MINITAB Tutorial

Contents

1. 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 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.

Figure 1 Initial screen viewed by MINITAB user
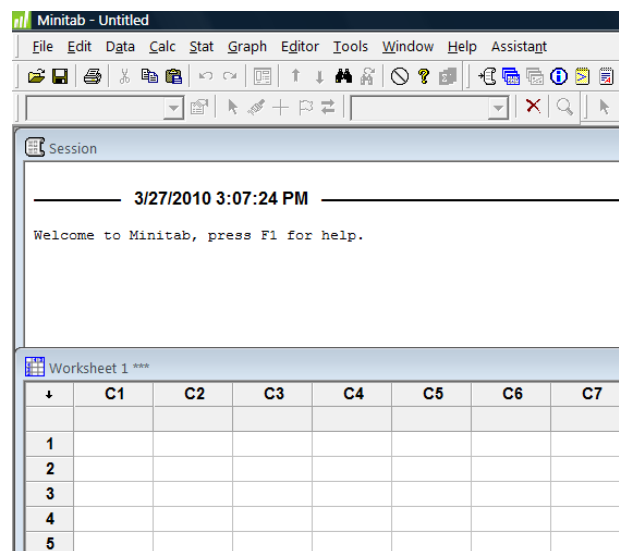
2. Creating a MINITAB Data Worksheet Ready for Analysis

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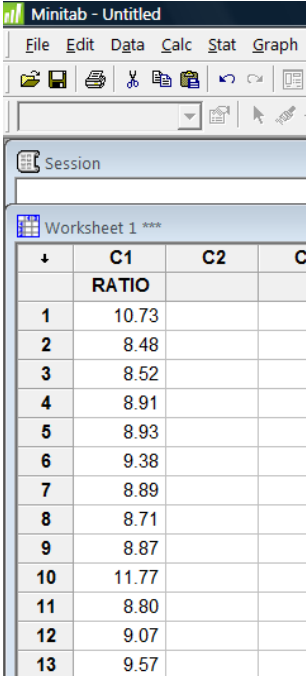
To access data already saved as a MINITAB file, select File on the main menu bar, then Open Worksheet, as shown in Figure 3 In the resulting "Open Worksheet" dialog box (see Figure 4), select the folder where the data file resides, then select the data set (e.g., CONDO). After clicking Open, the data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

Finally, if the data are saved in an external text file, access it by selecting File on the menu bar, click Other Files, then select Import Special Text (see Figure 5). The Import Special Text dialog box will appear, as shown in Figure 6. Specify the variable (column) names, then click OK. On the resulting screen, specify the folder that contains the external data file, click on the file name, then select Open. 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 7). The resulting menu, or

Figure 2 Data entered into the MINITAB worksheet
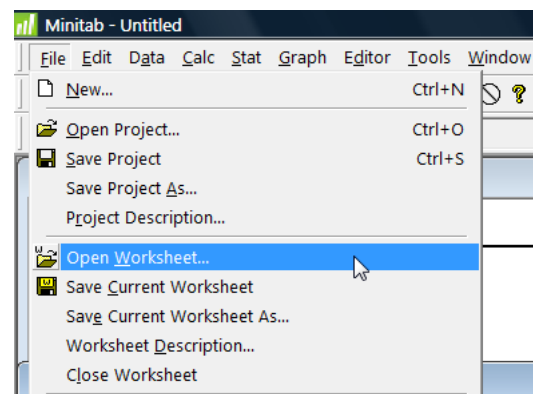

Figure 3 Accessing a MINITAB data file

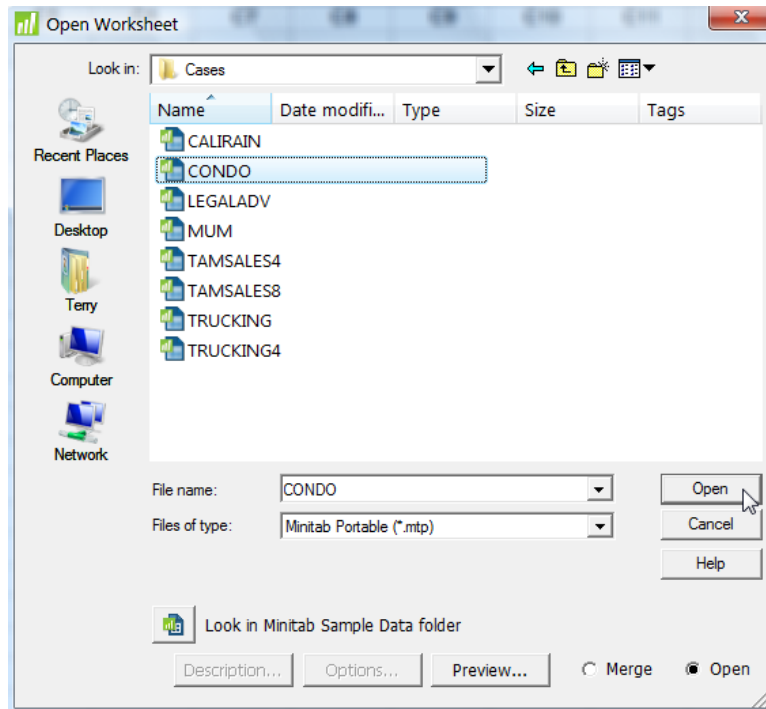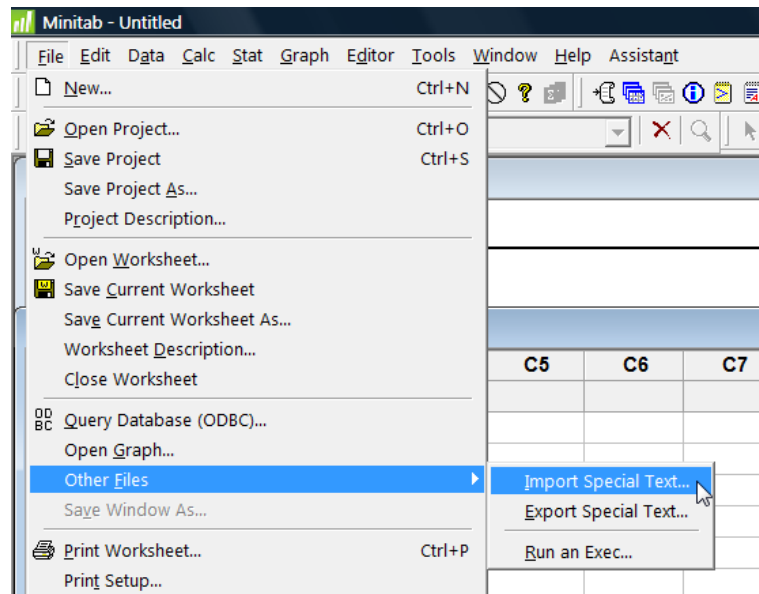**Figure 4** MINITAB Open Worksheet dialog box

