

Introduction to *Minitab*

(Student Version 12 and Professional Version 13)

O V E R V I E W

In this lab, you will become familiar with the general features of *Minitab* (*Student Version 12 and Professional Version 13*) statistical analysis software, as well as some specialized features for conducting introductory statistical analysis and graphing.

OBJECTIVES

By the end of the laboratory, you will be able to



- Enter data in *Minitab*.
- Save both **Projects** and **Worksheets**.
- Use *Minitab*'s pull down menus and the submenus.
- Calculate with columns of data.
- Use *Minitab* to calculate descriptive statistics.
- Draw histograms, boxplots, and scatterplots.

EQUIPMENT

- PC with *Minitab*
- Computer diskette to save files

B A C K G R O U N D M A T E R I A L

Minitab is statistical analysis software. It can be used for learning about statistics as well as statistical research. Statistical analysis computer applications have the advantage of being accurate, reliable, and generally faster than computing statistics and drawing graphs by hand. *Minitab* is relatively easy to use once you know a few fundamentals.

Note: The computer icon, , indicates you will need to complete the procedure on the computer. The book icon, , indicates that you will need to read the information.

OPENING MINITAB IN WINDOWS 95, 98, NT, OR XP



Open *Minitab* following the steps below.

- Click the **Start button** in the bottom left hand corner of the screen.
- Select **Programs >Minitab for Windows>Minitab** (or **Minitab 12 Student**).

Or

- Double click the **Minitab icon** on the desktop.
- **Minitab** will open.



GENERAL LAYOUT



When you first open *Minitab*, you will see **two windows**, a *Session window* and a *Worksheet window*.

- **Session Window:** The area that displays the statistical results of your data analysis and can also be used to enter commands.
- **Worksheet Window:** A grid of rows and columns used to enter and manipulate the data. Note: This area looks like a spreadsheet but will **not** automatically update the columns when entries are changed.

Other windows include

- **Graph Window:** When you generate graphs, each graph is opened in its own window.
- **Report Window:** Version 13 has a report manager that helps you organize your results in a report.
- **Other Windows:** *History and Project Manager* are other windows. See *Minitab* help for more information on these if needed.

DATA TYPES



- **Numerical:** Numerical data is the only type *Minitab* will use for statistical calculations. Numerical data is aligned on the right side of the column. *Minitab* will not recognize numbers with commas as numbers but will consider them text.
- **Text:** Text cannot be used for computations. Though “text” generally means words or characters, numbers can be classified as text. If column 1 has text in it, the column label will change from *CI* to *CI-T*. Data types can be changed. See the details in the Manipulating Data section.

- **Date/Time:** *Minitab* recognizes 3/5/00 as a date and 4:30 as a time but will store these internally as a number so you can manipulate them. The column label will indicate a date or time value by putting a *D* after the column name (for example *C1-D*).

ENTERING DATA



You can enter your data going down or across. In the top left corner of the **Worksheet window**, there is a cell with an arrow in it. Click this cell to change the action of the **Enter key**.

- If the arrow is pointing down, then the cursor will go down the column when you press Enter.
- If the arrow is pointing to the right, then the cursor will go across the row, to the next column when you press Enter.



Enter the data from the scenario below.

Scenario

An individual took measurements of the temperature and the amount of water s/he consumed during a three-hour period outside. The data, shown below, was collected for seven randomly selected days during the summer.

Temperature (F)	Water Consumption (ounces)
75	16
83	20
85	25
85	27
92	32
97	48
99	48

Entering data is really two steps: entering column headings and entering data.

1. **Enter the column headings.** Column headings must be entered above Row 1.
 - Enter “Temperature (F)” in the *first cell* in Column 1. (Note: The first cell is above Row 1.)
 - Enter “Water Consumption (ounces)” in *first cell* in Column 2.
2. **Enter the data.** Enter the corresponding temperatures and water consumption in the appropriate column as shown. Do not change the order of the items. Make sure the items were entered as numbers, not text.

Worksheet 1 ***		
↓	C1	C2
	Temperature (F)	Water Consumption (ounces)
1	75	16
2	83	20
3	85	25
4	85	27
5	92	32
6	97	48
7	99	48

Usually, it is best to take time to think about how you will be analyzing the data before you enter it. That can save trouble later. However, if your data is not entered in the best format the first time, you can manipulate it and may not have to re-enter it.

