

11

Learning more and further Minitab

Practice does not end here. (Ellis Ott, in Ott et al., 2000, p. 537)

Overview

To conclude the book, this final chapter highlights ways in which one can learn more about Minitab (the author invariably learns something new almost every time he uses the software!) and how one can obtain help with Minitab. Reference will be made to the creation of macros and their application. Brief reference will also be made to further features of Minitab not covered in this book and to Minitab Quality Companion.

11.1 Learning more about Minitab and obtaining help

11.1.1 Meet Minitab

The *Meet Minitab 16* guide (Minitab Inc., 2010), is available as a PDF at http://www.minitab.com/uploadedFiles/Shared_Resources/Documents/MeetMinitab/EN16_MeetMinitab.pdf. It deals with the following topics:


- Getting started
- Graphing data
- Analyzing data
- Assessing quality
- Designing an experiment

- Using Session commands
- Generating a report
- Preparing a worksheet
- Customizing Minitab
- Getting help
- Reference.

Its comprehensive index makes it a very useful resource for Minitab users, particularly beginners.

11.1.2 Help

Some reference has already been made to the Help facility in Chapter 2. It may be accessed in a variety of ways:

- Click Help in any dialog box.
- Click the Help icon  on the tool bar.
- Select **Help > Help** from the menus.

General information on navigation for Help is available via **Help > Help > How to Use Help**. The reader is urged to explore! The author believes that each Minitab user will develop his/her own approach to the utilization of the Help facilities.

As an example of how one might seek assistance with a particular topic, consider the need to analyse quarterly sales data for a company, i.e. a time series of data values. The data are stored in Halcro.MTW as a single column of quarterly sales figures for the years 2006 to 2010 inclusive. On clicking the Help icon a window appears with two panes as displayed in Figure 11.1.



Figure 11.1 Help window.

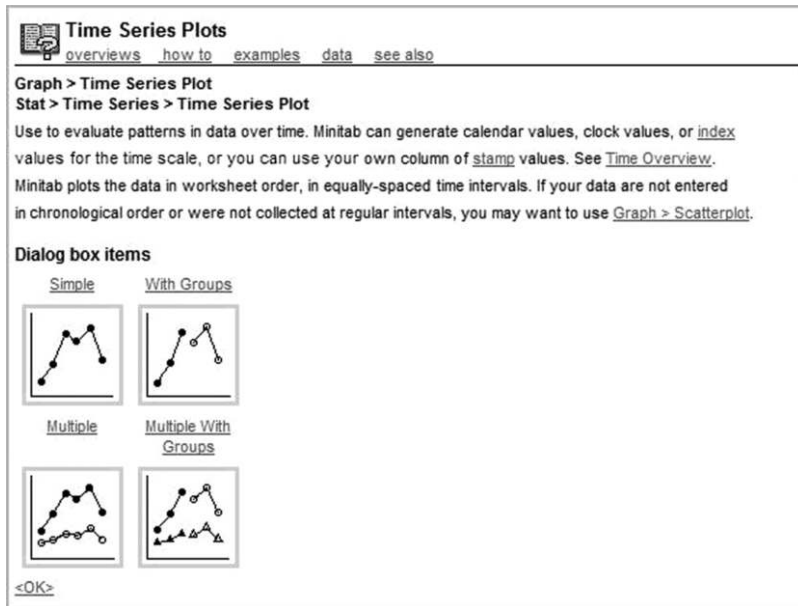



Figure 11.2 Help on time series plots.

Note the Hide icon in the top left-hand corner on the toolbar. On clicking on it the navigation pane on the left is hidden and the icon becomes a Show icon. Clicking on the **Index** tab and entering 'time series' reveals headings Time Series and Time Series Plot. Bearing in mind that display of data is wise whenever possible, on selecting Time Series Plot and clicking the **Display** button, a Topics Found window is displayed with links to **Time Series Plot (Character Graph menu)** and **Time Series Plot (Graph and Stat menus)**. This indicates that a time series plot may be created via both the **Graph** menu and the **Stat** menu or via the archaic **Character Graph** menu. In order to access the Help information on the topic one can highlight Time Series Plot (Graph and Stat menus) and double-click on it, or click the **Display** button below the navigation pane. Alternatively, one can click on a menu link in the window on the right and then click the required topic in the list that appears. Thus the sequence **Stat Menu > Time Series > Time Series Plot** will also reveal the information displayed in Figure 11.2.

Underneath the display heading there are links to:

- [overviews](#) of the topic;
- instructions on [how to](#) complete the dialog;
- [examples](#) of use of the command;
- an explanation of how [data](#) should be structured;
- [see also](#) links to other relevant topics and information.

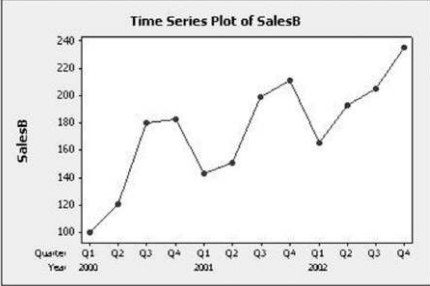
Exploration of all of these links can prove very informative. Clearly the information on completion of dialogs and the examples provided can be very helpful, especially when one is using a particular command for the first time. The links to other relevant topics in the

 **Example of a simple time series plot**
[main topic](#) [interpreting results](#) [session commands](#) [see also](#)

You are a sales manager and you want to view your company's quarterly sales for 2001 to 2003. Create a time series plot.

- 1 Open the worksheet NEWMARKET.MTW.
- 2 Choose **Graph > Time Series Plot or Stat > Time Series > Time Series Plot**.
- 3 Choose **Simple**, then click **OK**.
- 4 In **Series**, enter **SalesB**.
- 5 Click **Time/Scale**.
- 6 Under **Time Scale**, choose **Calendar**. Then, choose **Quarter Year**.
- 7 For start values, under **Quarter**, type **1**. Under **Year**, type **2000**.
- 8 Click **OK** in each dialog box.

Graph window output



Interpreting the results
 Overall sales increased over the three years. Sales may be cyclical, with lower sales in the first quarter of each year.

Tip To see the y- and x-values for a symbol in a series, hover your cursor over the symbol.


Figure 11.3 Help example of a simple time series plot.

majority of instances may be used to access methods, formulae and references to textbooks and journal articles.

With the display in Figure 11.2 on screen, clicking on [examples](#) and selecting **Simple** from the menu that appears yields the display in Figure 11.3.

The reader is invited to minimize the Help screen and to use the information displayed in Figure 11.3 to create the required time series plot. In step 1 you will need to open Halcro.MTW, in step 4 the name (Sales £000) of the column containing the data must be entered, and in step 7 you will need to enter 1 and 2006. As a further exercise the reader is also invited to delete the plot, to maximize the Help screen, to use the **Back** arrow to return to the previous Help screen and to find out how to add a Lowess smoother to the plot by clicking on the **Data View ...** button in the main dialog for the simple time series plot and then using the **Smoother** tab. The final plot is shown in Figure 11.4.

