

# **A Minitab Guide to Statistics**

**SECOND EDITION**

**Ruth Meyer • David Krueger**

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## PREFACE

*A Minitab Guide to Statistics* was written to introduce professionals and students to Minitab, a general purpose statistical computer system. This guide gives comprehensive information on the use of Minitab in statistics. Included are statistical concepts and techniques that are generally covered in a basic statistics course.

### More About Minitab

Minitab was developed at Penn State in 1972 for students in introductory statistics courses. Since then, Minitab has evolved into a comprehensive statistical system that is also used by students in advanced data analysis courses, and by scientists, engineers, and managers in business, government, and industry. Minitab is the international standard for the teaching of statistics. It is used at more than 5,000 sites in 60 countries.

Minitab runs on PCs, Macintosh computers, workstations, minicomputers, and mainframes. Although there are some differences in Minitab across releases and computer platforms, the commands and worksheet are basically the same.

This guide was developed for use with Minitab Release 13 as well as prior releases. All dialog boxes, graphs, and other output are produced with Release 13. If you have a different Minitab release, most of the commands are compatible, but the output may differ. We also worked all examples with Minitab Student Release 12. Menu and session commands and output are quite similar to Release 13, but some simulations in Chapter 6 will have to be reduced in size because of available memory.

### Features

This guide illustrates the use of Minitab in organizing and analyzing data. As statistical concepts are introduced in each chapter, we present appropriate Minitab commands, and provide step-by-step descriptions of how to effectively use Minitab. Interesting real world data sets are used throughout the guide in examples, and exercises which conclude each chapter. A computer diskette containing many of the data sets is available. The Appendix describes the large data sets. We have chosen examples and exercises from myriad professions, including business, education, government, health, medicine, and sports.

The chapters in this guide are designed to correspond to chapters of leading statistics texts. The final chapter of the supplement describes a survey sampling project. The objectives of the project are to illustrate the use of Minitab in questionnaire evaluation and to provide a review of statistical techniques.

## How to Use this Guide

The only way to learn Minitab is by doing Minitab. Since this software is relatively easy to use, you will experience success very quickly as you produce professional graphs within a short time. We encourage you to redo the examples that we have included in this guide. Most of the data sets are on a disk; the menu path and session commands are provided for each example. After you have mastered our examples, try the exercises at the end of the chapters.

Minitab works with data in a worksheet of columns and rows, very much like a spreadsheet. The commands are available through menus or through a command language in the Session window. If you are using Windows, you probably will use menu commands more often; however, menu and session commands can be used interchangeably. We show menu paths and session commands side-by-side for each example.

Clicking on a menu usually opens a dialog box allowing you to select variables and choose options. You will find dialog boxes throughout the guide. To select variables, you need to have the cursor in the box in which you want to enter the variables. Then highlight the variable(s) in the list of variables box and press *Select* or double-click on the variables. You can also type the column number or name in the box. We indicate this step in the menu path with the word *Select* followed by the name of the column.

As we name new columns or constants in a dialog box, we indicate this in the menu path with the word *Enter* followed by a column name. Minitab automatically uses the next available column or constant. Since the commands are printed in the session window, you can follow the action.

If you are using only session commands, you can follow the step-by-step list of commands to the right of the menu paths. The success will depend on the version of Minitab that you are using. Check the *Help* facility if you get an error message.

## Where to find More Information about Minitab

There are additional texts available for information on Minitab. We recommend the *Minitab User's Guides* from Minitab, Inc. You can also access Minitab information 24 hours a day on the World Wide Web at the address below. There you can download Minitab macros, find press releases, capabilities lists, and product information, and view graphical samples. Information about Minitab software and texts may be obtained from:

Minitab, Inc.  
3081 Enterprise Drive  
State College, PA 16801-3008

Telephone: 1-814-238-3280  
Fax: 1-814-238-4383  
Website: [www.minitab.com](http://www.minitab.com)

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## CHAPTER 1

# INTRODUCTION TO MINITAB

Minitab<sup>1</sup> is a computer software package that can increase your understanding of statistics and decrease your calculation time. It was originally designed to be an easy-to-use statistical system to help in the teaching of statistics. It has evolved into a powerful package for data analysis and graphics. In this chapter we give a general view of how Minitab works, and illustrate some menu and session commands to enter, print, and save data.