MANIPULATING DATA



Minitab can change data types within limits. You cannot make a simple switch of people's names to numeric values, but if you have a column of numbers that was accidentally entered as text, then you can change those numbers to numeric values. *Minitab* makes the following types of transformations.

N <u>u</u> meric to Text...
T <u>e</u> xt to Numeric...
D <u>a</u> te/Time to Text...
D <u>a</u> te/Time to Numeric...
N <u>u</u> meric to Date/Time...
T <u>e</u> xt to Date/Time...

To make these changes in *Minitab*, from the main menu select **MANIP > CHANGE DATA TYPE**. Then, select the option that you want and fill in the dialog box.



Check to make sure that the temperature/water data has been entered as numbers. If not, change the data to numeric using the **MANIP> CHANGE DATA TYPE** menu.

CALCULATING WITH DATA

You can add columns together, calculate the sum of a column or row, or convert a column's values to their Z-scores. These and other calculations can be completed under the main menu item of **CALC**.



Assume that the data collector for the temperature/water example learned that the thermometer that was used gave incorrect readings. For example, let's say the thermometer read the temperature ten degrees too low. Therefore, we want to create a column called "Temp plus 10" and have Minitab add ten degrees to the temperature in column C1.

1. Label column 3 as "**Temp plus 10.**"
2. Select **CALC > CALCULATOR**.
3. In the "**Store result in variable:**" box, select **C3 (Temp plus 10)**.
4. In the "**Expression**" box, we want to put the expression that tells Minitab to add ten to the contents in the temperature column. To do that, select **C1 (Temperature)**, then click on "+" (the plus sign) found next to the number 9 on the Calculator, then enter the number "10." The result in the expression box should look approximately like '**Temperature (F) + 10**'.
5. Click **OK**.
6. Look in the worksheet window. Column C3 should contain seven temperatures that are each ten degrees higher than the corresponding temperatures in column C1.

SAVING DATA



In *Minitab*, you can save data in two different formats. You can save the worksheet by itself or the entire project. Saving the worksheet as a separate file is a good habit. Then you will always have access to the data, even if the project you are working with becomes corrupted. To save the data in a worksheet by itself

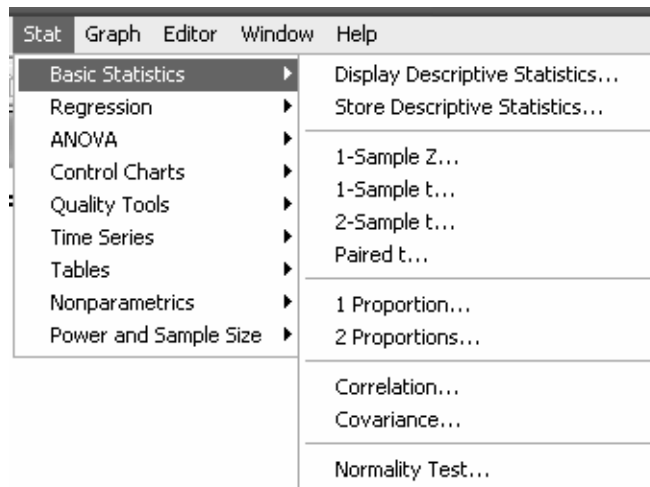
1. Select **FILE > SAVE CURRENT WORKSHEET AS**.
2. Use the arrow beside the **Save in:** field to select the **3½ Floppy (A:)** or the location of your diskette or USB device.
3. In the **File Name** field, type the name of the worksheet. *Minitab* will automatically add the extension **MTW** for *Minitab* worksheet.
4. Click **Save**.

You have saved only the worksheet with the data.

STATISTICAL ANALYSIS



Minitab will conduct a variety of statistical calculations. These are found under the main menu option of **STAT**. Each category also has subcategories. In this introductory lesson, we are interested in the **Basic Statistics**. A menu of the statistics categories and the subcategories for Basic Statistics from *Student Version 12* are shown below. (Note: *Professional Version 13* has additional options.)



For the temperature/water data, find the mean and standard deviation.

