d. Show the frequency distribution for the Gross Profit Margin using the five intervals: 0–14.9, 15–29.9, 30–44.9, 45–59.9, and 60–74.9. Construct a histogram similar to Figure 1.6.

e. What is the average price/earnings ratio?

Appendix  An Introduction to StatTools

Excel 2007 does not contain statistical functions or data analysis tools to perform all the statistical procedures discussed in the text. StatTools is a Microsoft Excel statistics add-in that extends the range of statistical and graphical options for Excel users. Most chapters include a chapter appendix that shows the steps required to accomplish a statistical procedure using StatTools. For those students who want to make more extensive use of the software, StatTools offers an excellent Help facility. The StatTools Help system includes detailed explanations of the statistical and data analysis options available, as well as descriptions and definitions of the types of output provided.

Installing and Opening StatTools

The Student CD packaged with the text provides instructions for downloading and installing the StatTools software on your computer. After installing the StatTools software, perform the following steps to use it as an Excel add-in.

Step 1. Click the Start button on the taskbar and then point to All Programs
Step 2. Point to the folder entitled Palisade Decision Tools
Step 3. Click StatTools for Excel

These steps will open Excel and add the StatTools tab next to the Add-Ins tab on the Excel Ribbon. Alternately, if you are already working in Excel, these steps will make StatTools available.

Using StatTools

Before conducting any statistical analysis, we must create a StatTools data set using the StatTools Data Set Manager. Let us use the Excel worksheet for the S&P 500 data set in Table 1.1 to show how this is done. The following steps show how to create a StatTools data set for the S&P 500 data.

Step 1. Open the Excel file named BWS&P
Step 2. Select any cell in the data set (for example, cell A1)
Step 3. Click the StatTools tab on the Ribbon
Step 4. In the Data group, click Data Set Manager
Step 5. When StatTools asks if you want to add the range $A$1:$F$26 as a new StatTools data set, click Yes
Step 6. When the StatTools—Data Set Manager dialog box appears, Click OK

Figure 1.13 shows the StatTools—Data Set Manager dialog box that appears in step 6. By default, the name of the new StatTools data set is Data Set #1. You can replace the name Data Set #1 in step 6 with a more descriptive name. And, if you select the Apply Cell Format option, the column labels will be highlighted in blue and the entire data set will have outside and inside borders. You can always select the Data Set Manager at any time in your analysis to make these types of changes.
Recommended Application Settings

StatTools allows the user to specify some of the application settings that control such things as where statistical output is displayed and how calculations are performed. The following steps show how to access the StatTools—Application Settings dialog box.

Step 1. Click the StatTools tab on the Ribbon
Step 2. In the Tools Group, click Utilities
Step 3. Choose Application Settings from the list of options

Figure 1.14 shows that the StatTools—Application Settings dialog box has five sections: General Settings; Reports; Utilities; Data Set Defaults; and Analyses. Let’s see how we can make changes in the Reports section of this dialog box.

Figure 1.14 shows that the Placement option currently selected is New Workbook. Using this option, the StatTools output will be placed in a new workbook. But, suppose
You would like to place the StatTools output in the current (active) workbook. If you click the words **New Workbook**, a downward-pointing arrow will appear to the right. Clicking this arrow will display a list of all the placement options, including **Active Workbook**; we recommend using this option. Figure 1.14 also shows that the **Updating Preferences** option in the Reports section is currently **Live—Linked to Input Data**. With live updating anytime one or more data values are changed StatTools will automatically change the output previously produced; we also recommend using this option. Note that there are two options available under Display Comments: **Notes and Warnings**; and **Educational Comments**. Because these options provide useful notes and information regarding the output, we recommend using both options. Thus, to include educational comments as part of the StatTools output you will have to change the value of False for Educational Comments to True.

The StatTools—Settings dialog box contains numerous other features that enable you to customize the way that you want StatTools to operate. You can learn more about all of these features by selecting the Help option located in the Tools group, or by clicking the Help icon located in the lower left-hand corner of the dialog box. When you are done making changes in the application settings, click OK at the bottom of the dialog box and then click Yes when StatTools asks you if you want to save the new application settings.
3. A scatter diagram to explore the relationship between Total Gross Sales and Number of Theaters. Discuss.

4. A scatter diagram to explore the relationship between Total Gross Sales and Number of Weeks in the Top 60. Discuss.

Appendix Using StatTools for Tabular and Graphical Presentations

In this appendix we show how StatTools can be used to construct a histogram and a scatter diagram.