11.1.3 StatGuide

Having used a command, one may use StatGuide™ to access guidance on interpretation on the output, whether it be Session window output or graphical output. For example, having created the plot displayed in Figure 11.4, clicking the StatGuide icon  (immediately to the right of the Help icon) yields the output displayed in Figure 11.5 in the right-hand window. The left-hand window provides **Contents**, **Index** and **Search** tabs for Help.

There are three panes in the window. The first pane provides general information on the command, a **Topics** button giving access to a list of other associated topics and arrow keys that

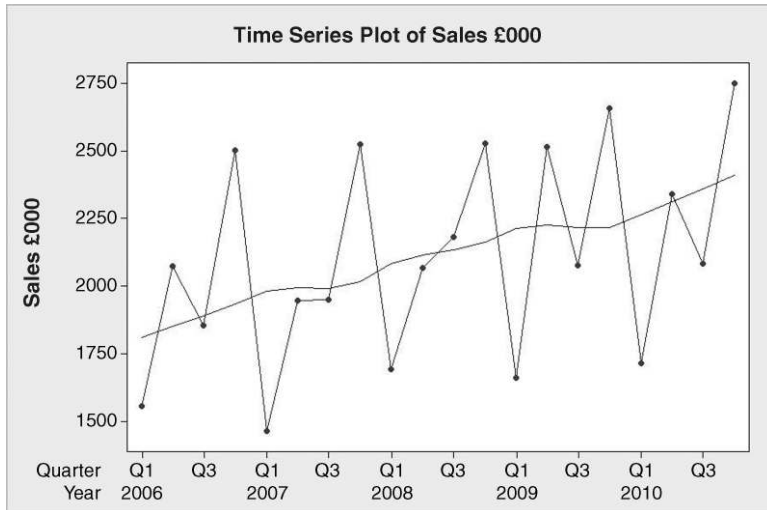


Figure 11.4 Time series plot of sales with smoother.

enable access to these. The second gives example output from the command (in this case a plot) and a **Data** button giving access to a description of the data used. The third pane provides interpretation of the output together with a **More** button that provides access to further information that is shown in Figure 11.6. The reader should note that clicking on any word or

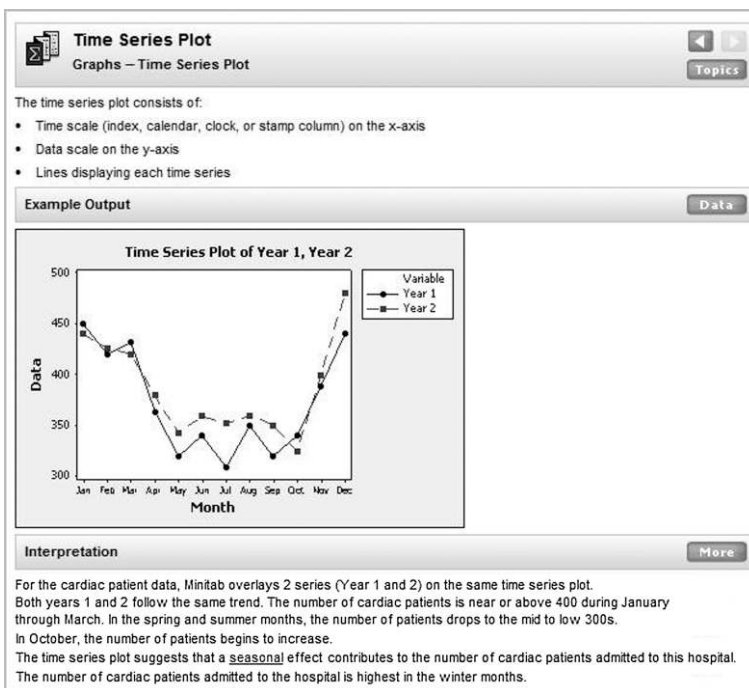


Figure 11.5 StatGuide for time series plot.

Time series plots versus other plots
You can create several plots to display data collected in chronological order:

- Time series plot – Use when you want to examine trends in your data over time. You can use time series plots in conjunction with other time series functions, such as forecasting.
- Area graph – Use to view a series of data divided into categories. Minitab plots time series data on the y-axis versus time on the x-axis, and shades the space below each line. Data are stacked, displaying the proportion each series contributes to the whole.
- Control charts – Use to detect out-of-control points for variable or attribute data collected over time.
- Scatterplot – Use when your data are not chronologically ordered, or if the data collection intervals are irregular. You will need to provide the time values along with the **time series** data.

time series
Sequence of measurements of some numerical quantity made at some regular interval.

Figure 11.6 StatGuide information on time series plots versus other plots.