You should have the temperature in column C1 and the water consumption in column C2. For this exercise, we will ignore the values in C3.

1. Select **STAT > BASIC STATISTICS > DISPLAY DESCRIPTIVE STATISTICS**.
2. In the Variables box, select **C1 (Temperature)**.
3. Click **OK**.
4. Look in the Session window. You should see the following display:

Descriptive Statistics: Temperature (F)

Variable	N	Mean	Median	TrMean	StDev	SE Mean
Temperat	7	88.00	85.00	88.00	8.47	3.20
Variable	Minimum	Maximum	Q1	Q3		
Temperat	75.00	99.00	83.00	97.00		

Terms in the output and some definitions

- **N** = number of data items in the sample
- **N*** = number of items in the sample that have missing values (N* does not show up when all the items in the sample have values, as in our example.)
- **Mean** = average

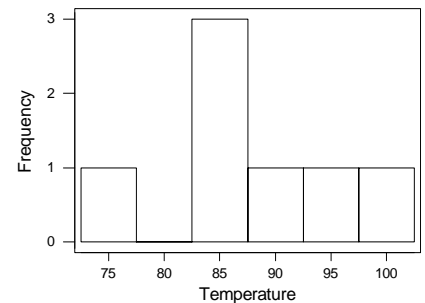
- **Median** = 50th percentile
- **TrMean** = the 5% trimmed mean
- **StDev** = standard deviation
- **SE Mean** = standard error of the mean = standard deviation divided by the square root of the sample size
- **Minimum** = smallest data value
- **Maximum** = largest data value
- **Q1** = 25th percentile = first quartile
- **Q3** = 75th percentile = third quartile

GENERATING GRAPHS

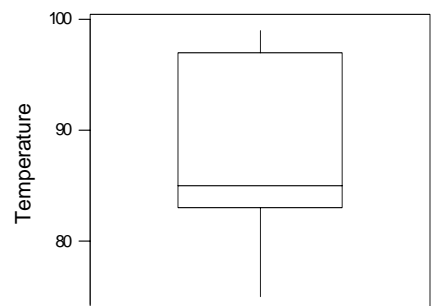


For this example, we will draw a histogram and boxplot of the temperature data and a scatterplot of the water consumption versus the temperature.

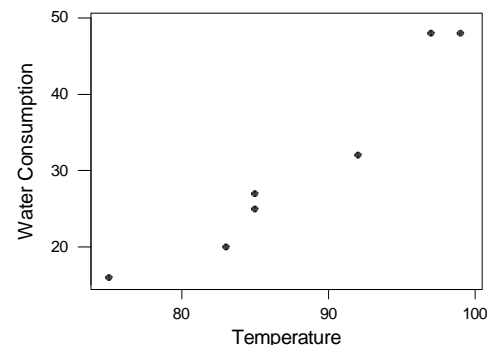
1. To draw a histogram, select **GRAPH > HISTOGRAM**.
2. In the **Graph Variables** box, select **C1 (Temperature)**.
3. Click **OK**.
4. Compare your answer with the resulting histogram shown on the right. (Note: You can change the settings for the width of the bars in the histogram by clicking **Options** on the histogram dialog box and making the desired changes.)



5. To draw a **boxplot**, select **GRAPH > BOXPLOT**.
6. In the **Graph Variables** box under the **Y**, select **C1 (Temperature)**. (Note: The **X** column is for categories. For example if you were graphing GPA by Gender, you would get two box plots, one for each gender. Our data is not broken down into categories, so this option is not relevant for this example.)
7. Click **OK**.
8. Compare your answer with the resulting boxplot shown on the right.



9. To graph a **scatterplot** for the water consumption based on the temperature, select **GRAPH > PLOT**.
10. In the **Graph Variables** box, under the **Y**, select **C2 (Water Consumption)** and under the **X**, select **C1 (Temperature)**.
11. Click **OK**.



12. Compare your graph with the graph shown on the right.

SAVING THE DATA, THE ANALYSIS, AND THE GRAPHS (SAVING THE PROJECT)



Save the project, including graphs on your diskette with the filename *thirstydata*.