Histogram

We use the audit time data in Table 2.4 to illustrate. Begin by using the Data Set Manager to create a StatTools data set for these data using the procedure described in the appendix in Chapter 1. The following steps will generate a histogram.

Step 1. Click the StatTools tab on the Ribbon
Step 2. In the Analyses Group, click Summary Graphs
Step 3. Choose the Histogram option
Step 4. When the StatTools—Histogram dialog box appears,

In the Variables section, select Audit Time
In the Options section,
   Enter 5 in the Number of Bins box
   Enter 9.5 in the Histogram Minimum box
   Enter 34.5 in the Histogram Maximum box
   Choose Categorical in the X-Axis box
   Choose Frequency in the Y-Axis box
Click OK
A histogram for the audit time data similar to the histogram shown in Figure 2.9 will appear. The only difference is the histogram developed using StatTools shows the class midpoints on the horizontal axis.

**Scatter Diagram**

We use the stereo and sound equipment data in Table 2.12 to demonstrate the construction of a scatter diagram. Begin by using the Data Set Manager to create a StatTools data set for these data using the procedure described in the appendix in Chapter 1. The following steps will generate a scatter diagram.

1. Click the **StatTools** tab on the Ribbon
2. In the **Analyses Group**, click **Summary Graphs**
3. Choose the **Scatterplot** option
4. When the StatTools—Scatterplot dialog box appears,
   - In the **Variables** section,
     - In the column labeled **X**, select **No. of Commercials**
     - In the column labeled **Y**, select **Sales Volume**
   - Click **OK**

A scatter diagram similar to the one shown in Figure 2.20 will appear.
Managerial Report

Use the methods of descriptive statistics to summarize the data in Table 3.16. Discuss your findings.

1. Include a summary for each variable in the data set. Make comments and interpretations based on maximums and minimums, as well as the appropriate means and proportions. What new insights do these descriptive statistics provide concerning Asia-Pacific business schools?

2. Summarize the data to compare the following:
   a. Any difference between local and foreign tuition costs.
   b. Any difference between mean starting salaries for schools requiring and not requiring work experience.
   c. Any difference between starting salaries for schools requiring and not requiring English tests.

3. Do starting salaries appear to be related to tuition?

4. Present any additional graphical and numerical summaries that will be beneficial in communicating the data in Table 3.16 to others.

Appendix Descriptive Statistics and Box Plot Using StatTools

In this appendix we show how StatTools can be used to develop descriptive statistics and construct a box plot.

Descriptive Statistics for One Variable

We use the starting salary data in Table 3.1 to illustrate. Begin by using the Data Set Manager to create a StatTools data set for these data using the procedure described in the appendix in Chapter 1. The following steps will generate a variety of descriptive statistics.

Step 1. Click the StatTools tab on the Ribbon
Step 2. In the Analyses Group, click Summary Statistics
Step 3. Choose the One-Variable Summary option
Step 4. When the One-Variable Summary Statistics dialog box appears,
   In the Variables section, select Starting Salary
   Click OK

A variety of summary statistics will appear.

Constructing a Box Plot

We use the starting salary data in Table 3.1 to illustrate. Begin by using the Data Set Manager to create a StatTools data set for these data using the procedure described in the appendix in Chapter 1. The following steps will create a box plot for these data.

Step 1. Click the StatTools tab on the Ribbon
Step 2. In the Analyses Group, click Summary Graphs
Step 3. Choose the Box-Whisker Plot option
Step 4. When the StatTools—Box-Whisker Plot dialog box appears,
   In the Variables section, select Starting Salary
   Click OK

A box plot similar to the one in Figure 3.11 will appear.
Covariance and Correlation

We use the stereo and sound equipment data in Table 3.7 to demonstrate the computation of the sample covariance and the sample correlation coefficient. Begin by using the Data Set Manager to create a StatTools data set for these data using the procedure described in the appendix in Chapter 1. The following steps will provide the sample covariance and sample correlation coefficient.