Figure 5 MINITAB options for accessing an external data file

dialog box, appears as in Figure 8. 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.
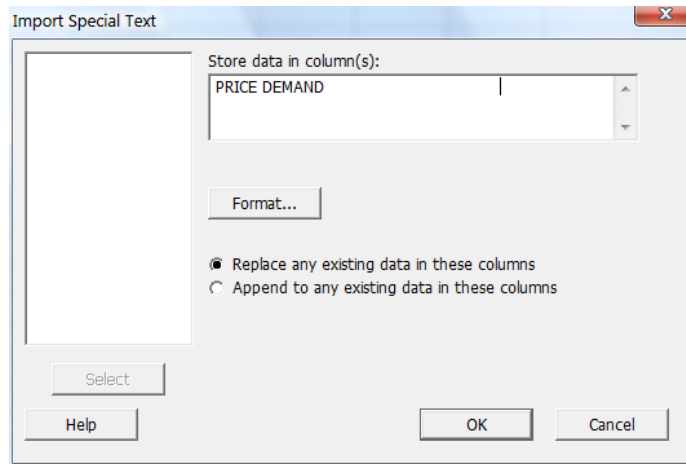
Figure 6 Import Special
Text dialog box

Figure 7 MINITAB menu
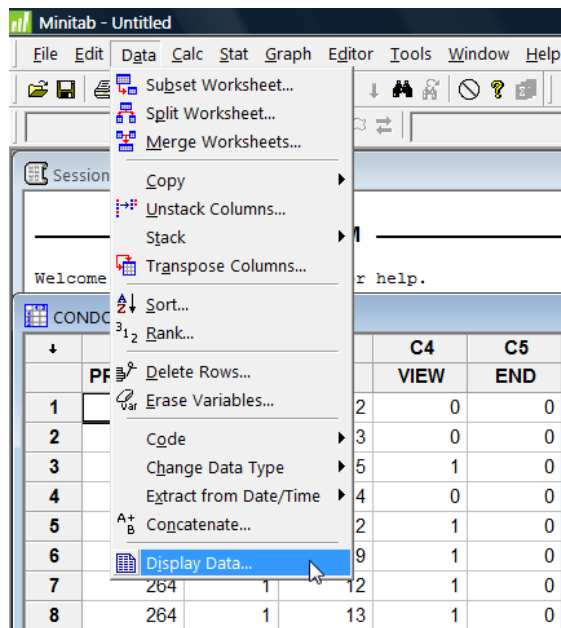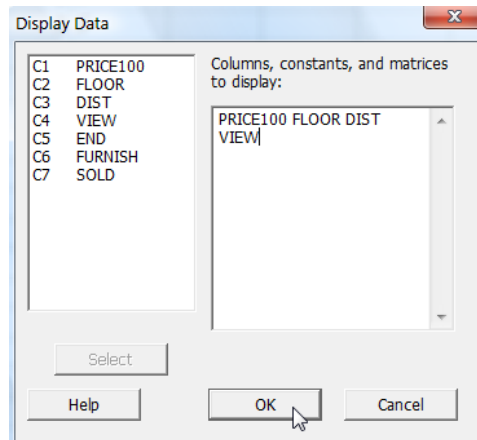options for listing data

Figure 8 Display Data
dialog box

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 9. 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 example, the dialog boxes for a histogram and scatterplot are shown, respectively, in Figures 10 and 11. Make the appropriate variable selections and click OK to view the graph.
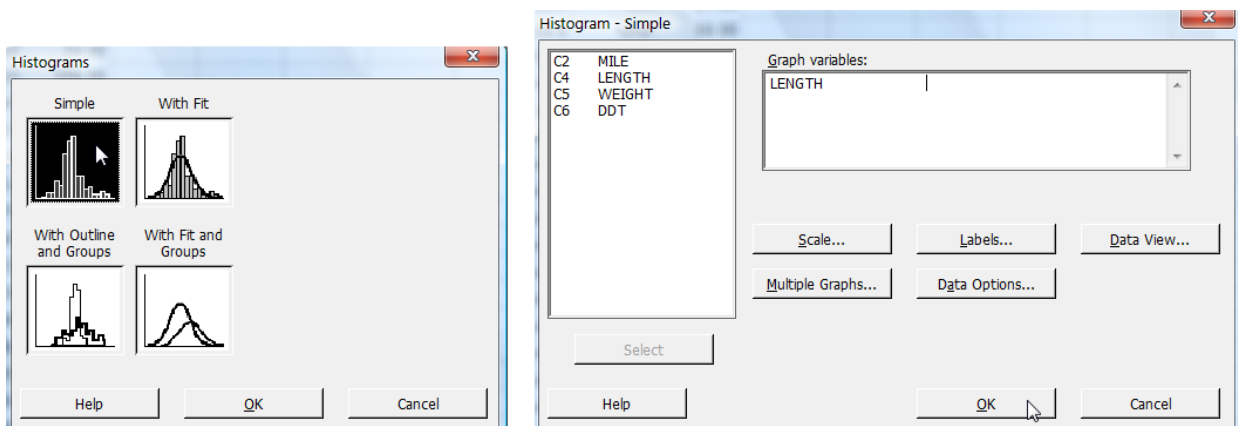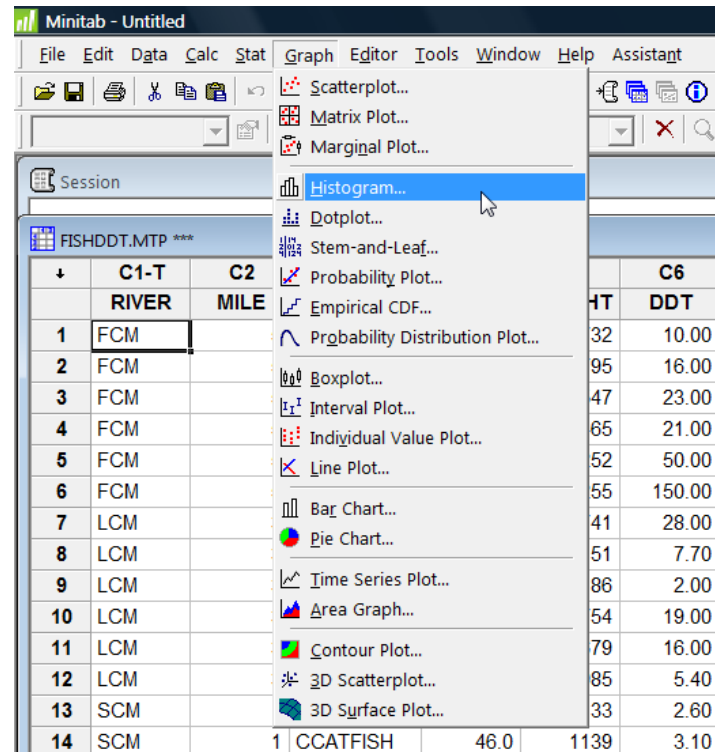
Figure 9 MINITAB menu options for graphing data