- Select **FILE > SAVE PROJECT AS**.
 - Use the arrow beside the **Save in:** field to select the **3½ Floppy (A:)** or the location of your diskette or USB device.
 - In the **File Name** field type “Thirsty Data.” *Minitab* will automatically add the extension **MPJ** for *Minitab* project.
 - Click **SAVE**.
-



Hand-in Assignment

- 1) Find the mean and standard deviation using *Minitab* for the "water consumed" sample data given in this worksheet.
- 2) Draw a histogram and boxplot of the water consumption data.
- 3) Draw a scatterplot of the temperature based on the water consumption. (i.e. Let temperature be the y variable and water consumption be the x variable.) Compare this scatterplot with the one that you created earlier in the tutorial. What do you notice? Which scatterplot is more representative of the original scenario? Why?
- 4) Print the results and graphs from this **Hand-in Assignment** section only. Write your response to the questions in this section directly on the scatterplot printout. Put your name on these pages and hand in **ONLY** these pages.

Introduction to *Minitab*

(Student and Professional Versions 14)

O V E R V I E W

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OBJECTIVES

By the end of the laboratory, you will be able to



- Enter data in *Minitab*.
- Save both **Projects** and **Worksheets**.
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Note: The computer icon, , indicates you will need to complete the procedure on the computer. The book icon, , indicates that you will need to read the information.

OPENING MINITAB IN WINDOWS 95, 98, NT, OR XP



Open *Minitab* following the steps below.

- Click the **Start button** in the bottom left hand corner of the screen.
- Select **Programs >Minitab 14>Minitab 14.**

Or

- **Double click the Minitab icon on the desktop.**
- **Minitab** will open.



GENERAL LAYOUT



When you first open *Minitab*, you will see **two windows**, a *Session window* and a *Worksheet window*.

- **Session Window:** The area that displays the statistical results of your data analysis. (Also used to enter commands and macros.)
- **Worksheet Window:** A grid of rows and columns used to enter and manipulate the data. Note: This area looks like a spreadsheet but will **not** automatically update the columns when entries are changed.

Other windows include

- **Project Manager:** Allows you to navigate, view, and manipulate various parts of your project such as session window output, graphs, worksheets, and related project areas. Note: This window is minimized at startup.
- **Report Window:** Found in the Project Manager for creating, arranging, and editing, reports of your work.
- **Graph Window:** When you generate graphs, each graph is opened in its own window.

DATA TYPES



- **Numerical:** Numerical data is the only type *Minitab* will use for statistical calculations. Numerical data is aligned on the right side of the column. *Minitab* will not recognize numbers with commas as numbers but will consider them text.
- **Text:** Text cannot be used for computations. Though “text” generally means words or characters, numbers can be classified as text. If column 1 has text in it, the column label will change from C1 to C1-T. Data types can be changed. See the details in the Manipulating Data section.

- **Date/Time:** *Minitab* recognizes 3/5/00 as a date and 4:30 as a time but will store these internally as a number so you can manipulate them. The column label will indicate a date or time value by putting a *D* after the column name (for example *CI-D*).

ENTERING DATA



You can enter your data going down or across. In the top left corner of the **Worksheet window**, there is a cell with an arrow in it. Click this cell to change the action of the **Enter key**.

- If the arrow is pointing down, then the cursor will go down the column when you press Enter.
- If the arrow is pointing to the right, then the cursor will go across the row, to the next column when you press Enter.



Enter the data from the scenario below.

Scenario

An individual took measurements of the temperature and the amount of water s/he consumed during a three-hour period outside. The data, shown below, was collected for seven random days during the summer.

Temperature (F)	Water Consumption (ounces)
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Entering data is really two steps: entering column headings and entering data.

3. **Enter the column headings.** Column headings must be entered above Row 1.
 - Enter “Temperature (F)” in the first cell in Column 1. (Note: The first cell is above Row 1.)
 - Enter “Water Consumption (ounces)” in first cell in Column 2.
4. **Enter the data.** Enter the corresponding temperature and water consumption values in the appropriate columns as shown. Do not change the order of the items. Make sure the items were entered as numbers not text.

↓	C1	C2
	Temperature (F)	Water Consumption (ounces)
1	75	16
2	83	20
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5	92	32
6	97	48
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Usually, it is best to take time to think about how you will be analyzing the data before you enter it. That can save trouble later. However, if your data is not entered in the best format the first time, you can manipulate it and may not have to re-enter it.