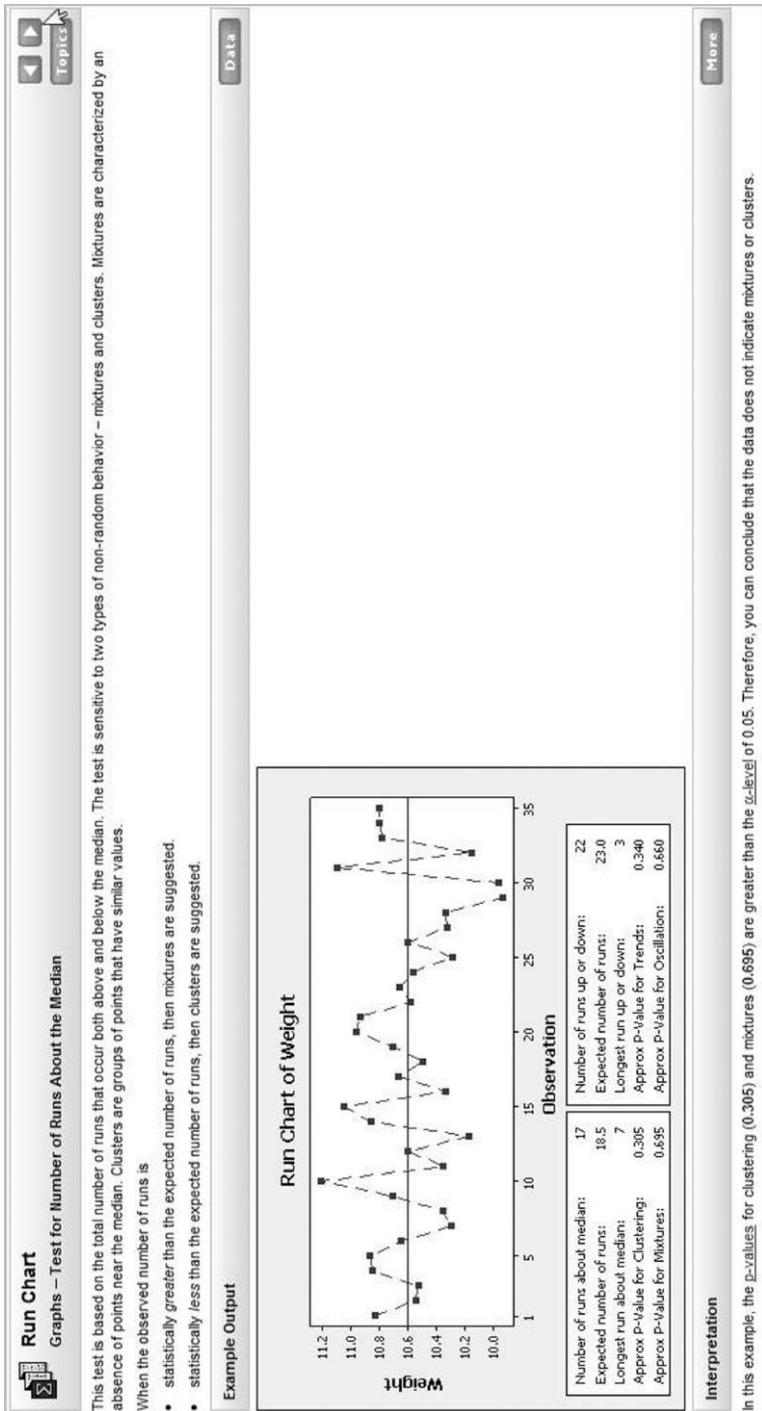


Figure 11.7 StatGuide information on test for number of runs about the median.

Results for: DTNTIME.MTW							
One-Sample Z: DTNTime							
Test of mu = 19 vs < 19							
The assumed standard deviation = 6							
Variable	N	Mean	StDev	SE Mean	Bound	Z	P
DTNTime	25	16.28	6.83	1.20	18.25	-2.27	0.012

Panel 11.1 Hypothesis test for door to needle time data.

phrase that is underlined leads to explanatory information being displayed such as the definition of a time series in Figure 11.6. It is interesting to note that no mention is made of run charts! Arrow keys are provided for navigation.

As a second example of the use of StatGuide, the reader is invited to open the Minitab worksheet `Scottish_Mean_Annual_Temperatures.MTW` and to create a run chart of mean annual temperatures using **Stat > Quality Tools > Run Chart . . .** Clicking on the StatGuide icon reveals two windows as in the previous case. A summary is given in the top pane of the window on the right and further topics may be accessed either by using the arrow keys or by using the drop-down menu that appears on clicking the **Topics** button. The right-hand window is displayed in Figure 11.7 following use of the arrow keys to locate information on the test for number of runs about the median. The middle pane gives example output and information on the associated data set via the **Data** button. The bottom pane provides interpretation of the output together with a **More** button that provides access to further information.

As a final example, recall the door to needle time data considered at the beginning of Chapter 7 and the test of the null hypothesis $H_0: \mu = 19$ versus the alternative hypothesis $H_1: \mu < 19$. It was assumed that the standard deviation was 6. The Session window output is shown in Panel 11.1. The data are available in `DTNTime.MTW`.


With the Session window active, clicking on StatGuide and selecting from **Topics** the one entitled Hypotheses yields the display in Figure 11.8. Once again additional information may be explored using the buttons, drop-down menus and arrow keys or by using the **Contents**, **Index** and **Search** tabs in the left-hand window. StatGuide information may also be accessed using **Help > StatGuide**.

11.1.4 Tutorials

A set of tutorials may be accessed via **Help > Tutorials**. The contents of the library of tutorials are displayed in Figure 11.9. With P Chart selected the right-hand window displays the information in Figure 11.10.

Note the **Uses** (current), **Data** and **How To** tabs in the top left-hand corner of the window. **Data** provides answers to the questions ‘What kind of data is required?’ and ‘What should my worksheet look like?’. **How To** provides guidance under the headings:

- Scenario
- Choose the appropriate analysis



One-Sample Z
Test of the Mean – Hypotheses

◀ ▶
Topics

When you use the Z-procedures, you are really trying to decide which of two opposing hypotheses seem to be true, based on your sample data:

- H_0 (the null hypothesis). That μ is equal to the reference value
- or -
- H_1 (the alternative hypothesis). That μ is not equal to the reference value. (By default, H_1 is nondirectional. However, a directional hypothesis can be specified instead.)

Example Output

Test of $\mu = 15$ vs not = 15
The assumed standard deviation = 2.6

Variable	N	Mean	StDev	SE Mean
Fat Content	13	16.600	2.066	0.721

Variable	95% CI	Z	P
Fat Content	(15.187, 18.013)	2.22	0.027

Interpretation

Suppose a delician wants to know the following: Based on the mean of the sample, is it likely that the actual mean saturated fat content for the oil is different from the advertised value of 15%? Thus, your hypotheses are $H_0: \mu = 15$, and $H_1: \mu \neq 15$.

Figure 11.8 StatGuide information on hypotheses for a one-sample z-test.

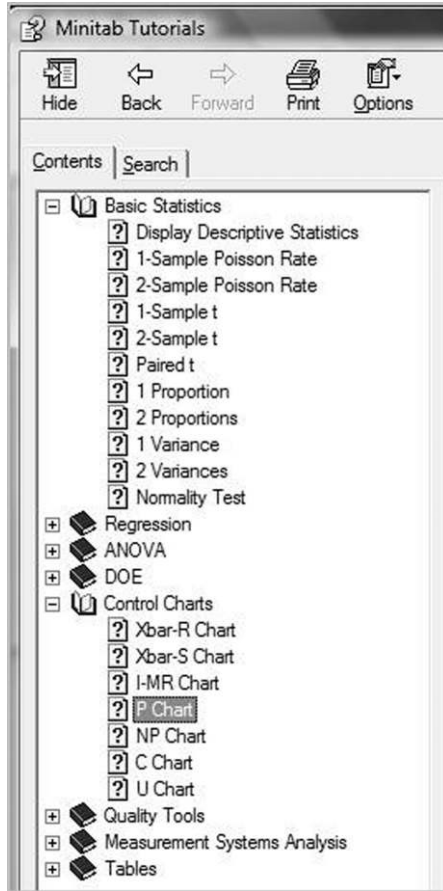


Figure 11.9 Contents of library of tutorials.

- Enter your data
- Specify options
- Interpreting the output

with the final one stating ‘Now what? For guidance on interpreting the results of this analysis, see StatGuide’!