Step 1. Click the StatTools tab on the Ribbon
Step 2. In the Analyses Group, click Summary Statistics
Step 3. Choose the Correlation and Covariance option
Step 4. When the StatTools—Correlation and Covariance dialog box appears,
   In the Variables section
       Select No. of Commercials
       Select Sales Volume
   In the Tables to Create section,
       Select Table of Correlations
       Select Table of Covariances
   In the Table Structure section select Symmetric
   Click OK

A table showing the correlation coefficient and the covariance will appear.
45. A production process is checked periodically by a quality control inspector. The inspector selects simple random samples of 30 finished products and computes the sample mean product weights $\bar{x}$. If test results over a long period of time show that 5% of the $\bar{x}$ values are over 2.1 pounds and 5% are under 1.9 pounds, what are the mean and the standard deviation for the population of products produced with this process?

46. About 28% of private companies are owned by women (The Cincinnati Enquirer, January 26, 2006). Answer the following questions based on a sample of 240 private companies.
   a. Show the sampling distribution of $\hat{p}$, the sample proportion of companies that are owned by women.
   b. What is the probability the sample proportion will be within $\pm .04$ of the population proportion?
   c. What is the probability the sample proportion will be within $\pm .02$ of the population proportion?

47. A market research firm conducts telephone surveys with a 40% historic response rate. What is the probability that in a new sample of 400 telephone numbers, at least 150 individuals will cooperate and respond to the questions? In other words, what is the probability that the sample proportion will be at least 150/400 = .375?

48. Advertisers contract with Internet service providers and search engines to place ads on Web sites. They pay a fee based on the number of potential customers who click on their ad. Unfortunately, click fraud—the practice of someone clicking on an ad solely for the purpose of driving up advertising revenue—has become a problem. Forty percent of advertisers claim they have been a victim of click fraud (BusinessWeek, March 13, 2006). Suppose a simple random sample of 380 advertisers will be taken to learn more about how they are affected by this practice.
   a. What is the probability that the sample proportion will be within $\pm .04$ of the population proportion experiencing click fraud?
   b. What is the probability that the sample proportion will be greater than .45?

49. The proportion of individuals insured by the All-Driver Automobile Insurance Company who received at least one traffic ticket during a five-year period is .15.
   a. Show the sampling distribution of $\hat{p}$ if a random sample of 150 insured individuals is used to estimate the proportion having received at least one ticket.
   b. What is the probability that the sample proportion will be within $\pm .03$ of the population proportion?

50. Lori Jeffrey is a successful sales representative for a major publisher of college textbooks. Historically, Lori obtains a book adoption on 25% of her sales calls. Viewing her sales calls for one month as a sample of all possible sales calls, assume that a statistical analysis of the data yields a standard error of the proportion of .0625.
   a. How large was the sample used in this analysis? That is, how many sales calls did Lori make during the month?
   b. Let $\hat{p}$ indicate the sample proportion of book adoptions obtained during the month. Show the sampling distribution of $\hat{p}$.
   c. Using the sampling distribution of $\hat{p}$, compute the probability that Lori will obtain book adoptions on 30% or more of her sales calls during a one-month period.

Appendix Random Sampling with StatTools

If a list of all the elements in a population is available in an Excel file, StatTools Random Sample Utility can be used to select a simple random sample. For example, a list of the top 100 metropolitan areas in the United States and Canada is provided in column A of the data set MetAreas (Places Rated Almanac—The Millennium Edition 2000). Column B contains the overall rating of each metropolitan area. Assume that you would like to select a simple
random sample of 30 metropolitan areas in order to do an in-depth study of the cost of living in the United States and Canada.

Begin by using the Data Set Manager to create a StatTools data set for these data using the procedure described in the appendix to Chapter 1. The following steps will generate a simple random sample of 30 metropolitan areas.

**Step 1.** Click the StatTools tab on the Ribbon

**Step 2.** In the Data Group click Data Utilities

**Step 3.** Choose the Random Sample option

**Step 4.** When the StatTools—Random Sample Utility dialog box appears,
- In the Variables section, Select Metropolitan Area
- Select Rating

- In the Options section,
  - Enter 1 in the Number of Samples box
  - Enter 30 in the Sample Size box

- Click OK

The random sample of 30 metropolitan areas will appear in columns A and B of the worksheet entitled Random Sample.
problems. To learn more about the transmission failures, Metropolitan used a sample of actual transmission repairs provided by a transmission repair firm in the Detroit area. The following data show the actual number of miles driven for 50 vehicles at the time of transmission failure.