MANIPULATING DATA



Minitab can change data types within limits. You cannot make a simple switch of people's names to numeric values, but if you have a column of numbers that was accidentally entered as text, then you can change those numbers to numeric values. *Minitab* makes the following types of transformations.

N <u>u</u> meric to Text...
T <u>e</u> xt to Numeric...
D <u>a</u> te/Time to Text...
D <u>a</u> te/Time to Numeric...
N <u>u</u> meric to Date/Time...
T <u>e</u> xt to Date/Time...

To make these changes in *Minitab*, from the main menu select **DATA > CHANGE DATA TYPE**. Then, select the option that you want and fill in the dialog box.



Check to make sure that the temperature/water data has been entered as numbers. If not, change the data to numeric using the **DATA > CHANGE DATA TYPE** menu.

CALCULATING WITH DATA

You can add columns together, calculate the sum of a column or each row, or convert a column's values to their Z-scores. These and other calculations can be completed under the main menu item of **CALC**.



Assume that the data collector for the temperature/water example learned that the thermometer that was used gave incorrect readings. For example, let's say the thermometer read the temperature ten degrees too low. Therefore, we want to create a column called "Temp plus 10" and have Minitab add ten degrees to the temperature in column C1.

7. Label column 3 as "**Temp plus 10.**"
8. Select **CALC > CALCULATOR**.
9. In the "**Store result in variable:**" box, select **C3 (Temp plus 10)**.
10. In the "**Expression**" box, we want to put the expression that tells Minitab to add ten to the contents in the temperature column. To do that, select **C1 (Temperature)**, then click on "+" (the plus sign) found next to the number 9 on the Calculator, then enter the number "10." The result in the expression box should look approximately like '**Temperature**' + **10**.
11. Click **OK**.
12. Look in the worksheet window. Column C3 should contain seven temperatures that are each ten degrees higher than the corresponding temperatures in column C1.

SAVING DATA



In *Minitab*, you can save data in two different formats. You can save the worksheet by itself or the entire project. Saving the worksheet as a separate file is a good habit. Then you will always have access to the data, even if the project you are working with becomes corrupted. To save the data in a worksheet by itself

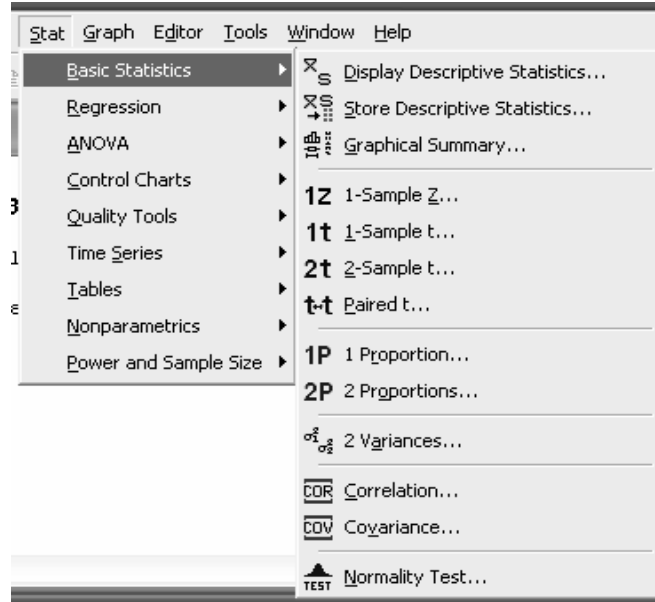
5. Select **FILE > SAVE CURRENT WORKSHEET AS**.
6. Use the arrow beside the **Save in:** field to select the **3½ Floppy (A:)** or the location of your diskette or USB device.
7. In the **File Name** field, type the name of the worksheet. *Minitab* will automatically add the extension **MTW** for *Minitab* worksheet.
8. Click **Save**.

You have saved only the worksheet with the data.

STATISTICAL ANALYSIS



Minitab will conduct a variety of statistical calculations. These are found under the main menu option of **STAT**. Each category also has subcategories. In this introductory lesson, we are interested in the **Basic Statistics**. A menu of the statistics categories and the subcategories for Basic Statistics from Student Version 14 are shown below. (Note: Professional Version 14 has additional options.)



