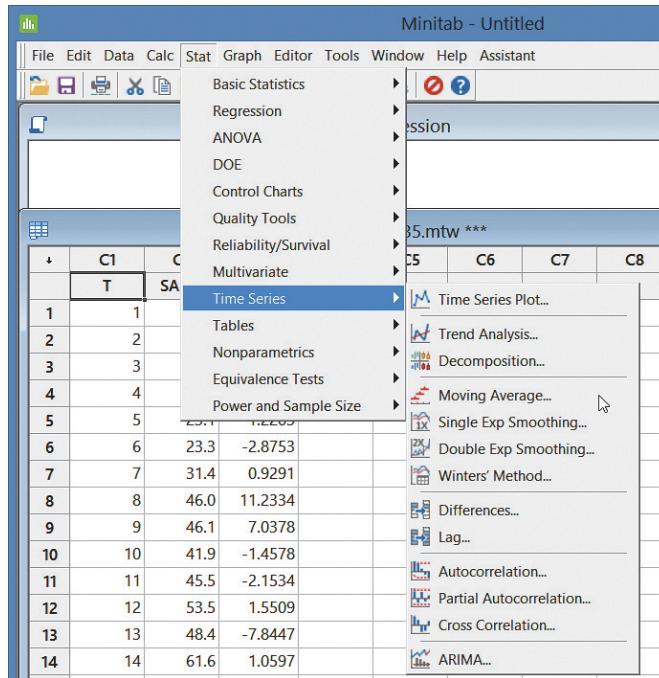
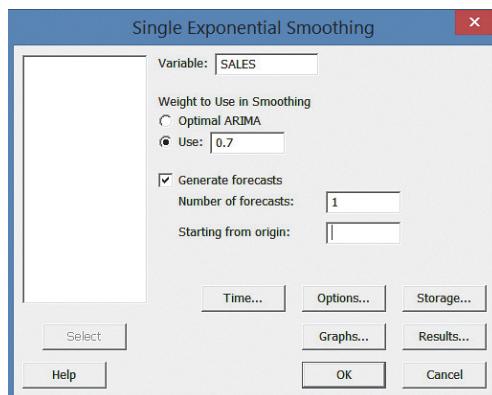


Figure 39 Exponential Smoothing Dialog Box



click on Time Series. This will produce the menu list shown in Figure 38. The options include Moving Average, Single Exp Smoothing (i.e., the exponential smoothing method covered in this text), Double Exp Smoothing (i.e., the Holt-Winter's method with trend), and Winter's Method (i.e., the Holt–Winter's method with trend and seasonality). For example, clicking Single Exp Smoothing will result in the dialog box shown in Figure 39.

Select the quantitative variable to be smoothed in the Variable box and set the value of the smoothing constant in the Weight to use in smoothing box. Click OK to view the results.

(*Note:* Time series models with a first-order autoregressive error term are not available in MINITAB.)