<p>| | | | | | | | | | | | | | | |</p>
<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>85,092</td>
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<td>59,465</td>
<td>77,437</td>
<td>32,534</td>
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<td>59,902</td>
<td></td>
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<td></td>
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<td>39,323</td>
<td>89,641</td>
<td>94,219</td>
<td>116,803</td>
<td>92,857</td>
<td>63,436</td>
<td>65,605</td>
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<tr>
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<td>61,978</td>
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<td>69,222</td>
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<td>74,425</td>
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<td>79,294</td>
<td>64,544</td>
<td>86,813</td>
<td>116,269</td>
<td></td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>37,831</td>
<td>89,341</td>
<td>73,341</td>
<td>85,288</td>
<td>138,114</td>
<td>53,402</td>
<td>85,586</td>
<td>82,256</td>
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</tr>
</tbody>
</table>

Managerial Report

1. Use appropriate descriptive statistics to summarize the transmission failure data.
2. Develop a 95% confidence interval for the mean number of miles driven until transmission failure for the population of automobiles with transmission failure. Provide a managerial interpretation of the interval estimate.
3. Discuss the implication of your statistical finding in terms of the belief that some owners of the automobiles experienced early transmission failures.
4. How many repair records should be sampled if the research firm wants the population mean number of miles driven until transmission failure to be estimated with a margin of error of 5000 miles? Use 95% confidence.
5. What other information would you like to gather to evaluate the transmission failure problem more fully?

Appendix Interval Estimation with StatTools

In this appendix we show how StatTools can be used to develop an interval estimate of a population mean for the $\sigma$ unknown case and determine the sample size needed to provide a desired margin of error.

**Interval Estimation of Population Mean: $\sigma$ Unknown Case**

In this case the population standard deviation $\sigma$ will be estimated by the sample standard deviation $s$. We use the credit card balance data in Table 8.3 to illustrate. Begin by using the Data Set Manager to create a StatTools data set for these data using the procedure described in the appendix to Chapter 1. The following steps can be used to compute a 95% confidence interval estimate of the population mean.

**Step 1.** Click the StatTools tab on the Ribbon

**Step 2.** In the Analyses group, click Statistical Inference

**Step 3.** Choose the Confidence Interval option

**Step 4.** When the StatTools—Confidence Interval dialog box appears,
- For Analysis Type choose One-Sample Analysis
- In the Variables section, select NewBalance
- In the Confidence Intervals to Calculate section, Select the For the Mean option
- Select 95% for the Confidence Level
- Click OK

Some descriptive statistics and the confidence interval will appear.
Chapter 8  Interval Estimation

**Determining the Sample Size**

In Section 8.3 we showed how to determine the sample size needed to provide a desired margin of error. The example used involved a study designed to estimate the population mean daily rental cost for a midsize automobile in the United States. The project director specified that the population mean daily rental cost be estimated with a margin of error of $2 and a 95% level of confidence. Sample data from a previous study provided a sample standard deviation of $9.65; this value was used as the planning value for the population standard deviation. The following steps can be used to compute the recommended sample size required to provide a 95% confidence interval estimate of the population mean with a margin of error of $2.

1. Click the StatTools tab on the Ribbon
2. In the Analyses group, click Statistical Inference
3. Choose the Sample Size Selection option
4. When the StatTools—Sample Size Selection dialog box appears,
   - In the Parameter to Estimate section, select Mean
   - In the Confidence Interval Specification section, select 95% for the Confidence Level
   - Enter 2 in the Half-Length of Interval box
   - Enter 9.65 in the Estimated Std Dev box
   - Click OK

The output showing a recommended sample size of 90 will appear.
2. Compute the standard deviation for each of the four samples. Does the assumption of .21 for the population standard deviation appear reasonable?

3. Compute limits for the sample mean $\bar{x}$ around $\mu = 12$ such that, as long as a new sample mean is within those limits, the process will be considered to be operating satisfactorily. If $\bar{x}$ exceeds the upper limit or if $\bar{x}$ is below the lower limit, corrective action will be taken. These limits are referred to as upper and lower control limits for quality control purposes.

4. Discuss the implications of changing the level of significance to a larger value. What mistake or error could increase if the level of significance is increased?

**Case Problem 2**  
**Unemployment Study**

Each month the U.S. Bureau of Labor Statistics publishes a variety of unemployment statistics, including the number of individuals who are unemployed and the mean length of time the individuals have been unemployed. For November 1998, the Bureau of Labor Statistics reported that the national mean length of time of unemployment was 14.6 weeks.

The mayor of Philadelphia requested a study on the status of unemployment in the Philadelphia area. A sample of 50 unemployed residents of Philadelphia included data on their age and the number of weeks without a job. A portion of the data collected in November 1998 follows. The complete data set is available in the data file BLS.