## MINITAB COMMANDS INTRODUCED IN THIS CHAPTER

END	INSERT	NAME	PRINT	READ
SET	STOP			

### 1.1 ACCESSING MINITAB

Minitab is available on PC and Macintosh computers, minicomputers, or mainframes. Although there are some differences in Minitab across releases and computer platforms, the commands and worksheet are basically the same.

## MICROCOMPUTER ENVIRONMENT

If you use a microcomputer, you need to be familiar with the operating system, the directory and path names, disk drives, and diskettes. If you need more practice with these features, please refer to your system's user guide.

With the Minitab user interface, you can type commands and subcommands in the session window or you can execute them by choosing from menus and by completing dialog boxes. The commands and corresponding output are given in the session window. In addition, you can copy, edit, and execute previous commands.

To use a Windows version of Minitab, you need to know the basics of Windows. This includes moving and resizing windows, using menus, and using dialog boxes. If you are not familiar with these basics,

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<sup>1</sup> Minitab is a trademark name of Minitab, Inc.

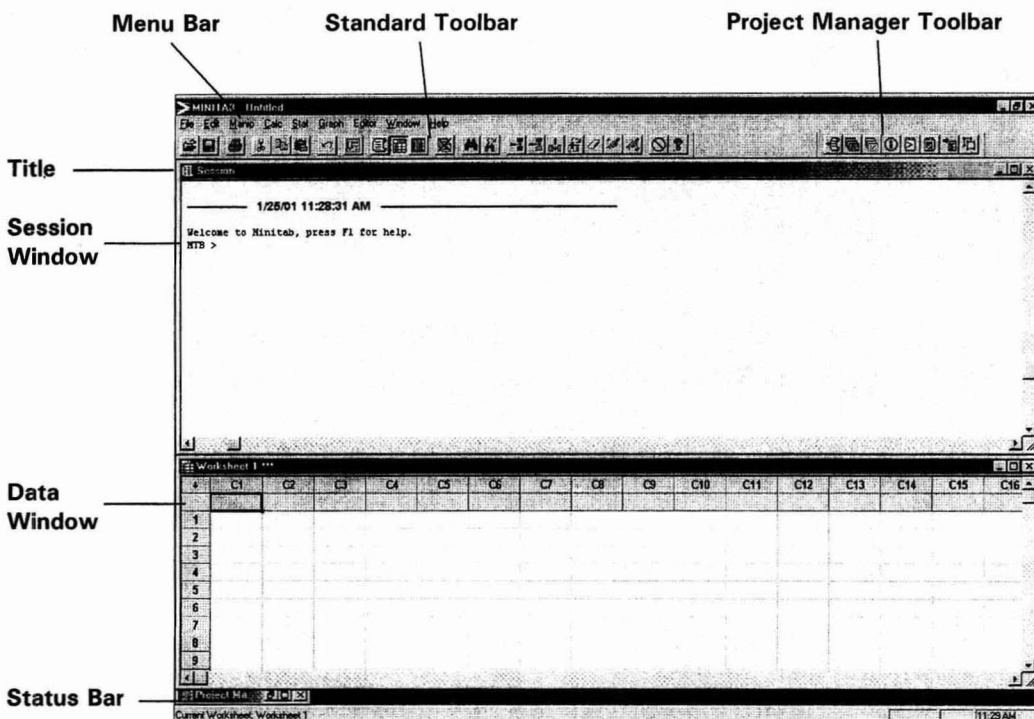


please refer to documentation or the online help facility on Windows.