11.1.5 Assistant

This new facility in Minitab 16 provides interactive decision trees for users to follow on the topics following:

- Measurement system analysis
- Capability analysis

Uses	Data	How To	P Chart
Use 1: To monitor the stability of your process			
<p>A bakery isn't alarmed when a few loaves of bread are burnt, but a surge in the percentage of burnt loaves is a serious problem. Even very stable processes vary somewhat, and trying to fix minor fluctuations in a process can actually cause instability. A P chart monitors the proportion of defectives that are produced in your process and alerts you to those changes that could signal a problem that is worth addressing.</p>			
Use 2: To determine whether your process is stable and ready for improvement			
<p>A call center is disappointed with the number of incomplete sales calls. It struggles to fix the problem by changing its calling script. However, a sudden influx of new, inexperienced operators has made the process unstable, which makes it difficult to tell what effect the process changes may have. A process needs to be stable before you attempt to fine tune it, and a P chart can confirm (or deny) this stability.</p>			
Use 3: To demonstrate improved process performance			
<p>A construction company has received unacceptably high numbers of defective smoke detectors from one of its suppliers. The construction company wants to know for certain that the supplier has reduced process variability. Your customers, employees, and management want clear proof that you have improved a process. A P chart before and after an improvement can provide that proof.</p>			

Figure 11.10 Part of tutorial on the P chart.

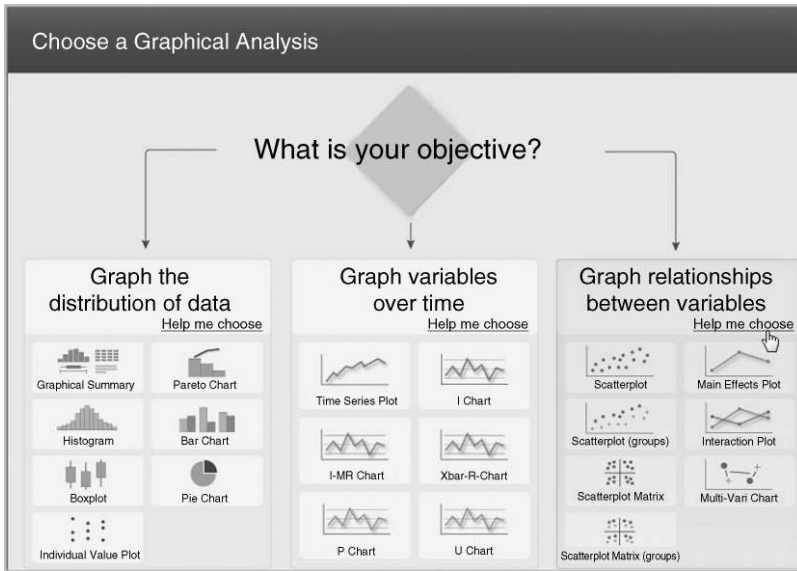


Figure 11.11 Assistant help on graphing relationships between variables.

- Graphical analysis
- Hypothesis tests
- Regression analysis
- Control charts.

Suppose that you would like guidance on carrying out graphical analysis of the data in Vehicles.MTW giving engine capacity (litres) and fuel consumption (litres per 100 km) for a sample of 20 cars. Figure 11.11 indicates how, having decided that the objective is to graph relationships between variables, Assistant provides further help in the form of the decision tree shown in Figure 11.12 by clicking on **Help me choose**.

One could select a path through the tree to reach a decision through visual scrutiny of the tree or one could **Click to start** and proceed interactively. Figure 11.13 shows the outcome of clicking on the first decision box.

In Figure 11.13 the mouse pointer is shown as the author was about to click on **Next** in order to select the **Association between variables** option and to advance to the next step. Thus **Association between variables** with **One continuous X** (engine capacity) and **No groups** leads the user to the **Scatterplot** option (bottom left of the tree in Figure 11.12) with the display in Figure 11.14.

The user is informed that a scatterplot shows the relationship between a continuous *X* (engine capacity) and a continuous *Y* (fuel consumption). Some guidelines are provided: to view the detail one must click on the relevant + sign. In Figure 11.14 the guidelines on examining the regression equation and the model fit are displayed. In order to create the scatterplot the user simply uses the **Click to Create Graph** icon. In the dialog box that appears

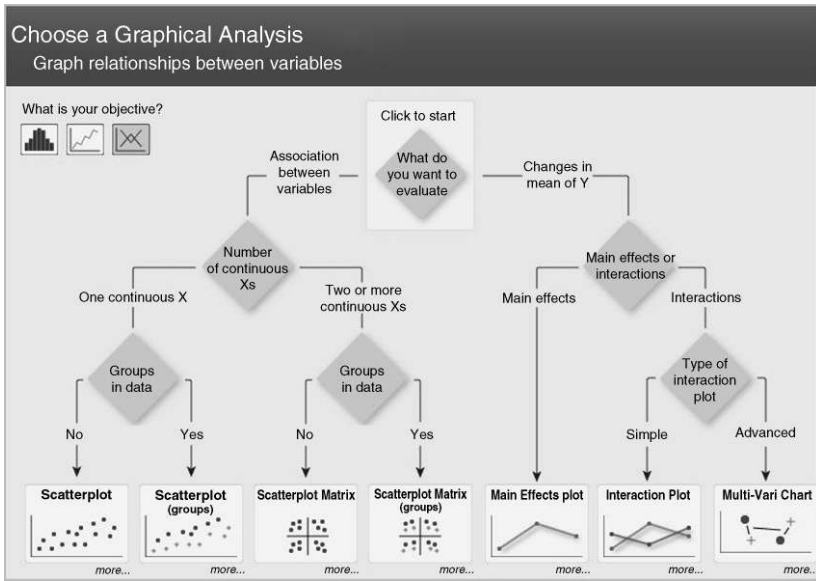


Figure 11.12 Decision tree for choosing a graphical analysis.

consumption is specified as the *Y* column and capacity as the *X* column. On clicking **OK** and moving the mouse pointer to the fitted line on the plot, the display in Figure 11.15 is obtained. (Note that the dialog for the creation of the scatterplot via the Assistant is simpler than that obtained via **Graph > Scatterplot...**).

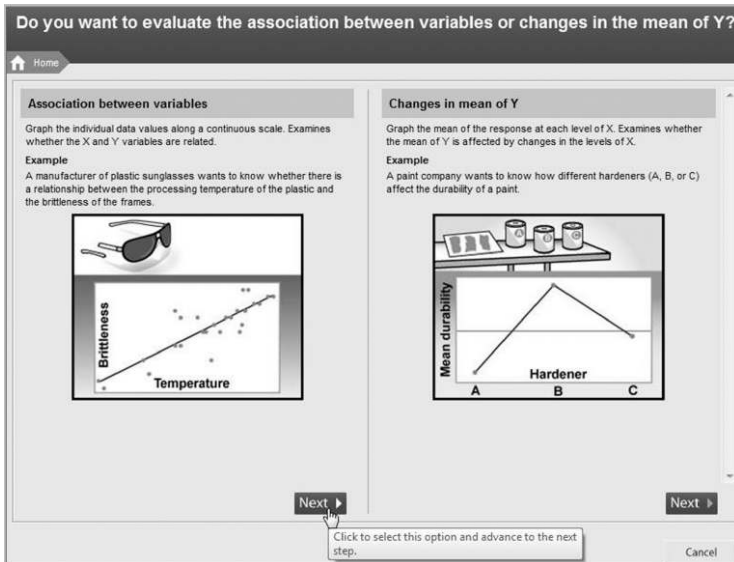


Figure 11.13 Assistance with first decision.