For the temperature/water data, find the mean and standard deviation.

You should have the temperature in column C1 and the water consumption in column C2. For this exercise, we will ignore the values in C3.

5. Select **STAT > BASIC STATISTICS > DISPLAY DESCRIPTIVE STATISTICS**.
6. In the Variables box, select **C1 (Temperature)**.
7. Click **OK**.
8. Look in the Session window. You should see the following display.

Descriptive Statistics: Temperature (F)

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3
Temperature (F)	7	0	88.00	3.20	8.47	75.00	83.00	85.00	97.00

Variable	Maximum
Temperature (F)	99.00

Terms in the output and some definitions

- **N** = number of data items in the sample
- **N*** = number of items in the sample that have missing values (N* may not appear when there is no missing data.)
- **Mean** = average

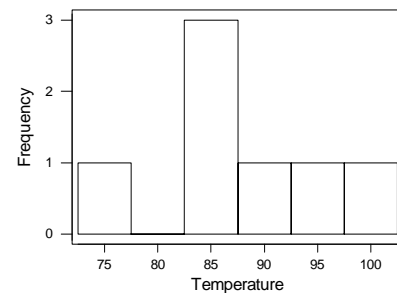
- **SE Mean** = standard error of the mean = standard deviation divided by the square root of the sample size
- **StDev** = standard deviation
- **Minimum** = smallest data value
- **Q1** = 25th percentile = first quartile
- **Median** = 50th percentile
- **Q3** = 75th percentile = third quartile
- **Maximum** = largest data value

GENERATING GRAPHS

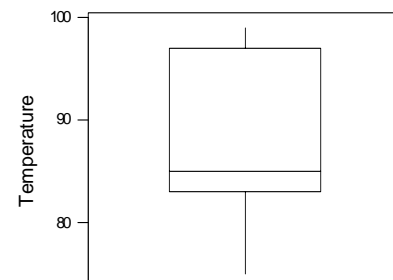


For this example, we will draw a histogram and boxplot of the temperature data and a scatterplot of the water consumption versus the temperature.

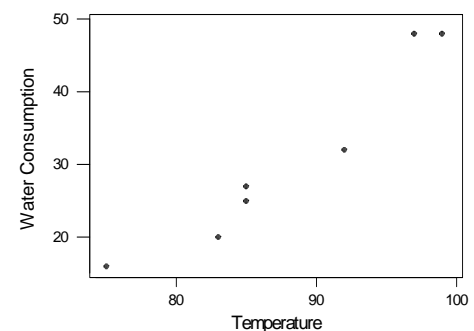
1. To draw a histogram, select **GRAPH > HISTOGRAM**.
2. Choose **Simple** and click **OK**.
3. In the **Graph Variables** box, select **C1 (Temperature)**.
4. Click **OK**.
5. Compare your answer with the resulting histogram shown on the right. (Note: You can change the settings for the width of the bars in the histogram by **clicking the x-axis** and clicking **EDITOR > EDIT X-Scale** and then selecting the **Binning** tab).



6. To draw a **boxplot**, select **GRAPH > BOXPLOT**.
7. Choose **Simple** under **One Y** and click **OK**.
(Note: If your data is broken down into categories, choose another type of boxplot. For example if you were graphing GPA by Gender, you would choose **With Groups** to get two box plots, one for each gender.)
8. In the **Graph Variables**, select **C1 (Temperature)**.
9. Click **OK**.



10. Compare your answer with the resulting boxplot shown on the right.
11. To graph a scatterplot for water consumption based on temperature, select **GRAPH > SCATTERPLOT**.
12. Choose **Simple**, and Click **OK**.
13. In the first row, under **Y**, select **C2 (Water Consumption)** and under **X**, select **C1 (Temperature)**.
14. Click **OK**.
15. Compare your graph with the graph shown on the right.



SAVING THE DATA AND ANALYSIS AND GRAPHS (SAVING THE PROJECT)



Save the project, including graphs on your diskette with the filename *thirstydata*.