<table>
<thead>
<tr>
<th>Age</th>
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<th>Age</th>
<th>Weeks</th>
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<td>18</td>
<td>40</td>
<td>20</td>
<td>33</td>
<td>13</td>
</tr>
</tbody>
</table>

**Managerial Report**

1. Use descriptive statistics to summarize the data.
2. Develop a 95% confidence interval estimate of the mean age of unemployed individuals in Philadelphia.
3. Conduct a hypothesis test to determine whether the mean duration of unemployment in Philadelphia is greater than the national mean duration of 14.6 weeks. Use a .01 level of significance. What is your conclusion?
4. Is there a relationship between the age of an unemployed individual and the number of weeks of unemployment? Explain.

**Appendix**  
**Hypothesis Testing with StatTools**

In this appendix we show how StatTools can be used to conduct hypothesis tests about a population mean for the $\sigma$ unknown case

**Population Mean: $\sigma$ Unknown Case**

In this case the population standard deviation $\sigma$ will be estimated by the sample standard deviation $s$. We use the example discussed in Section 9.4 involving ratings that 60 business travelers gave for Heathrow Airport.
Chapter 9  Hypothesis Tests

Begin by using the Data Set Manager to create a StatTools data set for these data using the procedure described in the appendix in Chapter 1. The following steps can be used to test the hypothesis $H_0: \mu \leq 7$ against $H_a: \mu > 7$.

**Step 1.** Click the StatTools tab on the Ribbon
**Step 2.** In the Analyses group, click Statistical Inference
**Step 3.** Choose the Hypothesis Test option
**Step 4.** When the StatTools—Hypothesis Test dialog box appears,
   
   For Analysis Type, choose One-Sample Analysis
   In the Variables section, select Rating
   In the Hypothesis Tests to Perform section,
   Select the Mean option
   Enter 7 in the Null Hypothesis Value box
   Select Greater Than Null Value (One-Tailed Test) in the Alternative Hypothesis box
   If selected, remove the check in the Standard Deviation box
   Click OK

The results from the hypothesis test will appear. They include the $p$-value and the value of the test statistic.
In the Confidence Intervals to Calculate section, Select the For the Difference of Means option Select 95% for the Confidence Level Click OK

Because the sample size for Cherry Grove \( (n_1 = 28) \) differs from the sample size for Beechmont \( (n_2 = 22) \), StatTools will inform you of this difference after you click OK in step 4. A dialog box will appear saying “The variable Beechmont contains missing data, which the analysis will ignore.” Click OK. A Choose Variable Ordering dialog box then appears indicating that the analysis will compare the difference between the Cherry Grove data set and the Beechmont data set. Click OK and the StatTools interval estimation output will appear.

Hypothesis Tests About \( \mu_1 \) and \( \mu_2 \)

We will use the software evaluation example and the completion time data presented in Table 10.1. Begin by using the Data Set Manager to create a StatTools data set for these data using the procedure described in the appendix in Chapter 1. The following steps can be used to test the hypothesis \( H_0: \mu_1 - \mu_2 \leq 0 \) against \( H_a: \mu_1 - \mu_2 > 0 \).

Step 1. Click the StatTools tab on the Ribbon
Step 2. In the Analyses group, click Statistical Inference
Step 3. Choose the Hypothesis Test option
Step 4. When the StatTools—Hypothesis Test dialog box appears,
   For Analysis Type, choose Two-Sample Analysis
   In the Variables section,
   Select Current
   Select New
   In the Hypothesis Tests to Perform section,
   Select Difference of Means
   Enter 0 in the Null Hypothesis Value box
   Select Greater Than Null Value (One-Tailed Test) in the Alternative Hypothesis box
   Click OK
   When the Choose Variable Ordering dialog box appears, click OK

The results of the hypothesis test will then appear.

Inferences About the Difference Between Two Population Means: Matched Samples

StatTools can be use to develop interval estimates and conduct hypothesis tests for the difference between population means for the matched samples case. We will use the matched-sample completion times in Table 10.2 to illustrate.

Begin by using the Data Set Manager to create a StatTools data set for these data using the procedure described in the appendix in Chapter 1. The following steps can be used to compute a 95% confidence interval estimate of the difference between the population mean completion times.