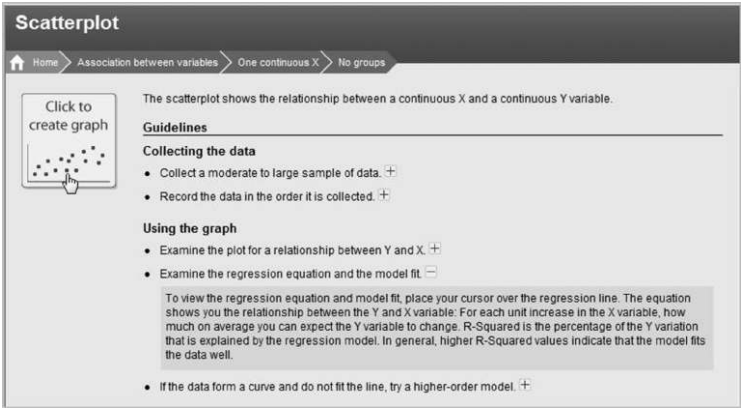


Figure 11.14 Scatterplot outcome via interactive decision tree.

The line provides a reasonably good fit to the data. The R^2 value indicates that 87.5% of the variation in fuel consumption may be attributed to engine capacity. Substituting capacity 3 into the equation yields consumption of 10.6. Thus the model fitted to the data predicts that, on average, cars with 3-litre engine capacity would consume 10.6 litres per 100 km.

Once again the reader is urged to explore use of the Assistant. As Minitab develops further in the future perhaps books such as this will become redundant!

11.1.6 Glossary, methods and formulas

Help > Glossary provides access to a statistical glossary. As indicated in Figure 11.16, a statistical term of interest may be sought either via the **Index** tab or using the **Search** tab.

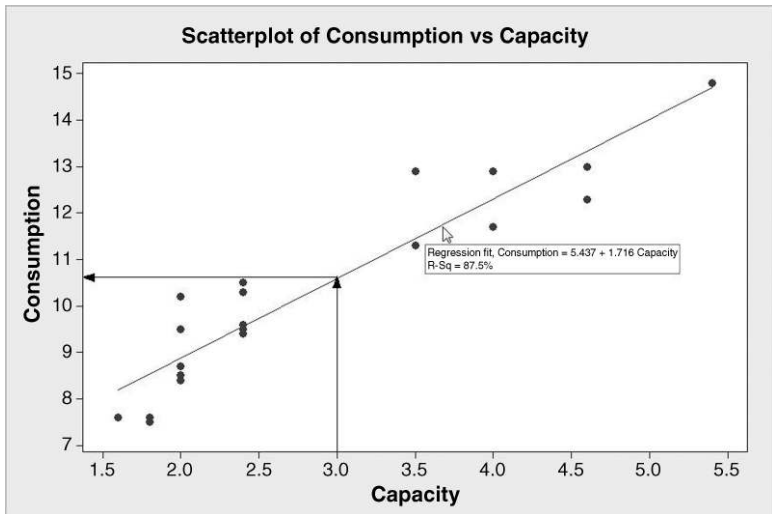


Figure 11.15 Scatterplot with fitted regression line.

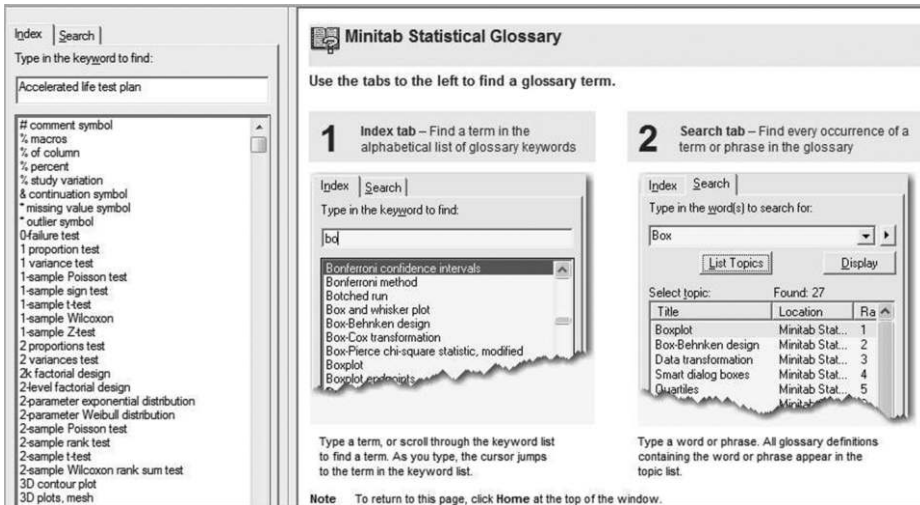


Figure 11.16 Statistical glossary.

For example, if one wished to obtain information on R^2 (R-squared) in regression then clicking on the **Search** tab, entering ‘R’ in the search window and clicking on **List Topics** reveals a list including R-squared. Double-clicking on this entry in the list reveals the explanation shown in Figure 11.17.

Should the details of how R-squared is calculated be of interest, then **Help > Methods and Formulas > Regression > General Regression > R²** yields the required information shown in Figure 11.18.

Further information on methods and formulas in regression may be obtained by clicking on relevant items in the **General Regression** list shown.

11.1.7 Minitab on the web and Knowledgebase/FAQ

Either **Help > Minitab on the Web** or **Help > Knowledgebase/FAQ** accesses the Minitab website and a wealth of information. The home page displayed in Figure 11.19 was accessed using **Help > Minitab on the Web** and shows seven tabs: **Products, Training, Support, Academic, Store, Company** and **Theater**. The **Theater** tab provides access to a number of videos: Getting Started, Analysing Data, Assessing Capability, Data Manipulation, Graphing Data, Creating Control Charts, Using the Assistant Menu and Navigating Projects. The reader is urged to watch these in order to reinforce his or her understanding of the software and the statistical methods.

The Knowledgebase and answers to frequently asked questions may be accessed either using **Help > Knowledgebase/FAQ** or using the link at the bottom left of the home page. In Chapter 5 reference was made to the Deming funnel experiments. The displays in Figure 5.47 were created using a Minitab macro. Suppose that you wish to obtain a copy of the macro so that you can demonstrate the plots (in glorious colour!) to colleagues. Performing a search of the knowledgebase using the phrase Deming funnel led to the display in Figure 11.20.