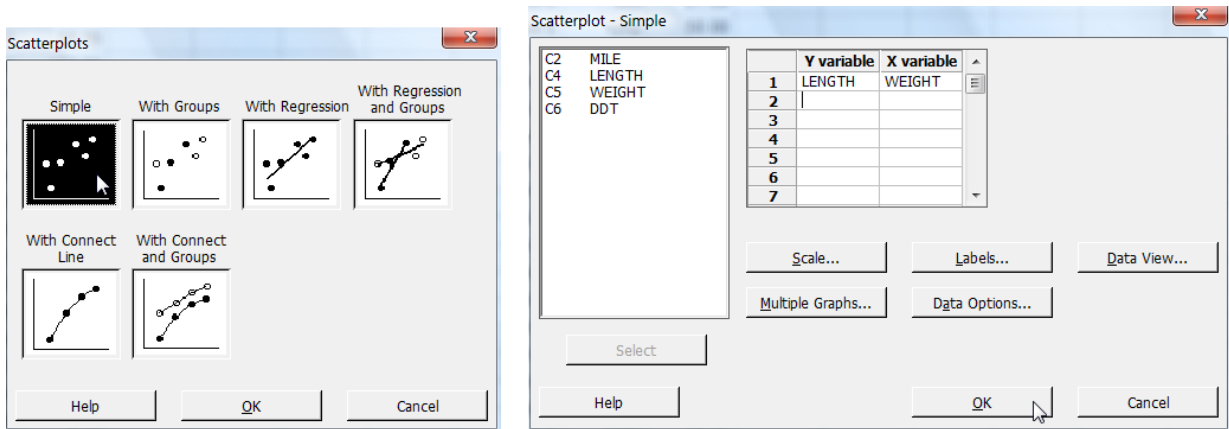
Figure 10 Histogram dialog boxes

Figure 11 Scatterplot dialog boxes

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 12). The resulting dialog box appears in Figure 13a.

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, and then click on "Correlation" (see Figure 12). The resulting dialog box appears in Figure 13b. Enter the variables of interest in the Variables box, then click OK to obtain a printout of the correlations.

Figure 12 MINITAB menu options for Descriptive Statistics
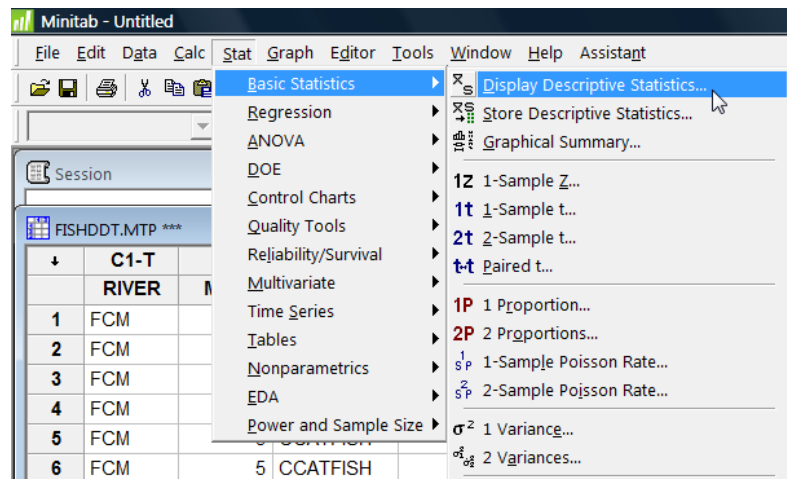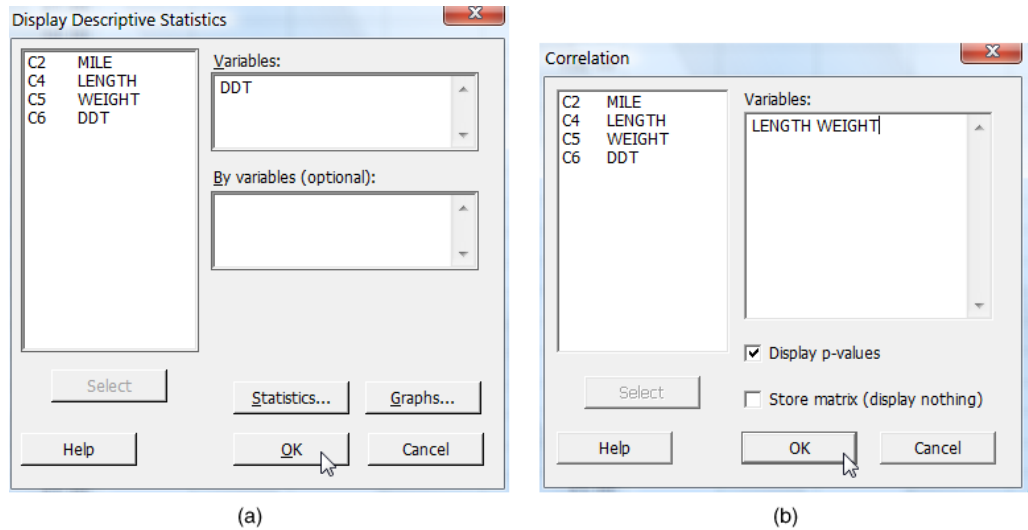
Figure 13 Descriptive Statistics and Correlation dialog boxes