Step 1. Click the StatTools tab on the Ribbon
Step 2. In the Analyses group, click Statistical Inference
Step 3. Choose the Confidence Interval option
Step 4. When the StatTools—Confidence Interval dialog box appears, For Analysis Type, choose Paired-Sample Analysis. In the Variables section, Select Method 1
Select Method 2
In the Confidence Intervals to Calculate section, Select the For the Difference of Means option
Select 95% for the Confidence Level
If selected, remove the check in the For the Standard Deviation box
Click OK
When the Choose Variable Ordering dialog box appears, click OK

The confidence interval will appear.

Conducting hypothesis tests for the matched samples case is very similar to conducting hypothesis tests for the difference in two means shown above. After selecting the Hypothesis Test option in step 3, select the Paired-Sample Analysis option in step 4.
In Section 14.3, we found that the sample with \( n = 10 \) provided the sample correlation coefficient for student population and quarterly sales of \( r_{xy} = .9501 \). The test statistic is

\[
t = r_{xy} \sqrt{\frac{n - 2}{1 - r_{xy}^2}} = .9501 \sqrt{\frac{10 - 2}{1 - (.9501)^2}} = 8.61
\]

The \( t \) distribution table shows that with \( n - 2 = 10 - 2 = 8 \) degrees of freedom, \( t = 3.355 \) provides an area of .005 in the upper tail. Thus, the area in the upper tail of the \( t \) distribution corresponding to the test statistic must be less than .005. Because this test is a two-tailed test, we double this value to conclude that the \( p \)-value associated with \( t_{8.61} \) must be less than \( .005 \). Excel shows the \( p \)-value as .000. Because the \( p \)-value is less than \( .01 \), we reject \( H_0 \) and conclude that \( r_{xy} \) is not equal to zero. This evidence is sufficient to conclude that a significant linear relationship exists between student population and quarterly sales.

Note that the conclusion of a significant relationship is identical to the conclusion obtained in Section 14.5 for the \( t \) test conducted using Armand’s estimated regression equation \( \hat{y} = 60 + 5x \). Performing regression analysis provides the conclusion of a significant relationship between \( x \) and \( y \) and in addition provides the equation showing how the variables are related. As a result, most analysts find that using correlation as a test of significance is unnecessary.

### Appendix 14.3 Regression Analysis Using StatTools

In this appendix we show how StatTools can be used to perform the regression analysis computations for the Armand’s Pizza Parlors problem. Begin by using the Data Set Manager to create a StatTools data set for these data using the procedure described in the appendix in Chapter 1. The following steps describe how StatTools can be used to provide the regression results.

**Step 1.** Click the **StatTools** tab on the Ribbon  
**Step 2.** In the **Analyses** group, click **Regression and Classification**  
**Step 3.** Choose the **Regression** option  
**Step 4.** When the StatTools—Regression dialog box appears,  
    Select **Multiple** in the **Regression Type** box  
    In the **Variables** section,  
    Click the **Format button** and select **Unstacked**  
    In the column labeled **I** select **Population**  
    In the column labeled **D** select **Sales**  
    Click **OK**

The regression analysis output will appear in a new worksheet.

Note that in step 4 we selected **Multiple** in the Regression Type box. In StatTools, the Multiple option is used for both simple linear regression and multiple regression. The StatTools—Regression dialog box contains a number of more advanced options for developing prediction interval estimates and producing residual plots. The StatTools Help facility provides information on using all of these options.
Appendix  Multiple Regression Analysis Using StatTools

In this appendix we show how StatTools can be used to perform the regression analysis computations for the Butler Trucking problem. Begin by using the Data Set Manager to create a StatTools data set for these data using the procedure described in the Appendix in Chapter 1. The following steps describe how StatTools can be used to provide the regression results.

**Step 1.** Click the StatTools tab on the Ribbon

**Step 2.** In the Analyses group, click Regression and Classification

**Step 3.** Choose the Regression option

**Step 4.** When the StatTools—Regression dialog box appears,
- Select Multiple in the Regression Type box
- In the Variables section:
  - Click the Format button and select Unstacked
  - In the column labeled I select Miles
  - In the column labeled I select Deliveries
  - In the column labeled D select Time
- Click OK

The regression analysis output will appear in a new worksheet.