The single result from the search performed has identification number ID 1259, and clicking on this leads to a display of the solution to the query – see Panel 11.2. The reader is

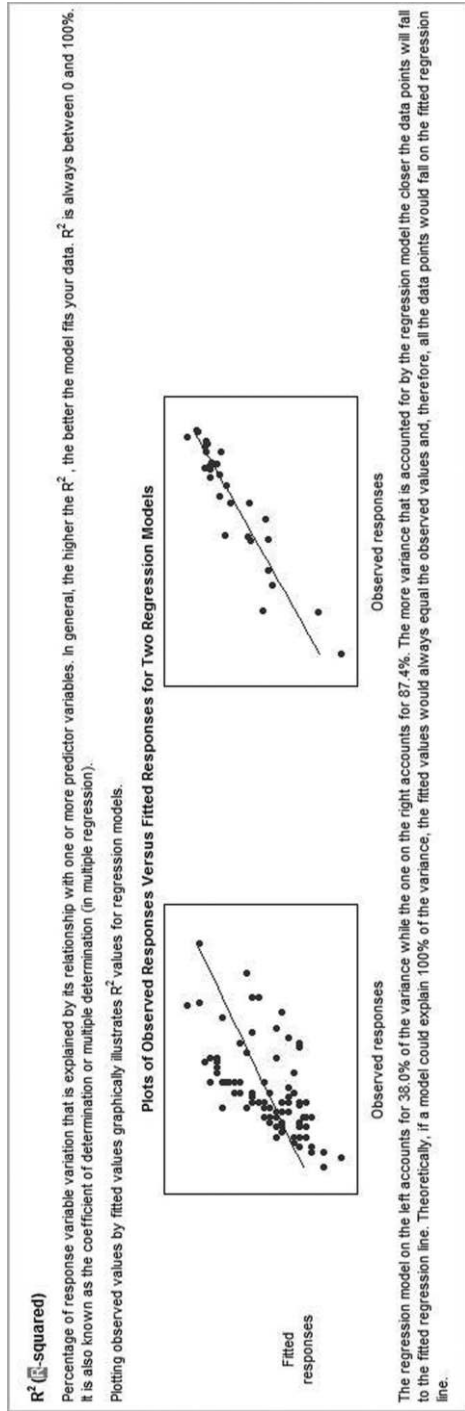


Figure 11.17 Glossary explanation of R-squared.

General Regression

Methods	Analysis of variance	Fits and residuals	Diagnostic measures
Weighted regression	S	Fitted value	Leverages
Box-cox transformation	R^2	Standard error of the fitted value	Cook's distance
Regression model	Adjusted R^2	Residuals	DFITS
Regression equation	Sum of squares	Standardized residuals	Pure error lack-of-fit test
Coefficients	Degrees of freedom	Deleted (Studentized) residuals	Variance inflation factor
Coefficients	MS Regression	Prediction	Durbin-Watson statistic
Standard error of the coefficient	MS Error	Confidence interval	Model characteristics
t-value	MS Total	Prediction interval	XX inverse
p-value	F	PRESS	Design matrix
	p-value	Predicted R^2	
	Sequential sum of squares		

R² (R-sq)

Coefficient of determination; indicates how much variation in the response is explained by the model. The higher the R^2 , the better the model fits your data. The formula is:

$$r^2 = 1 - \frac{SS\ Error}{SS\ Total} = 1 - \frac{\sum(y_i - \hat{y}_i)^2}{\sum(y_i - \bar{y})^2}$$

Notation

y_i = i^{th} observed response value

\bar{y} = mean response

\hat{y}_i = i^{th} fitted response

Figure 11.18 Formula for calculation of R-squared.

invited to access the link and to follow steps 2 and 3 so that the macro may be used as an example in the next section.

The Minitab Help menu also provides **Keyboard Map...**, **Check for Updates**, **Licensing...**, **Contact Us** and **About Minitab** which will not be referred to further. It should be noted that under the **Support** tab **Online Support** enables one to create an account with Minitab in order to seek help from the company's experts.



Figure 11.19 Minitab on the web.

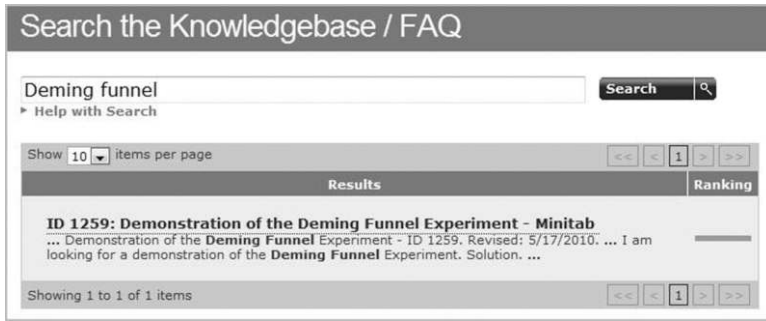


Figure 11.20 Knowledgebase search result.

Solution

You can use the Demonstration of the Deming Funnel Experiment macro, available from our Macros Library, for a demonstration of the Deming Funnel Experiment.

The Deming funnel experiment showed that an inappropriate reaction to common cause variation makes matters worse. With Minitab's SPC commands, the data is displayed graphically so that the performance of a process can be evaluated and a proper course of action for improvement determined.

Note: The macro produces data in the worksheet. Please make sure there is an empty worksheet active before running the macro.

1. Click the link, Demonstration of the Deming Funnel Experiment Macro, below.
2. To the right of the Demonstration of the Deming Funnel Experiment description, click Code. You can also click Documentation for information about this macro.
3. Save the page as a macro, called FUNNEL.MAC, in your Minitab macros directory (for example C:\Program Files\Minitab\Minitab 16\English\Macros). For instructions, click **How to save this page as a macro** at the top of the Code page.
4. In the Session window at the command prompt MTB>, type the following and then press Enter:

```
%FUNNEL
```

Note: To display the command prompt, activate the Session window and choose Editor > Enable Commands.

Related documents

- [Demonstration of the Deming Funnel Experiment Macro](#)

Panel 11.2 Instructions for downloading a Minitab macro.

11.2 Macros

11.2.1 Minitab Session commands

Each day the accident and emergency department at a hospital records the number of patients admitted (Patients) and the number of patients who wait for more than 2 hours to see a doctor (Number). The file December2010.xls includes data for December 2010. Each month an individuals (X) chart of the percentage of patients who waited for more than 2 hours to see a doctor is required, with tests for evidence of special causes 1, 2, 5 and 6 implemented.

```

MTB > WOpen "C:\Users\Public\Documents\Second Edition\Chapter
11_Dev\Ch11_Data\December2010.xls";
SUBC> FType;
SUBC> Excel.
Retrieving worksheet from file:
'C:\Users\Public\Documents\Second
Edition\Chapter 11_Dev\Ch11_Data\December2010.xls'
Worksheet was saved on 09/01/2011

Results for: Sheet1

MTB > Name C4 'Percentage'
MTB > Let 'Percentage' = 'Number' / 'Patients' * 100
MTB > IChart 'Percentage';
SUBC> Test 1 2 5 6.

I Chart of Percentage

MTB >


```

Panel 11.3 Session window output for control chart of percentages.