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 14. Click on the

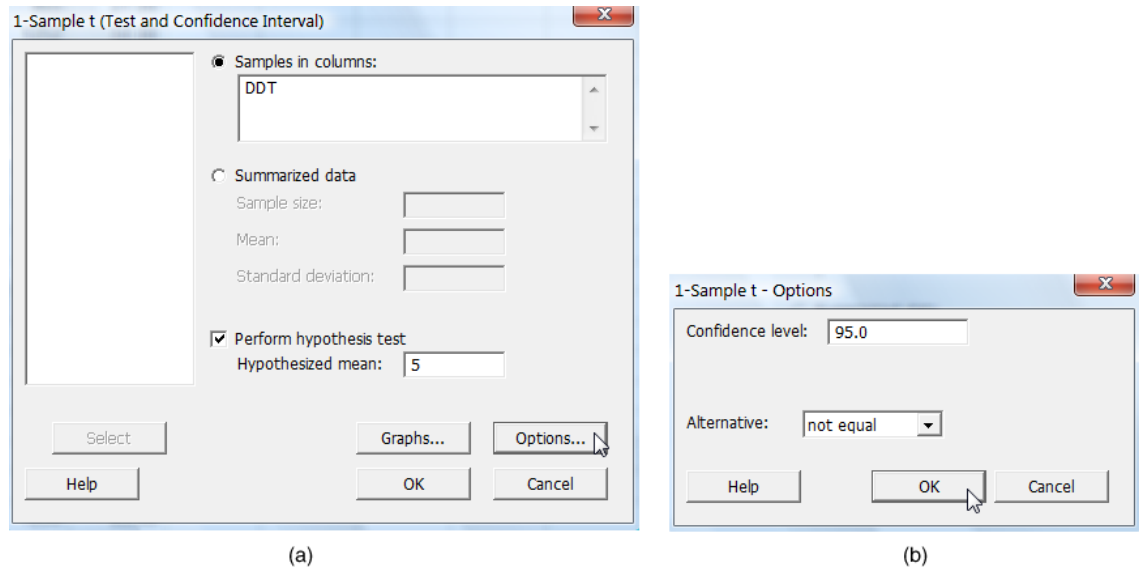**Figure 14** MINITAB menu options for hypothesis tests of means
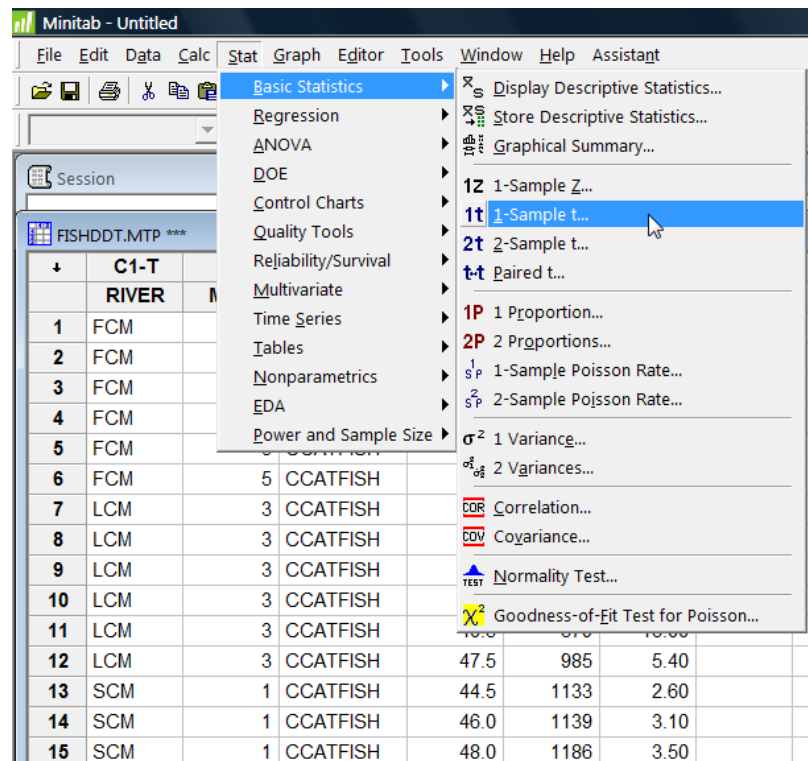
Figure 15 One-Sample t-Test for Mean dialog boxes

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 15. In Figure 15a, 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 for the mean and to select the form of the alternative hypothesis, click on Options and make the selections as shown in Figure 15b. Click OK to return to the 1-Sample t dialog box (Figure 15a), 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 16. The resulting dialog box appears as shown in Figure 17.