To start Minitab using Windows, double click the shortcut to Minitab icon on the desktop or choose the path:

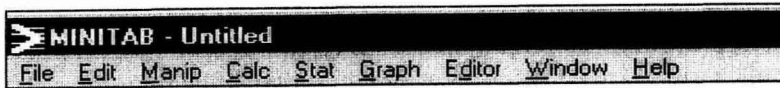
**Start ► Programs ► MINITAB 13 for Windows ► MINITAB**

The screen that you will see is similar to that shown below. It contains the session and data windows, menu bar, standard and project manager toolbars, and status bar. These windows can be repositioned or resized.



The **session window** lets you create a program by typing commands and subcommands. Typically menu and session commands, subcommands, and the corresponding output are displayed as they are executed. Data entered in the session window are also displayed. The **data window** allows you to enter data in a worksheet either by typing, generating, or importing data from a file.

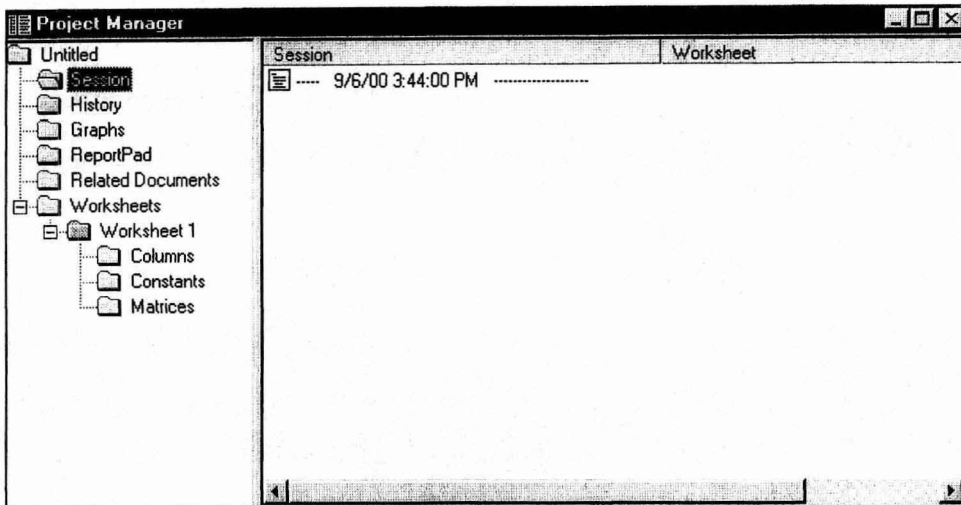
Across the top is the **menu bar**, from which you can open menus and choose commands. Click on a menu item, then click again to open a submenu, execute a command, or open a dialog box. Menu items that are dimmed are not currently available for use.



For example, if you choose the path

**Window ► Project Manager**

the following screen is opened.



Minitab's **project manager** is new in Release 13. It allows you to better organize and manage your work. The following folders contain commands, data, output, graphs, and other related documents.

- **Session** Use this folder to copy, delete, or print output and graphs from the session window. You can append contents of the session window to the ReportPad.
- **History** This folder contains all the commands used during a project session. Use this folder to repeat a sequence of commands or to create a macro (described in Chapter 2).
- **Graph** Use this folder to manage all graphs. You can delete, arrange, or append graphs to the ReportPad.
- **ReportPad** This is Minitab's new word processor to create reports. Right-click output or graphs to add to the ReportPad. You can edit and print a report from the ReportPad, or copy to another word processor such as Microsoft Word.
- **Related Documents** This gives a list of other related non-Minitab files, documents, or

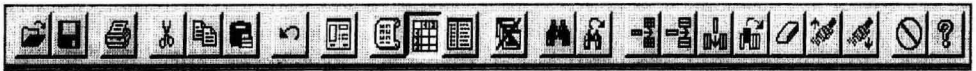
Internet URLs for reference or other use.