The reader is invited to set up a new Minitab project and, with the Session window active, to use **Editor** to select **Enable Commands**. The MTB > prompt will appear in the Session window. Open the file December2010.xls. Use **Calc > Calculator**, with **Store result in variable:** Percentage and **Expression:** 'Number'/'Patients' * 100 specified using **Select** and the keyboard in the dialog box, to compute the required column of percentages, and **Stat > Control Charts > Variables Charts for Individuals > Individuals...** to create the required chart.

The Session window will appear as shown in Panel 11.3. Note the command prompt MTB > and the subcommand prompt SUBC >. As an alternative to using the menus and dialog boxes in Minitab one may perform tasks by typing session commands and subcommands directly into the Session window (once commands have been enabled as described above.) For example, typing the command Runchart c3 1 into the Session window, and pressing the enter key, creates a run chart of the data. Alternatively, Runc 'Percentage' 1 may be used; many commands may be abbreviated to the first four letters and variable names in quotes may be used instead of column numbers.

Information on Session commands is available via **Help > Help > Session Commands**. (The first version of Minitab that the author used was Release 7. It was entirely driven using session commands, and on occasion he finds it quicker to carry out work with a series of typed commands rather than using the menus. However, many whose first introduction to Minitab is via Release 16 may never use session commands.)

Suppose that we had omitted to activate the third test for evidence of special causes on the control chart. Use of **Window > Project Manager** and clicking on the **History** folder or clicking on the History icon  reveals the Session commands generated as the tasks described earlier were performed. The pair of commands requiring editing may be highlighted as shown in Figure 11.21 – a command and any associated subcommands must all be highlighted for editing. When highlighting more than one line, keep the control key pressed after highlighting the first and click on the remaining lines requiring highlighting.

On selecting **Edit > Command Line Editor** the final line may be edited to read Test 1 2 3 5 6. Clicking on **Submit Commands** causes the individuals chart to be re-created with the additional test implemented. The History folder now contains two additional lines. The two

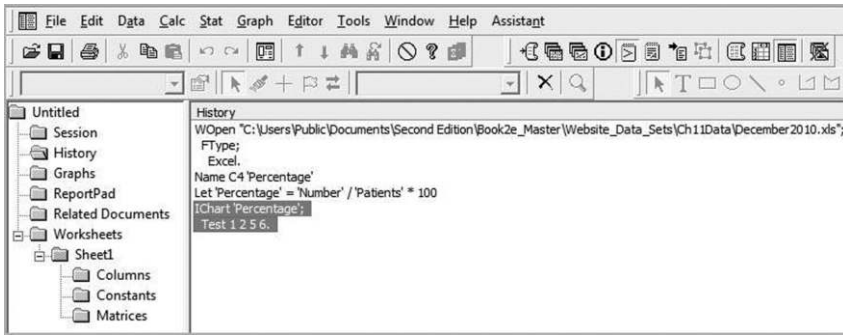


Figure 11.21 Session commands in History folder.

lines highlighted in Figure 11.21 may be deleted together with the first three lines that are the commands for reading the data from one particular file. A right click reveals a menu. Selection of **Save History As...** enables the commands for the creation of the control chart of the monthly data to be saved as an exec file.

The reader is invited to select **Save History As...** and to choose **Save as type: Exec Files (*.MTB)** and to save the commands in a file named Monthly.MTB. On opening the file November 2010.xls in Minitab the commands stored in the exec file may be implemented using **File > Other Files > Run an Exec...** Accept one, the default number of times to execute the set of stored commands, select the file Monthly.MTB and click **Open**. The commands will be executed, the percentages calculated and displayed on the control chart. Of course the set of tasks being carried out by the exec in this case is small, but the example serves to illustrate the potential value of an exec for carrying out repetitive routine tasks.

11.2.2 Global and local Minitab macros

An exec is one form of Minitab macro. In addition, one can create global and local macros. An exec file may be converted into a global macro by using Notepad and adding three lines of text to the set of commands stored in the exec file as indicated in bold in Panel 11.4.

The first and last additional lines *must* be gmacro and endmacro, and the second additional line is the macro name. The file may then be stored as IChart.MAC, with the extension. MAC indicating that it contains a Minitab macro. Instructions for this may be found by carrying out the Knowledgebase search displayed in Figure 11.20 and following the guidelines thereby

```

gmacro
IChart
Name C3 'Percentage'
Let 'Percentage' = 'Weight > 2' / 'Patients'*100
IChart 'Percentage' ;
  Test 1 2 3 5 6.
endmacro
    
```

Panel 11.4 Global macro for creation of control chart of percentages.

obtained that are displayed in Panel 11.2. If it is stored in the Macros folder in the Minitab 16 folder then it may be invoked simply by typing the command %IChart in the Session window. Alternatively, the file may be stored as a text file named Ichart.txt and invoked by typing the command %Ichart.txt in the Session window.) Readers are encouraged to try this out for themselves. If the file is not stored in the Macros folder then the path must be specified. Readers are also encouraged now to try out the Deming funnel experiment macro they were invited to download in Section 11.1.5. The file FunnelBU.txt is supplied for the benefit of any reader unable to make the download.

In creating a local macro one is essentially writing a program that can involve variables and control statements such as **if** and **goto**, in addition to Minitab commands. Global macros operate directly on the current worksheet. Local macros are more complicated and hence more difficult to write. The term ‘local macro’ is used because this type of macro creates a ‘local worksheet’ during the running of the macro that is erased from the computer memory once the macro has been executed. Arguments and variables may be passed between the global and local worksheets during the running of a local macro. Details of the creation of local macros will not be covered in this book. Readers wishing to learn more about local macros will find comprehensive information available via **Help > ? Help** and a single click on **Macros** under the **References** heading in the **Minitab Help** window.

Some macros require information from the user. For example, the Minitab macro for the creation of the Bland–Altman plot in Figure 9.13 requires the user to indicate the two columns that contain the measurements. Thus if the macro is stored as blandalt.MAC in the Minitab Macros folder it would be invoked using %blandalt c2 c3 to create the plot in Figure 9.13 as the second and third columns of the supplied worksheet Outside_Diameters.MTW contain the measurements. The reader is invited to re-create the plot.

An example of a macro that requires numerical information to be provided via the keyboard is the macro blankch for the creation of a blank Xbar or individuals (X) control chart. As an exercise the interested reader could use the macro to create a blank chart for the Xbar chart component of Figure 5.13. The rod cutting process had historical mean and standard deviation of 60.00 and 0.02 respectively, and the samples were of size 4.