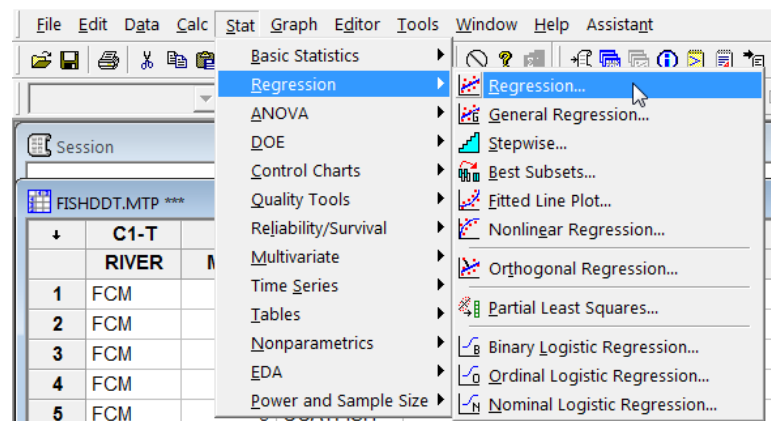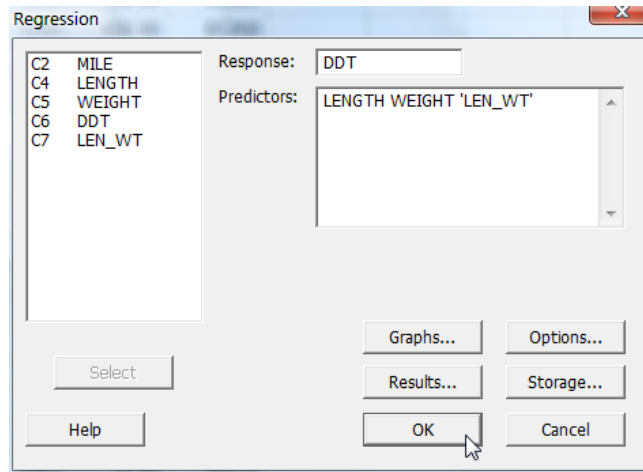**Figure 16** MINITAB menu options for Regression

Figure 17 Regression dialog box

Specify the quantitative dependent variable in the Response box and the independent variables in the Predictors box. (*Note*: If your model includes interaction and/or squared terms, you must create and add these higher-order variables to the MINITAB worksheet before running a regression analysis. You can do this by clicking the Calc button on the MINITAB main menu and selecting the Calculator option.)

Optionally, you can get MINITAB to produce prediction intervals for future values of the dependent variable and variance inflation factors by clicking the Options button and checking the appropriate menu items in the resulting menu list. Residual plots are obtained by clicking the Graphs button 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.

As an alternative, you can fit general linear models by clicking on the Stat button on the MINITAB main menu bar, then click on Regression, and finally click on General Regression (see Figure 16). The resulting dialog box appears in Figure 18.

Figure 18 General Regression dialog box
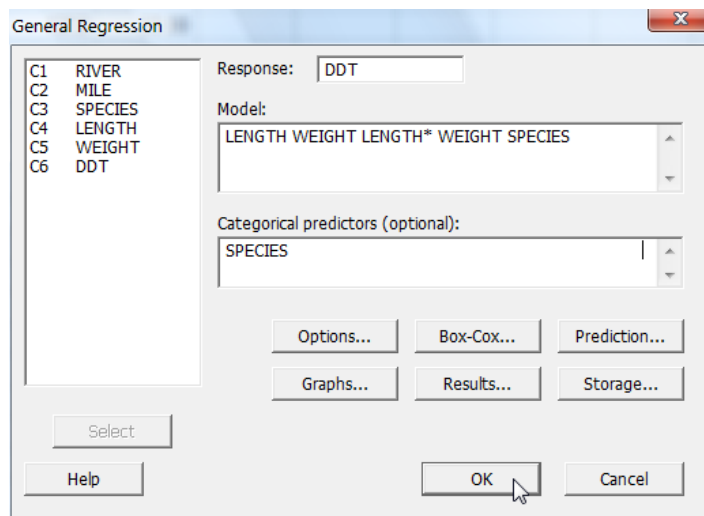
Specify the dependent variable in the Response box and the terms in the model in the Model box. (*Note*: MINITAB will automatically create the appropriate number of dummy variables for each qualitative variable specified. Also, interaction terms are indicated by placing an asterisk between the variables that are to interact [e.g., LENGTH $*$ WEIGHT]. Similar notation is used for squared terms [e.g., LENGTH*LENGTH].) Identify the qualitative independent variables in the model by placing these variables in the Categorical Predictors box.

To obtain parameter estimates for all terms in the model, click the Results button and make the appropriate selection. To save predicted values and residuals, click the Storage button and make the appropriate selections. To produce residual plots, click the Graphs button and make your selections. When all the options you desire have been checked, click OK on the General Regression dialog box to view the multiple regression results.

8. Stepwise Regression

To conduct a stepwise regression analysis, click on the Stat button on the main menu bar, then click on Regression, and click on Stepwise (see Figure 16). The resulting dialog box appears in Figure 19. Specify the dependent variable in the Response box and the independent variables in the stepwise model in the Predictors box. As an option, you can select the value of α to use in the analysis by clicking on the Methods button and specifying the value. (The default is $\alpha = .15$.) Click OK to view the stepwise regression results.

To conduct an all-possible-regressions selection analysis, click on the Stat button on the main menu bar, then click on Regression, and click on Best Subsets (see Figure 16). Specify the dependent variable in the Response box and the independent variables in the 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 16).

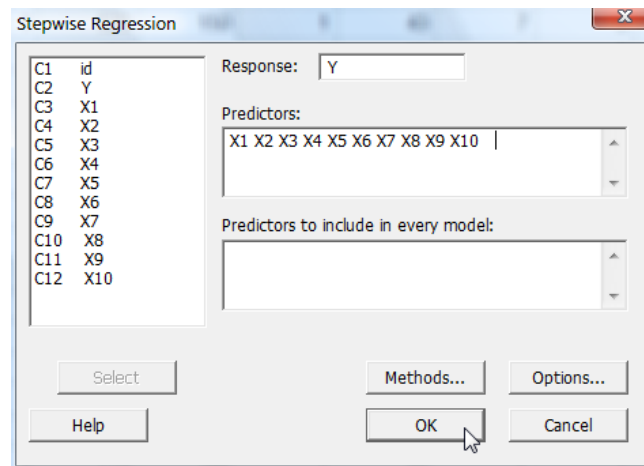**Figure 19** Stepwise Regression dialog box
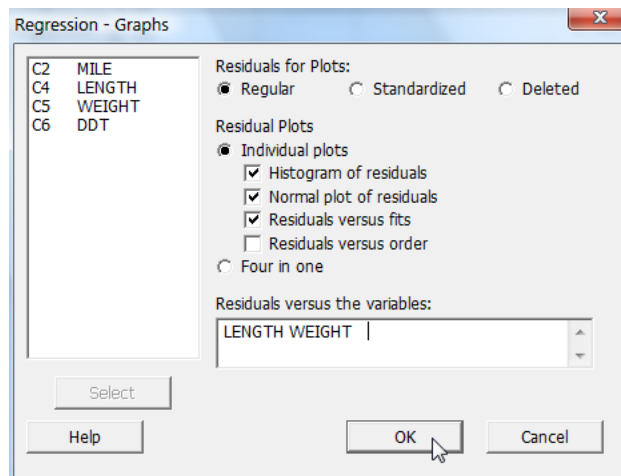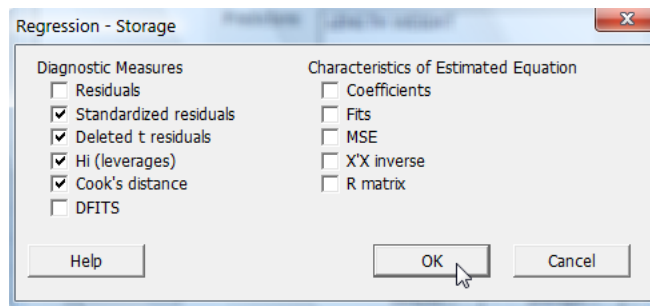
Figure 20 Residual Plots dialog box