- **Worksheet** Use this folder for information on worksheets including columns, constants, counts of columns, missing values, and matrices.

The **project manager toolbar** provides shortcuts to these folders.

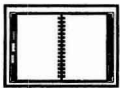


The **standard toolbar** displays buttons for commonly used functions; the buttons change depending on which window is active. Place your mouse pointer over the button to see its name. Here is the standard toolbar when the data window is active.



For example, the icons  cut, copy, and paste cells in the data window.

The **status bar** at the bottom of the screen displays explanatory text for the menu item or toolbar button you are currently using.



#### NOTE

*We use Release 13 for Windows to illustrate all examples in this guide. The session window commands and corresponding output are provided in each example. If you are using other releases of Minitab, most of the commands have the same arguments and subcommands; some of the output may differ slightly. Refer to the Minitab User's Guide for your Release or the HELP facility for specific information on commands that differ from the examples in this guide. We worked all examples with Minitab Student Release 12 and added notes in the simulation examples where you may have insufficient memory.*

## MAINFRAME VERSION

If you use a mainframe computer, you need to learn how to 'log on' to the system. Generally the log on procedure requires you to enter an account number, a user name or user identification, and a password.

If you are successful with the log on procedure, you are in the computer's operating system. The

computer usually gives you information about the system, and then a system prompt. It expects you to respond with a system command. The procedure for accessing Minitab varies, but generally, you need to type the word **Minitab** following the system prompt. The system responds with the version of Minitab that it has in its library, some information on Minitab, and the MTB > prompt. You can then enter Minitab session commands.

## 1.2 MINITAB WORKSHEET

Minitab works with data in a worksheet of columns and rows. Usually, a column contains the data for one variable, with an observation in each row or a data point in each cell. Columns are denoted C1, C2, C3, . . . , and rows within columns are numbered 1, 2, 3, and so on. Most Minitab work is done in columns. The first row is reserved for column names.

↓	C1	C2	C3	C4	C5	C6
	<i>Name</i>					
1						
2						
3						
4						

Multiple worksheets are available with **Minitab Release 13** with each worksheet allowing up to 4,000 columns. The numbers of rows and cells depend on the memory allocation. You can control this if you choose

### Edit ► Preferences ► General

Move the slider in the memory usage section somewhere between the following endpoints:

- **Share nicely.** Minitab will share more memory with other programs currently running.
- **Use as much as necessary.** Minitab will use as much memory as necessary, sharing less memory with other programs currently running.

Multiple worksheets are also available with **Student Release 12** with each worksheet allowing up to 1,000 columns with 5,000 data points. The size is displayed on the screen when you start Minitab.

## WORKING WITH THE WORKSHEET

This section gives more details on Minitab's worksheet. Usually a column contains the data for one variable, with an observation in each row or a data point in each cell.

### Columns

- A column contains alpha or numeric data (date/time is a third type of data). The type of data can be assigned or changed.
- Minitab identifies a column as alpha or numeric by the first value entered in that column.

### Rows

- Individual rows can be accessed by specifying the row number in parentheses following the column number or name; C1(9) denotes the ninth row of C1.
- The subscript can be any expression which produces a positive integer. C1(COUNT(C2)) denotes the row of C1 corresponding to the number of observations in C2.

### Cells

- Cells in a data window contain values that you enter or generate with commands.
- Cells do not contain formulas as in Microsoft Excel and Lotus 1-2-3.

## MINITAB CONSTANTS

Minitab can store individual numbers, such as an average or standard deviation, in constant locations denoted K1, K2, K3, . . . **Constants** are created by LET or by any command that produces a single number answer. An example is MEAN, the command that calculates the arithmetic average. The result of the command is automatically printed; you need to print the stored constant to view it. For example, if a column named Scores contains test results, the MEAN command below calculates, prints, and stores the mean in a constant K1. The PRINT command prints K1.

```
MTB > MEAN 'Scores' K1
```

```
Mean of Scores
```

```
Mean of Scores = 76.600
```

```
MTB > PRINT K1
```

```
Data Display
```

```
K1      76.600
```

For more advanced work, Minitab has **matrices** denoted M1, M2, M3, . . . Each matrix can store one

table of numbers. The number of available matrices depends on your computer.

