Minitab Exercise 1 (Rev8_16, Minitab 17)

In this session you will learn to:

- Learn about Pareto charts
- Create a worksheet
- Enter and edit column data

- Save data
- Do arithmetic
- Create a Pareto chart

A Pareto chart is a bar chart that depicts the frequency or cost (money, time). The ordering of the bars, from most frequent (highest cost) to least highlights the most significant categories. In quality applications, the categories are often defect types.

Consider the following hypothetical scenario: A simple electronic sub-assembly is manually prepared as follows.

Bare Board

Components

→ Manual Assembly → Manual soldering → Visual Inspection
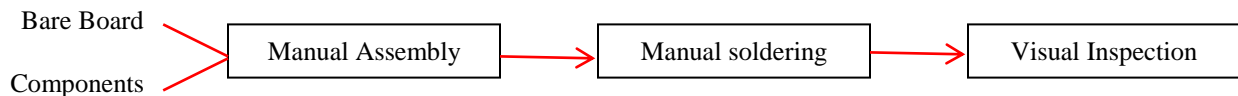
A checklist of defects is made by inspectors of an assembly. The following table lists the day's inspection results by inspector. The data will be used in this session.

Defect type	Inspector/Number of defects of each type found					
	Mary	Jim	Pat	Jason	Marty	Sarah
Missing part	9	8	10	7	8	12
Incorrect assembly	4	3	9	6	2	2
Board Surface finish problem	1	0	3	1	2	1
Solder defect	6	10	7	5	8	3
Other	1	2	0	1	1	3

Step 1 - Start Minitab

Open Minitab.

The start up screen will contain two windows

Session - will display text output such as tables of statistics

Worksheet - is your **data** window here you will enter, edit and view the column data for each worksheet. Each data set that you work with in a project is contained in a worksheet. You can have many worksheets in one project.

Step 2 - Enter column data from the keyboard

To make entries going across a row, click the data direction arrow (above the row numbers) to make it point to the right. The top row (not numbered) is used for the column labels.

1. Label the first column *Defect* and the next columns with the names of the persons who collected the data.

2. Move your cursor back to column 1, row 1.

3. Enter the defect types in column 1. (To make entries going down a column, click the data direction arrow to make it point down.)

4. Enter the remaining data in the chart

You now have two types of data in your chart. Your *defect* column is a text column - notice the -T that appeared by the column number. Numeric data doesn't have an identifier by it. A -D would be added for date/time data. (If for some reason your numeric columns have a T on them, you can change it to numeric under **Data >Change Data Type>Text to Numeric**.)

Step 3. Perform arithmetic

To build the Pareto chart, we need the total frequencies of each defect type. Since you have all the data, you can calculate this new variable using Minitab's calculator. The calculator performs the equation you enter and puts the result in the variable you specify.

1. Choose **Calc > Row Statistics**   Select **Sum.**

2. Move the cursor to the **Input variables** area. Notice that the column names appear in the box on the left. You want the sum for each of the rows so use your cursor to highlight them by clicking on your first data row and dragging the cursor down until all applicable rows are highlighted. Then click **Select** to enter them into the input variables area.

3. You decide to call the new variable *Total*. In **Store results in**, type **Total.** Click **OK.**

Minitab will create a new column called *total* in the first available column.

Step 4. Save your work

It is a good idea to save your work frequently. Now is a good time since you have just completed entering and calculating new data in the worksheet.

1. Choose **File** > **Save Project as**

2. Enter the **file name**. Minitab will automatically add the .MPJ extension once you save the document. Click **Save**.

Step 5. Create a Pareto Diagram

You now have the information you need to create a Pareto Diagram using the frequency data for each defect type.

1. Choose **Stat > Quality Tools > Pareto Chart.**

2. Move cursor to **Defects or attribute data in**. Your defect labels are in C1, so select that from the listing on the right by highlighting it, then clicking **select**. (You could also double click on C1.)

3. Your cursor should now be at **Frequencies in**. Select your total column from the listing.

4. Click on **Options**. In the **X axis label:** enter **Type of Defect**. In **the Y axis label** enter **Frequency**.

5. Move the cursor to the **title** area and enter a title for your graph "**Number of Defects by Type**". Click **OK**.

6. Click OK. The Pareto chart will now appear.

Step 6. More arithmetic

In thinking about your defects, you realize that some defects have a greater cost associated with them than others. We now want a new Pareto chart that orders the defects by cost to the company. The average cost to rework a defect is as shown in the table

Your chart window may be blocking your data window (worksheet) now. To move between different windows, select **Window** then the window you wish to have forward. In this case, you now want to use your worksheet. Or if part of the data window is showing, you can just click on it to move it forward.