Figure 21 Regression Residuals Storage dialog box

The resulting dialog box appears in Figure 17. Specify the dependent variable in the Response box and the independent variables in the model in the Predictors box. To produce residual plots, click on the Graphs button. The resulting menu appears as shown in Figure 20.

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 17). The resulting menu appears as shown in Figure 21.

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 click on Regression, and finally click on Binary Logistic Regression, as shown in Figure 22. The resulting dialog box appears in Figure 23.

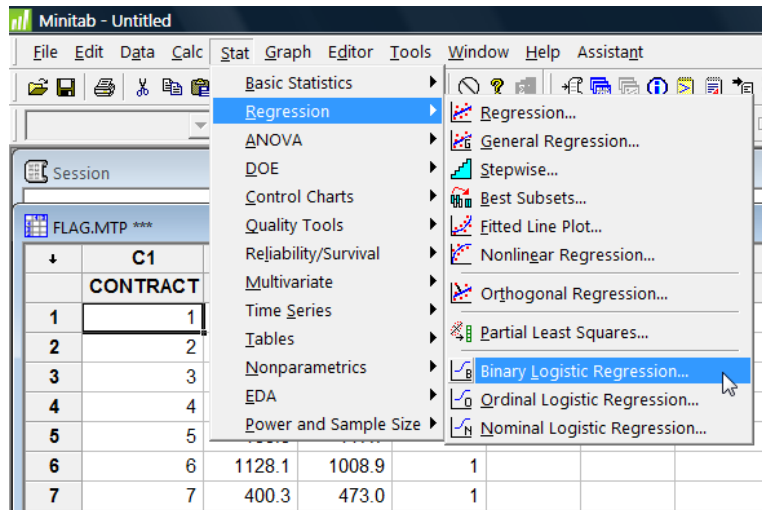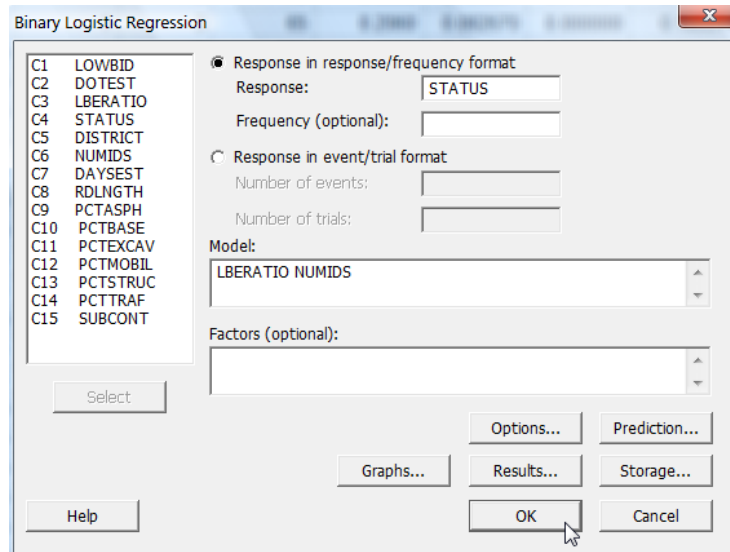**Figure 22** MINITAB menu options for Logistic Regression

Figure 23 Logistic Regression dialog box

Specify the dependent variable in the Response box and the terms in the logistic model in the Model box. (*Note*: If your model includes interaction and/or squared terms, you must create and add these higher-order variables to the MINITAB worksheet before running a regression analysis. You can do this by clicking the Calc button on the MINITAB main menu and selecting the Calculator option.) If any of the independent variables are qualitative, put them in the Factors box. MINITAB will automatically create dummy variables for these qualitative predictors. After making the variable selections, click the OK button to view the logistic regression results.

11. 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 24. The resulting dialog box appears in Figure 25.

