

## **Homework 5 Problems**

### Computer Assignment

- 1) The following data represent the concentration of 50 batches of product (which has a nominal concentration of 50%) (Data also is stored in “HW5\_Computer\_Data.xlsx”)

50.5, 50.8, 50.0, 51.3, 51.0, 51.8, 51.2, 51.9, 50.8, 51.6, 51.9, 51.4, 50.5, 50.8, 51.8, 51.2, 52.8, 51.8, 50.5, 50.6, 51.9, 51.0, 51.8, 51.6, 51.0, 51.2, 51.5, 51.8, 51.3, 51.6, 50.5, 50.5, 50.8, 51.4, 51.4, 51.4, 50.6, 50.5, 51.0, 50.5, 50.3, 51.6, 51.4, 51.7, 52.4, 51.6, 51.8, 51.3, 50.5, 50.8

Use MINITAB to answer the following questions:

Open MINITAB (you will see two windows: session and worksheet), enter the data in a column of a worksheet.

- a) Construct a stem-and-leaf plot of the 50 data points. What is the nature of the distribution (symmetric or skewed)? **MINITAB Instructions:** Select **Graph** followed by **stem and leaf**. Then, enter appropriate column label (for example C1 if your data is in column C1) in variable area. Then click OK. MINITAB will display the plot in the session window.
- b) Draw a histogram for the data. **MINITAB Instructions:** Select **Graph**, followed by **Histogram (select simple)**, enter appropriate column label in *graph variable* area, select bar for *display* and *graph for each*. Click okay. This will create a histogram with a default value of the number of intervals based on the data size and spread in the data. However, if you would like to create a histogram with a desired number of bars (intervals) then perform the following steps: Once histogram is generated, double click on a bar. This action will open a dialogue box. Double click on the ‘Binning’ tab, select number of intervals, enter the desired number of intervals that you would like to use for creating a histogram. Then click OK. MINITAB will display histogram in a new window. Does histogram look symmetric or skewed?
- c) Compute numerical description of the data. **MINITAB Instructions:** Select **Stat**, then **basic statistics**, and finally **Display descriptive statistics**. MINITAB will produce numerical descriptions of the data in the session window. Explain the numerical descriptions. If you click on the **Graph** button of the **Display descriptive statistics** window, MINITAB will allow you to select from a list of graphs, the graphs that you would like it to produce for the data. Select the graphs you would like to produce for the given dataset, and then click on the **OK** button.

## Textbook Assignment

Do the modified problem statements of Chapter 6 of the textbook given below. Interpret your charts and numerical summary in words for each problem for which you are required to produce charts and statistical summary. Use MINITAB to do these problems.

Note:

1. Perform hand calculations when calculating values of sample statistic and verify their values using MINITAB.
2. Use the Microsoft Word file template to prepare your solution. This template file is attached in the Homework 5 Assignment (“HW5\_Computer\_Template.docx”).

6.1.2) Suppose that you multiply all of the observations in a sample by 10. How does this change the sample mean? How does this change the sample standard deviation?

6.1.6) The breakdown time in minutes of an insulating fluid between electrodes at 34kV are given below. (Data also is stored in “HW5\_Computer\_Data.xlsx”)

0.19, 0.70, 0.95, 1.30, 2.75, 3.10, 4.20, 4.70, 4.80, 6.48, 7.32, 8.00, 8.28, 12.08, 31.80, 32.40, 34.00, and 36.60.

Use Minitab to determine the sample mean, sample standard deviation, sample range, sample quartiles, and interquartile range (IQR). Then do **HAND CALCULATIONS** to verify the values obtained from MINITAB. Also, use MINITAB to plot a dot diagram.