Defect type	Cost to rework
Missing part	0.50
Incorrect assembly	2.75
Surface finish problem	5.00
Solder defect	.37
Other	.75

1. Create a new column of data labeled *cost*. Enter the cost associated with each defect type in the column.

2. Choose **Calc** > **Calculator**

3. You decide you need a new variable for the total times cost. The new variable will be called *worth*. In the **Store result in variable** box, type **worth.**

4. In **Expression**, type **total * cost**. (Rather than typing this, you could use the calculator features in the dialog box and select the columns.)

5. Click **OK**

Step 7. Create another Pareto Chart

In this step we create a Pareto which provides us with information as to the defect types that are costing us most.

1. Use your data in worth to create a second Pareto chart. (Refer to step 5 if needed.) Your defect or attribute data column will remain the same, but now you will indicate **worth** for **frequencies in**. Give the axis and graph appropriate titles.

Notice that the graph window names are the same for both graphs. So that you can more easily identify which chart is which you need to rename the graph windows.

2. Choose **Window > Project Manager.** Then click on Graphs in the left window.

3. Click on the graph to be renamed. (If you are not sure which one is which, double click on a graph name. The graph will appear, but the Project Manager window will stay active.) Right-click, select **Rename,** and enter the new name for the graph window as the same as your graph title.

4. Minimize the Project Manager.

5. Choose **File** > **Save Project**.

Step 8. Print or Copy

Copy the graphs to step 9 of this handout. Right click on the graph, the *Copy Graph* to the clipboard. You can then paste it into the handout.

Step 9. Answer the following questions *(Separate handout is provided of this step in word format so that you can type in your responses and submit to the drop box.)*

a. Paste the two charts here.

b. You show your charts to your manager. She asks you how you prepared the chart by worth. Describe the steps would you have to take to prepare a Pareto Chart by worth if you had to create it by hand (not with Minitab)? The description should be such that the manager you are explaining it to could prepare it by hand if she needed to.

c. Compare the two graphs that you generated. What are the most significant differences?

d. Which problems do you think are most significant? Why? (Discussion must refer to the Pareto data and to potential impact on both the company and customer.)

e. Based on the analysis, recommend two approaches for management to take to <u>further investigate</u> significant problems? Make specific recommendations each in a separate paragraph. Incorporate at least two different tools, other than Pareto charts, that were discussed in the lecture.

(Note: Grading rubric on next page provides more information on expectations for each question.)

Grading Rubric - Minitab Exercise 1 Paretos

Points – full credit when all characteristics have been met.

2   Question a.
- Charts have been correctly run.
- Chart title and axis titles appropriately reflect chart.

4   Question b.
- Steps to complete the chart by hand are sufficient for someone not familiar with Pareto charts to prepare such a chart.
- Instructions for all aspects of the generated charts are included.
- Steps are in a logical order and clearly understandable.
- Only steps pertinent to the specified chart are included.
- Description shows understanding of chart concepts

2   Question c.
- Multiple significant differences are correctly identified for the charts
- Differences are identified which would be of importance to management analyzing the charts.

6   Question d.
- At least three problems are discussed.
- Rationale for selection of problems refers to both Pareto chart's data
- Discussion company reflects more than basic interpretation of the charts.
- Impacts to both company and customer are addressed in the response.
- Problems and rationale are clearly written and understandable.

6   Question e.
- Discussion focuses on how to approach investigation into the significant problems including what problem is being addressed and why the approach is being taken.
- Discussion of approach incorporates at least two different tools covered in the Quality Tools Module
- Understanding of the tools is demonstrated with detailed description of how it is applicable to the specific problem.
- The response does not include solutions, but focuses on activities to investigate causes or further clarify the problems.
- There is no redundancy with prior question responses.
- Each approach is covered in its own paragraph.

Other – one point deductions will be made for each of the following
- The assignment is not submitted in pdf format
- The assignment does not utilize the turn-in template provided.
- There are more the 4 misspellings and/or grammar errors.

Note: Expectation is that you use your own words to answer all questions. Any objective evidence of plagiarism will result in an Academic Misconduct Complaint as indicated in the syllabus.