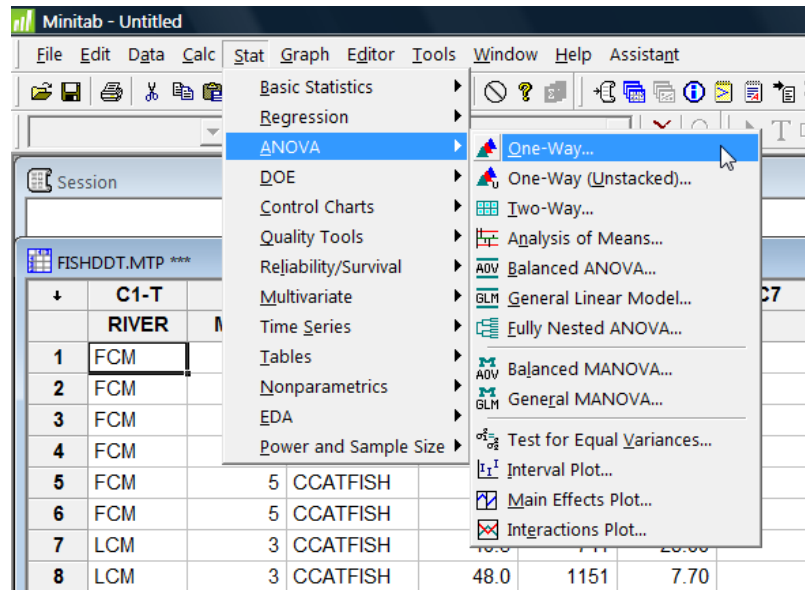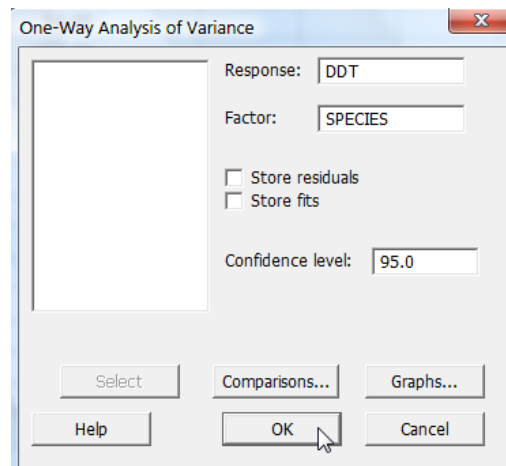**Figure 24** MINITAB menu options for One-Way ANOVA

Figure 25 One-Way ANOVA dialog box

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 26. 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). Click OK to return to the One-Way ANOVA dialog box (Figure 25). 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 24). The dialog box shown in Figure 27 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.

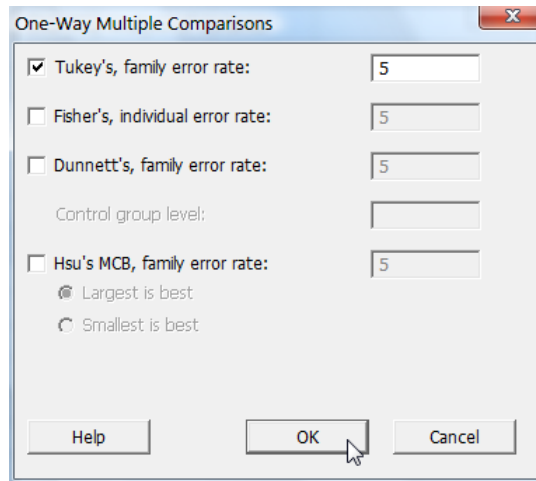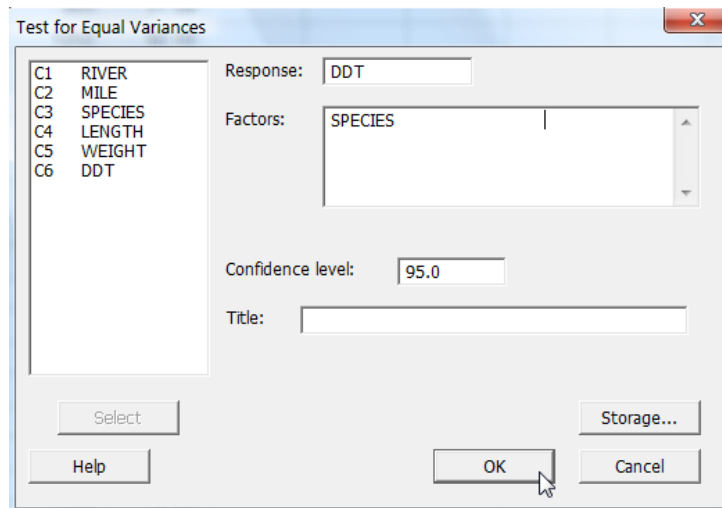**Figure 26** Multiple Comparisons dialog box for ANOVA

Figure 27 Test for Equal Variances dialog box

12. Analysis of Variance for Factorial Designs

To conduct an ANOVA for a two-factor factorial design, click on the Stat button on the MINITAB main menu bar, then click on ANOVA, and finally click on Two-Way (see Figure 24). The resulting dialog box appears in Figure 28.

Specify the dependent variable in the Response box, the first qualitative factor in the Row Factor box, and the second qualitative factor in the Column Factor box. A model with main effects and factor interaction will automatically be fit. Click on OK to view the ANOVA results.

For more general factorial designs, click on the Stat button on the MINITAB main menu bar, then click on ANOVA, and finally click on General Linear Model (see Figure 24). The resulting dialog box appears in Figure 29.

Specify the dependent variable in the Responses box and the terms in the factorial model in the Model box. (*Note*: Interaction terms are indicated by placing an asterisk between the variables that are to be interacted [e.g., RATIO * SUPPLY].)
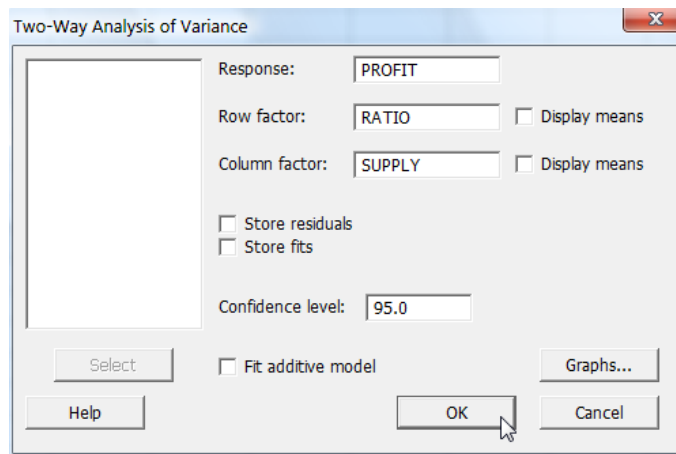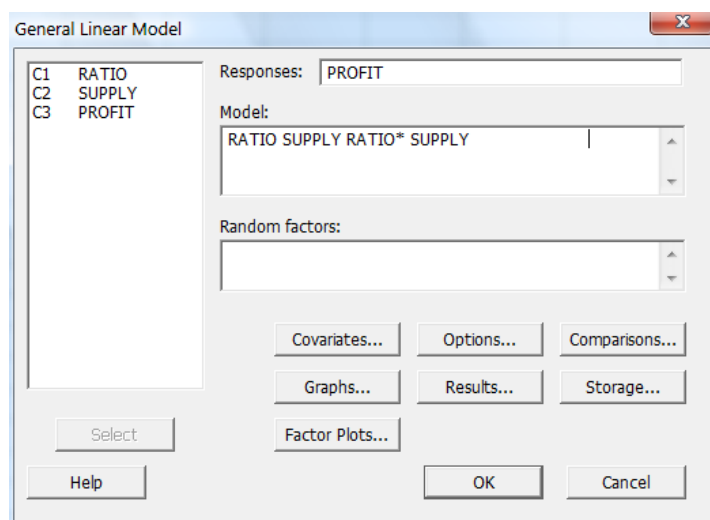
Figure 28 Two-Way
ANOVA dialog box