The StatTools—Regression dialog box contains a number of more advanced options for developing prediction interval estimates and producing residual plots. The StatTools Help facility provides information on using all of these options.
Step 4. When the StatTools—Regression dialog box appears,
Select Stepwise in the Regression Type box
In the Variables section,
Click the Format button and select Unstacked
In the column labeled D select Sales
In the column labeled I select Time, Poten, AdvExp, Share,
Change, Accounts, Work, and Rating
In the Parameters section,
Select Use p-Values
Enter .05 in the p-Value to Enter box
Enter .05 in the p-Value to Leave box
In the Advanced Options section, select Include Detailed Step Information
Click OK

The regression output in Figure 16.12 will appear.

The StatTools—Regression dialog box contains a number of more advanced options for
developing prediction interval estimates and producing residual plots. The StatTools Help
facility provides information on using all these options. StatTools can also be used to per-
form the forward selection and backward elimination procedures. The steps required are
very similar to the steps for the stepwise procedure. The major difference is that in step 4
you would select either Forward or Backward in the Regression Type box. If you choose
Forward, you would enter a value in the p-Value to Enter box and if you choose Backward
you would enter a value the p-Value to Leave box.
24. An acceptance sampling plan with \( n = 15 \) and \( c = 1 \) was designed with a producer’s risk of .075.
a. Was the value of \( p_0 \) equal to .01, .02, .03, .04, or .05? What does this value mean?
b. What is the consumer’s risk associated with this plan if \( p_1 \) is .25?

25. A manufacturer produces lots of a canned food product. Let \( p \) denote the proportion of the lots that do not meet the product quality specifications. An \( n = 25, c = 0 \) acceptance sampling plan will be used.
a. Compute points on the operating characteristic curve when \( p = .01, .03, .10, \) and \( .20 \).
b. Plot the operating characteristic curve.
c. What is the probability that the acceptance sampling plan will reject a lot that has .01 defective?

Appendix

Control Charts Using StatTools

In this appendix we show how StatTools can be used to construct an \( \bar{x} \) chart and an \( R \) chart for the Jensen Computer Supplies data in Figure 14.9. Begin by using the Data Set Manager to create a StatTools data set for these data using the procedure described in the appendix in Chapter 1. The following steps describe how StatTools can be used to provide both control charts.

**Step 1.** Click the StatTools tab on the Ribbon

**Step 2.** In the Analyses group, click Quality Control

**Step 3.** Choose the X/R Charts option

**Step 4.** When the StatTools—Xbar and R Control Charts dialog box appears,

Select X-\( \bar{\text{Bar}} \)/R Chart in the Chart Type box

In the Variables section, select Observation 1, Observation 2, Observation 3, Observation 4, and Observation 5

Click OK

An \( \bar{x} \) chart similar to the one in Figure 14.7 will appear. It will be followed by an \( R \) chart similar to the one in Figure 14.8.
Key considerations as Allied develops its strategy for disposing of the case are the probabilities associated with John’s response to an Allied counteroffer of $400,000 and the probabilities associated with the three possible trial outcomes. Allied’s lawyers believe the probability that John will accept a counteroffer of $400,000 is .10, the probability that John will reject a counteroffer of $400,000 is .40, and the probability that John will, himself, make a counteroffer to Allied of $600,000 is .50. If the case goes to court, they believe that the probability the jury will award John damages of $1,500,000 is .30, the probability that the jury will award John damages of $750,000 is .50, and the probability that the jury will award John nothing is .20.

Managerial Report

Perform an analysis of the problem facing Allied Insurance and prepare a report that summarizes your findings and recommendations. Be sure to include the following items:

1. A decision tree
2. A recommendation regarding whether Allied should accept John’s initial offer to settle the claim for $750,000
3. A decision strategy that Allied should follow if they decide to make John a counteroffer of $400,000
4. Compute the probability for each final outcome using your recommended strategy. That is, develop a risk profile for your recommended strategy.

Appendix  An Introduction to PrecisionTree

PrecisionTree is an Excel add-in that can be used to develop and analyze decision trees. In this appendix we describe how to install and use PrecisionTree to solve the PDC problem presented in Section 19.1.

Installing and Opening PrecisionTree

The student CD, packaged with the text, provides instructions for downloading and installing the PrecisionTree software on your computer. After installing the PrecisionTree software, perform the following steps to use it as an Excel add-in.

Step 1. Click the Start button on the taskbar and then point to ALL Programs
Step 2. Point to the folder entitled Palisade DecisionTools
Step 3. Click PrecisionTree for Excel

These steps will open Excel and add the PrecisionTree tab next to the Add-Ins tab on the Excel Ribbon. Alternately, if you are already working in Excel, these steps will make PrecisionTree available.