- Select **FILE > SAVE PROJECT AS**.
 - Use the arrow beside the **Save in:** field to select the **3½ Floppy (A:)** or the location of your diskette or USB device.
 - In the **File Name** field type “Thirsty Data.” *Minitab* will automatically add the extension **MPJ** for *Minitab* project.
 - Click **SAVE**.
-



Hand-in Assignment

- 1) Find the mean and standard deviation using *Minitab* for the "water consumed" sample data given in this laboratory.
- 2) Draw a histogram and boxplot of the water consumption data.
- 3) Draw a scatterplot of the temperature based on the water consumption. (i.e. Let temperature be the y variable and water consumption be the x variable.) Compare this scatterplot with the one that you created earlier in the tutorial. What do you notice? Which scatterplot is more representative of the original scenario? Why?
- 4) Print the results and graphs from this **Hand-in Assignment** section only. Write your response to the questions in this section directly on the scatterplot printout. Put your name on these pages and hand in **ONLY** these pages.

Introduction to *Minitab*: Activity Solutions



Open *Minitab*.



Enter the data.

Worksheet 1 ***		
↓	C1	C2
	Temperature (F)	Water Consumption (ounces)
1	75	16
2	83	20
3	85	25
4	85	27
5	92	32
6	97	48
7	99	48



Check to make sure that the temperature/water data has been entered as numbers.



Calculate Temperature plus 10.

Intro to Minitab Data.MTW		
↓	C3	C4
	Temp plus 10	
1	85	
2	93	
3	95	
4	95	
5	102	
6	107	
7	109	



For the temperature/water data, and standard deviation.

find the mean

Descriptive Statistics: Temperature (F)

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3
Temperature (F)	7	0	88.00	3.20	8.47	75.00	83.00	85.00	97.00

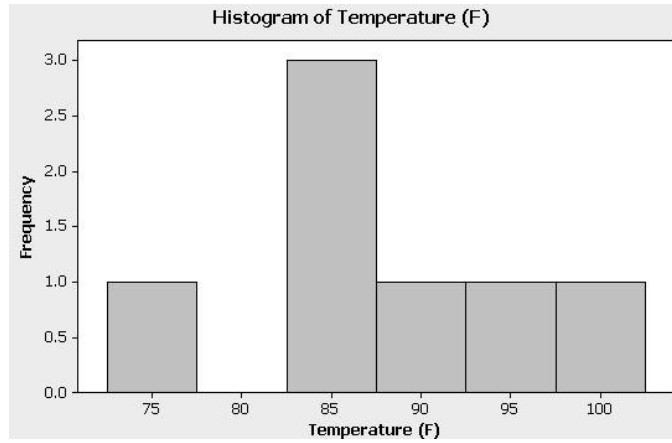
Variable	Maximum
Temperature (F)	99.00

Note: Versions 12 and 13 do not show N* when its value is 0, but do show the 5% trimmed mean (TrMean).