Figure 29 General Linear
Model dialog box

To run multiple comparisons of means for treatment main effects, click the Comparisons button. The dialog box shown in Figure 30 appears. Specify the main effects to be tested in the Terms box and select the comparison method (e.g., Bonferroni), then click OK to return to the Factorial ANOVA dialog box (Figure 29). Click OK to run and view the ANOVA results.

13. 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 the Stat button on the MINITAB main menu bar, then click on Regression, and click on Regression again, as shown in Figure 16. Specify the dependent and independent variables in the model on the resulting dialog box (see Figure 17.) Once the model has been specified, click on the Options button on the Regression dialog box to obtain the menu shown in Figure 31.

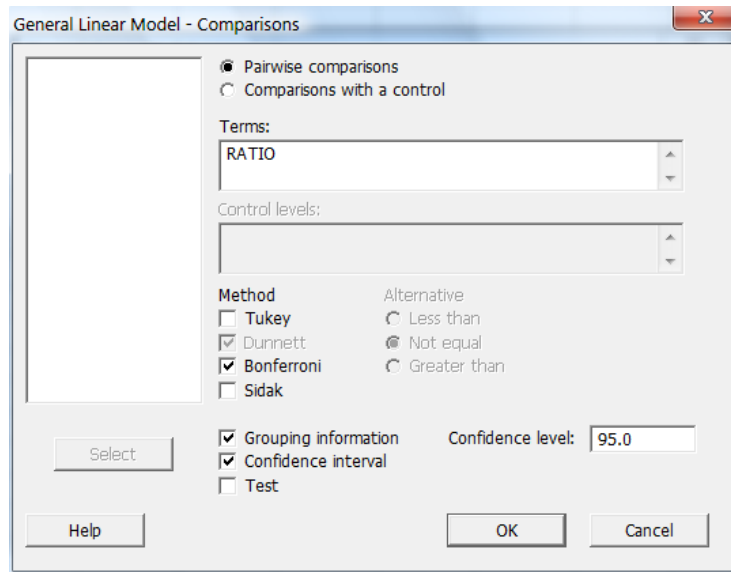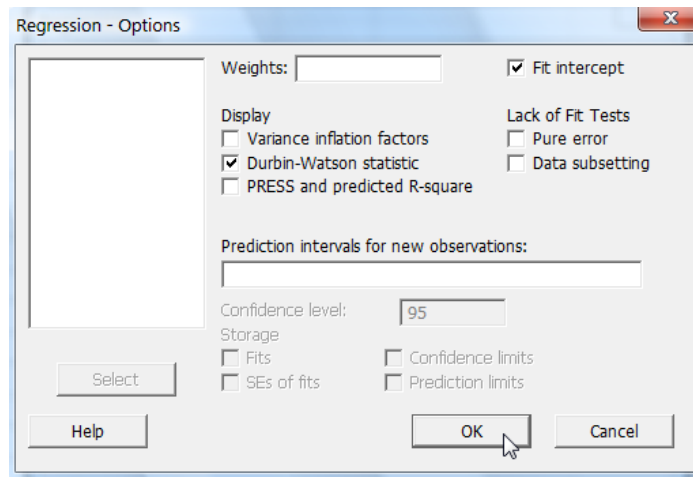**Figure 30** General Linear Model Comparisons dialog box

Figure 31 Regression Options dialog box for the Durbin–Watson test

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 click on Time Series. This will produce the menu list shown in Figure 32. 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 33.

Select the quantitative variable to be smoothed and place it 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.)

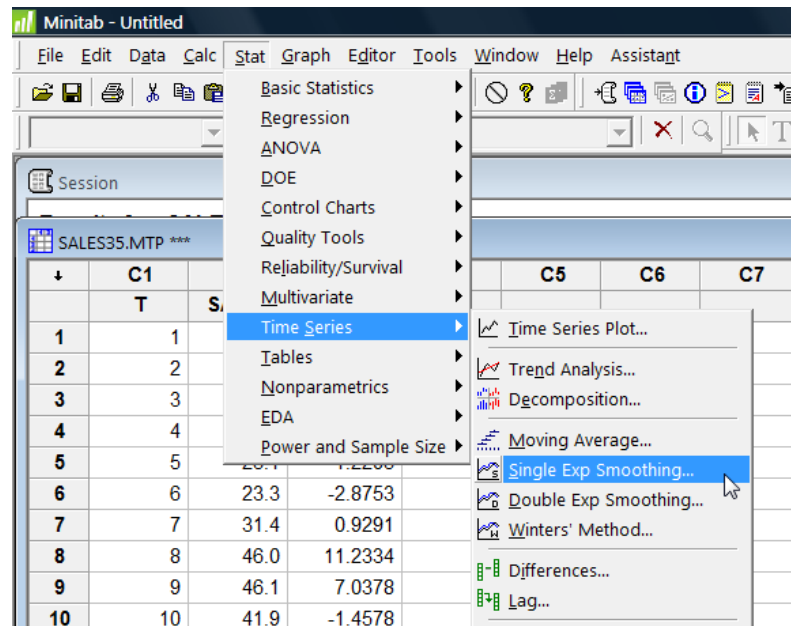**Figure 32** MINITAB menu options for Time Series Forecasting

Figure 33 Exponential Smoothing dialog box