Getting Started: An Initial Decision Tree

We assume that PrecisionTree has been installed, an Excel workbook is open, and a worksheet that will contain the decision tree has been selected. To create a PrecisionTree version of the PDC decision tree (see Figure 19.11) proceed as follows:

Step 1. Click the PrecisionTree tab on the Ribbon
Step 2. In the Create New group, click Decision Tree
Step 3. When the PrecisionTree for Excel dialog box appears:
   Click cell A1
   Click OK
Step 4. When the PrecisionTree-Model Settings dialog box appears:

Enter PDC in the Name box
Click OK

An initial decision tree with an end node and no branches will appear.

Adding a Decision Node and Branches

The initial tree shown above contains a name and one triangle-shaped end node. Recall that the PDC decision tree has one decision node with three branches, one for each decision alternative (small, medium, and large complexes). The following steps show how to change the end node to a decision node and add the three decision alternative branches.

Step 1. Click the triangle shaped end node
Step 2. When the Precision-Decision Tree Node Settings dialog box appears:
   Click the Decision button under Node Type
   Click the Branches tab
   Click Add
   Click OK

An expanded decision tree with a decision node and three branches will appear.

Naming the Decision Alternatives

Each of the three decision branches has the generic name Branch followed by a number to identify it. We want to rename the branches Small, Medium, and Large. Let us start with Branch #1.
Appendix  An Introduction to PrecisionTree

Step 1. Click the name Branch #1  
Step 2. When the PrecisionTree for Excel dialog box appears:  
   Replace Branch #1 with Small  
   Click OK  

Continue by applying the same two steps to name the other two decision branches. After naming the branches, the PDC decision tree with three branches appears as follows:

Adding Chance Nodes and Branches

The chance event for the PDC problem is the demand for the condominiums, which may be either strong or weak. Thus, a chance node with two branches must be added at the end of each decision alternative branch.

Step 1. Click the end node for the Small decision alternative branch  
Step 2. When the PrecisionTree-Decision Tree Node Settings dialog box appears:  
   Click the Chance button under Node Type  
   Click OK  

In Step 2, the default value for the number of branches in the Decision Tree Node Settings dialog box is 2. As a result, for the PDC problem we did not need to specify the number of branches for the chance node we just created. The decision tree now appears as follows:
We can now rename the chance node branches as Strong and Weak by using the same procedure we did for the decision branches. Chance nodes can now be inserted at the end of the other two decision branches in a similar fashion\(^1\). Doing so leads to the PDC decision tree shown in Figure 19.12.

### Inserting Probabilities and Payoffs

PrecisionTree provides the capability of inserting probabilities and payoffs into the decision tree. In Figure 19.12, we see that PrecisionTree automatically assigned an equal probability .5 (shown as 50\%) to each branch from a chance node. For PDC, the probability of strong demand is .8 and the probability of weak demand is .2. We can select cells C1, C5, C9, C13, C15, and C19 and insert the appropriate probabilities. The payoffs for the chance outcomes

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\(^1\)PrecisionTree also has a capability for copying nodes that could be used to create the other two chance nodes. Just right-click on the first chance node created, and click Copy SubTree. Then right-click on one of the other end nodes, and click Past Subtree. Do the same for the other end node.
are inserted in cells C2, C6, C10, C14, C16, and C20. After inserting the PDC probabilities and payoffs, the PDC decision tree appears as shown in Figure 19.13.

**Interpreting the Result**

When probabilities and payoffs are inserted, PrecisionTree automatically makes the backward pass computations necessary to compute expected values and determine the optimal solution. Optimal decisions are identified by the word *True* on the decision branch. Nonoptimal decision branches are identified by the word *False*. Note that the word *True* appears on the Large decision branch. Thus, decision analysis recommends that PDC construct the Large condominium complex. The expected value of this decision appears just to the right of the decision node at the beginning of the tree. Thus, we see that the maximum expected value is $14.2 million. The expected values of the other decision alternatives are displayed just to the right of the chance nodes at the end of the decision alternative branches. We see that the expected value of the decision to build the small complex is $7.8 million and the expected value of the decision to build the medium complex is $12.2 million.
Other Options

We have used PrecisionTree with a maximization objective. This is the default. If you have a decision tree with a minimization objective follow these steps:

Step 1. Click on the decision tree name (at the beginning of the tree)
Step 2. When the Model Settings dialog box appears:
   - Click the Calculation tab
   - Select Minimum Payoff in the Optimum Path box
   - Click OK