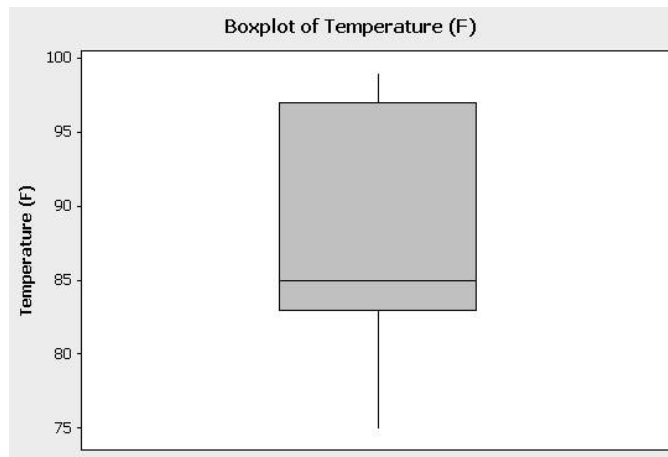


Generate Graphs

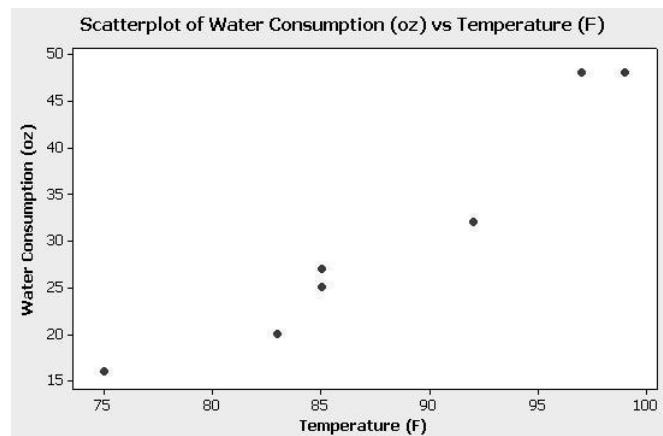
Histogram



Box Plot



Scatterplot



*Versions 12 & 13 may have a slightly different scale.



Save Project.

Introduction to *Minitab*: Assignment Solutions



Find the mean and standard deviation for "water consumed."

Descriptive Statistics: Water Consumption (oz)

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3
Water Consumptio	7	0	30.86	4.82	12.76	16.00	20.00	27.00	48.00

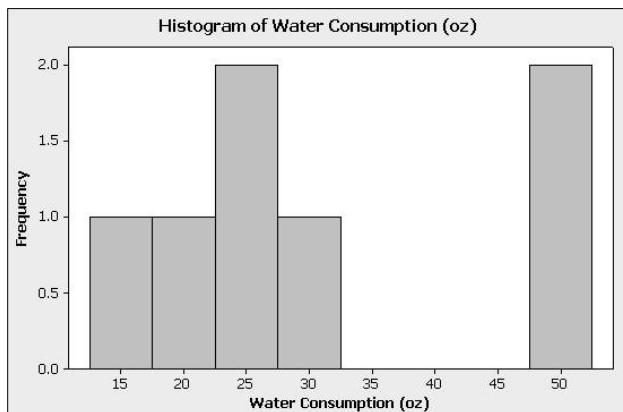
Variable	Maximum
Water Consumptio	48.00

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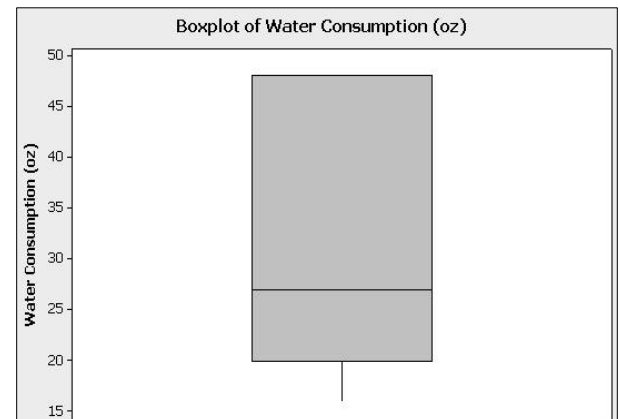


Generate graphs of the water consumption data.

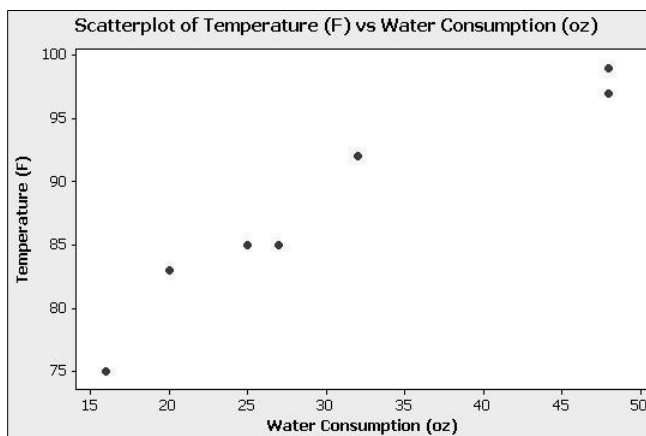
Histogram



Boxplot



Scatterplot



Compare scatterplots.

Both scatterplots show a positive linear relationship between water consumption and temperature. Typically, the independent variable is shown on the horizontal axis. The scatterplot with water on the horizontal axis is less representative of the original scenario because it implies water consumption is the independent variable. If this were true, the temperature would depend on how much water people drink.