When you begin a Minitab session, the worksheet is blank. During the session, you enter data in the worksheet, work with the data, and then you can save to a file for future use. Minitab reminds you to save your work before you end a session.

## 1.3 MENU AND SESSION COMMANDS

Minitab commands are available through the menus or through a command language in the session window. These commands, called menu commands and session commands, can be used interchangeably.

### USING MENU COMMANDS

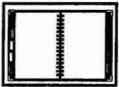
To use menu commands, click on an item in the menu bar to open the menu, execute a command, open a submenu, or open a dialog box. If a menu item is dimmed, it is currently unavailable.

For example, to open the data window, click the **Window** menu, then click **Worksheet**. *This path is shown in this guide as*

**Window ► Worksheet**

Choosing a command from a menu usually opens a **dialog box** allowing you to select variables and choose options. To select variables, you need to have the cursor in the box in which you want to enter the variables. Then highlight the variable(s) in the list of variables box and press **Select**. The variable(s) will appear in the box with the cursor.

You can name new columns in a dialog box. For example, when you use the Calculator function, you can name a column or constant in which to store the results. Minitab will automatically use the next available column or constant.



#### NOTE

*The **OK** button in the dialog box is usually the last button to press to activate a command. Pressing the **Enter Key** is the same as the OK button. You want to be sure the dialog box is completed before you press OK or the Enter key. For all the exercises in this guide, we provide the steps and the variables to select, and use **OK** after the final step is complete.*

## USING SESSION COMMANDS

Session commands are useful alternatives to menu commands, especially when you want to use macros to automatically repeat a series of commands. Most session commands are simple, easy to remember words, like PLOT, SAVE, or SORT.

You can execute session commands in either the session window, or by using the command line editor. To execute commands in the session window, type the commands at the MTB > prompt. If the MTB > prompt is not displayed in the session window, choose

### **Editor ► Enable Commands**

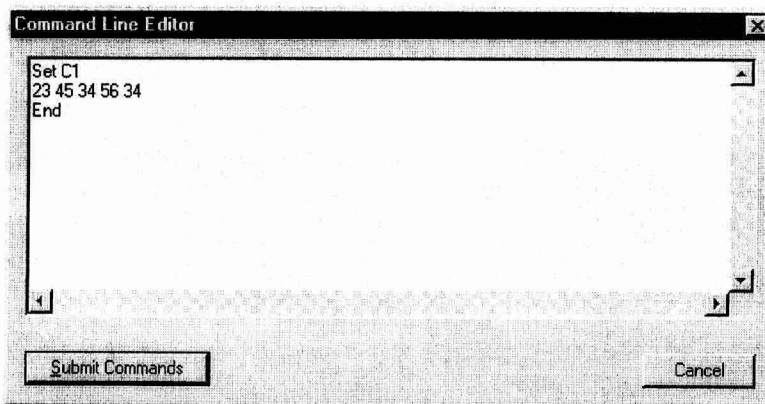
The command line editor lets you edit a set of commands and data before you actually execute the commands. To execute commands using the command line editor, choose