11.3 Further features of Minitab

In reliability and survival statistics interest often centre on the time to failure of a system, T . The survival or cumulative failure function is an alternative name for the cumulative distribution function of the random variable T . **Stat > Reliability/Survival** provides facilities for the display and analysis of data for time to failure of systems. Breyfogle (2003) devotes four chapters to reliability topics.

In a paper on multivariate methods and Six Sigma, Yang (2004, p. 94) made the following comments.

Multivariate statistical methods are powerful methods that are playing important roles in many fields. Data mining and chemometrics are among the successful applications of multivariate statistical methods in business and industry. However, multivariate statistical methods are seldom applied in Six Sigma practice as well as quality assurance practice in general . . . multivariate statistical methods can play important roles in Six Sigma (DMAIC) practice.

The multivariate procedures provided by Minitab are available under **Stat > Multivariate**. Johnson and Wichern (2001) give a comprehensive account of applications of multivariate statistical methods.

Comprehensive facilities for the analysis and modelling of time series are also provided under **Stat > Time Series**. Of particular importance for quality improvement are models that take into account time series in which autocorrelation is present. Montgomery (2009, pp. 527–545) gives further details and references.

11.4 Quality Companion

Six Sigma product and process improvement invariably involves work being done by project teams. Minitab Quality Companion[®] Release 3.0 is a project management aid that includes a variety of tools that are widely used in Six Sigma quality improvement. Minitab claims that Quality Companion simplifies quality initiatives by providing the soft tools need to develop, organize and execute projects. With tools, files and data in a single project file, project teams are able to focus less on managing details and more on reaching goals. Using Quality Companion it is possible to:

- create a plan of action with a Roadmap[™];
- centralize and share project data;
- standardize project deliverables with built-in forms;
- customize data and forms to meet the needs of the organization;
- map processes and assign data to any process step;
- establish the flow of value through the organization;
- organize ideas and challenges with brainstorming tools;
- create presentations to keep stakeholders informed;
- guide project teams with templates and coaches.

The default DMAIC project template provided by the software contains a Roadmap based on the Six Sigma stages: define, measure, analyse, improve and control. However, customization of the template is possible for use with quality improvement strategies other than Six Sigma. An overview is provided in *Getting Started: Quality Companion[®] 3* (Minitab Inc., 2009), available as a PDF at http://www.minitab.com/uploadedFiles/Shared_Resources/Documents/Brochures/companion3getstarted.pdf. The software provides coaches to help the user select an appropriate statistical method to analyse process data captured, for example, before and after a process change. The analysis capture tools enable output from Minitab analyses to be added to a Quality Companion project and Minitab project files may readily be added as related documents. Figure 11.22 displays a Quality Companion project window with Minitab output. Note the Project Manager window on the left with components of DMAIC.

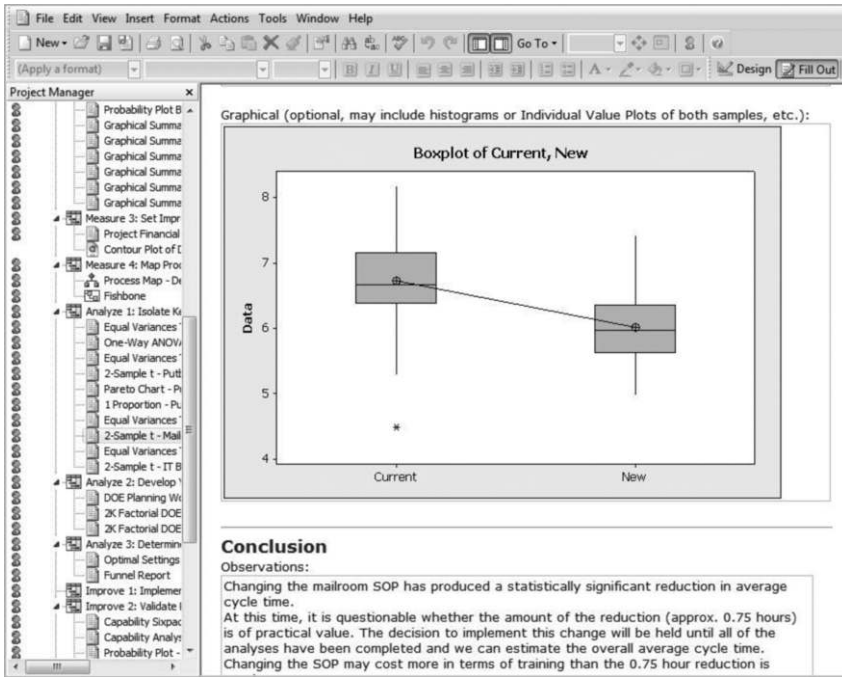


Figure 11.22 A Quality Companion project incorporating Minitab output.

11.5 Postscript

Hoerl and Snee (2005) claim that ‘Six Sigma is the best way we have found to actually deploy statistical thinking broadly’. The author makes no apology for presenting for a second time in this book, in Box 11.1, the summary of the measure, analyse, improve and control phases of DMAIC given by Hoerl (1998). Statistical thinking has a major role to play in all four phases and Minitab is a powerful and versatile tool for the application of statistical tools that may be used to foster understanding of variation and to reduce it.

Measure – Based on customer input, select the appropriate responses (the Ys) to be improved and ensure that they are quantifiable and can be accurately measured.

Analyze – Analyze the preliminary data to document current performance or baseline process capability. Begin identifying root causes of defects (the Xs or independent variables) and their impact.

Improve – Determine how to intervene in the process to significantly reduce the defect levels. Several rounds of improvement may be required.

Control – Once the desired improvements have been made, put some type of system into place to ensure the improvements are sustained, even though additional Six Sigma resources may no longer be focused on the problem.

Box 11.1 Description of key phases in applying Six Sigma methodology.

Invariably the author learns something new each time he uses Minitab – it provides a vast and growing resource. It is his earnest hope that the reader has benefited from study of this book and will continue to learn more about Six Sigma and other strategies for quality improvement and the statistical tools that are vital for their successful implementation.

In a presentation on the future of Six Sigma, Antony (2010) made the following points:

- Six Sigma is on the upswing in financial and healthcare services and its application in small and medium-sized enterprises will continue to grow in the years to come.
- ‘Six Sigma has been very successful – perhaps the most successful business improvement strategy of the last 50 years’ (Montgomery, 2005b).
- Six Sigma will continue to evolve. However, the key concepts and sound principles of Six Sigma will stay for many years whatever the ‘next big thing’ will be.

So good luck as you tackle the exciting and rewarding task of using Minitab to apply statistical methods to product and process improvement in the context of Six Sigma or other improvement methodologies and remember that, whenever you are dealing with data, ‘Display is an obligation’!