### **Edit ► Command Line Editor**

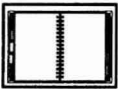
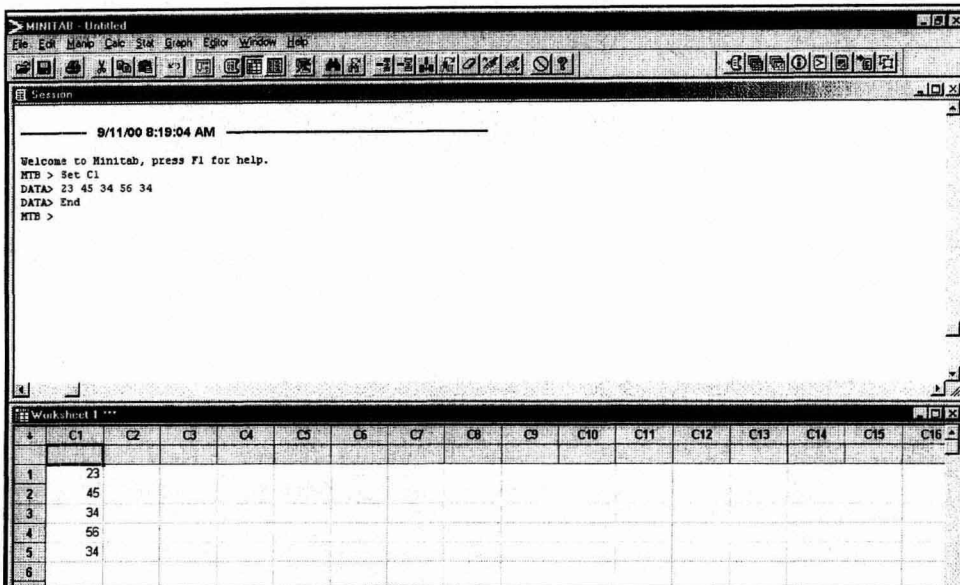
and type, paste, and edit commands in the command line editor window. Then click

### **Submit Commands**

to execute the commands in the session window. For example, type the following lines in the command line editor:



and click Submit Commands. The data will be entered in column C1.



### NOTE

*Minitab has several hundred different commands, some of which have options and subcommands. Whenever we introduce a command or subcommand, we give a brief description, the Release 13 for Windows menu command in bold print, and the session commands with arguments and subcommands. Refer to the **HELP** facility for additional information concerning other Minitab versions.*



## MORE ON SESSION COMMANDS

This section gives details on Minitab's command structure. Commands have arguments to identify columns and constants. Most commands have subcommands to specify options or to provide additional output. Subcommands are very similar to menu command options.

### Commands

- Type the command and arguments in proper order on the command line. *No extra text is allowed on the command line*
- Each command must begin on a new line. If a command does not fit on one line, use the **ampersand symbol &** or two plus ++ symbols at the end of the command line. Minitab responds with **CONT>**, and you can continue the command.

### Subcommands

- To use one or more subcommands, end the command line with a semicolon and a **SUBC>** prompt will appear on the next line.
- Type the subcommands and arguments in proper order, ending each line with a semicolon.
- End the last subcommand line with a period. If you forget to place a period, you will get the **SUBC>** prompt; enter a period on that line.
- If you make a mistake, enter **ABORT** on a new subcommand line. This cancels the command and all subcommands.

### Specifying Arguments

- An argument entered on a command or subcommand line can be a column, constant, text string, or a number.
- Enter column numbers (C1) or column names ('Sales'), stored constants (K5) or names ('Mean'), or a computer file ('Problem2.mtp').
- Enclose text strings such as titles or file names in double quotes ("Population of the Fifty States").
- Enclose a constant in double quotes if you want to use it as text ("1999").
- Abbreviate a set of consecutive columns or stored constants with a dash (PRINT C1-C5 is the same as PRINT C1 C2 C3 C4 C5).
- Abbreviate a sequence of numbers with a colon (1:5 is the same as 1 2 3 4 5).

## 1.4 ENTERING DATA FROM THE KEYBOARD

Minitab provides many ways to enter data in a worksheet. You can type data in the data or session windows, open a file, paste data from the clipboard, or generate data. This section shows you how to enter data from the keyboard in both the data and session windows and how to generate patterned data. Minitab uses alpha or text data, numeric data, and date/time data. Although some commands such as those for input, output, and editing work with alpha data, most Minitab commands work only with numeric data. Alpha data, for example the names of companies, are often used as row labels.