6.1.12) Cloud seeding, a process in which chemicals such as silver and frozen carbon dioxide are introduced by aircraft into clouds to promote rainfall was widely used in the 20<sup>th</sup> century. Recent research has questioned its effectiveness. An experiment was performed by randomly assigning 52 clouds to be seeded or not. The amount of rain generated was then measured in acre-feet. Here are the data for the unseeded and seeded clouds. (see “HW5\_Computer\_Data.xlsx”)

Unseeded: 80.2, 26.2, 95.5, 40.0, 28.8, 21.8, 11.7, 68.0, 345.8, 321.8, 1202.0, 1.5, 4.8, 163.2, 372.5, 244.0, 47.8, 87.2, 26.5, 24.0, 830.8, 4.3, 36.9, 147.5, 17.0, 29.9

Seeded: 274.9, 302.0, 242.8, 255.5, 17.0, 115.9, 31.2, 702.4, 334.5, 1697.0, 118.5, 199.0, 130.1, 275.2, 118.5, 1650.0, 7.9, 430.2, 40.8, 92.9, 201.3, 32.0, 4.2, 979, 491.2, 2745.0.

Find the sample mean, sample standard deviation, and sample range for (a) All 52 clouds, (b) The seeded clouds, and (c) The unseeded clouds. Compare sample statistics.

6.2.4) An article in Technometrics [“Validation of regression models: Methods and Examples” (1977, Vol. 19(4), p.425)] presented the following data on the motor fuel octane ratings of several blends of gasoline: (“HW5\_Computer\_Data.xlsx”)

~~Construct a stem-and-leaf display for the data. Interpret the plot. Calculate the median and quartiles of these data using Microsoft Excel without using mathematical formulas, except like summation and mathematical operations. Verify these values with the ones obtained via MINITAB. Interpret them.~~

88.5	91.1	88.2	91.8	89.8
94.7	86.7	88.5	88.4	92.7
84.3	93.4	93.3	92.6	93.3
90.1	96.1	87.4	93.7	86.7
89	89.6	91.1	96.5	91
89.8	90.4	90.5	84.3	90.9
91.6	91.6	100.3	93.2	89.9
90.3	90.7	87.6	88.6	91.8
90	88.6	92.7	88.7	89.7
91.5	88.3	87.9	92.7	92.2
89.9	94.2	93	89.3	
98.8	85.3	94.4	91	
88.3	90.1	90.4	87.5	
90.4	89.3	91.2	87.8	
91.2	91.1	86.7	88.3	
90.6	92.2	94.2	89.2	
92.2	83.4	90.8	92.3	
87.7	91	90.1	88.9	

6.3.4) Construct histogram with 8 and 16 bins for the modified data as given in data in Exercise 6.2.4 of this assignment. Compare the histograms. Do both histograms display similar information? Explain your answer.

6.4.8) The following cold start ignition times in seconds of an automobile engine for a particular gasoline used were obtained for a test vehicle: 1.70, 1.90, 2.65, 2.42, 3.10, 3.30, 2.62, and 1.90. As second formulation of the gasoline was tested in the same vehicle, with the following times in seconds: 1.80, 2.00, 3.10, 3.30, 2.75, 2.88, 3.40, 2.48, 1.80, and 3.5. Use these new data along with the cold start times data to construct comparative box plots. Write an interpretation of the information that you see in these plots.

6.5.1) In their book Time Series Analysis, Forecasting, and Control (Prentice Hall, 1994), G. E. P. Box, G. M. Jenkins, and G. C. Reinsel present chemical concentration readings made every 2 hours. Some of these data follow (read down the column, then left to right).

17.0	16.7	17.1	17.5	17.6
16.6	17.4	17.4	18.1	17.5
16.3	17.2	17.4	17.5	16.5
16.1	17.4	17.5	17.4	17.8
17.1	17.4	17.4	17.4	17.3
16.9	17.0	17.6	17.1	17.3
16.8	17.3	17.4	17.6	17.1
17.4	17.2	17.3	17.7	17.4
17.1	17.4	17.0	17.4	16.9
17.0	16.8	17.8	17.8	17.3

Construct and interpret a stem-and-leaf and time series plot.

6.6.2) In the data set of 6.6.2 (see “HW5\_Computer\_Data.xlsx”), there is a time variable (year) and three other variables that depend on time. For Part (a) of 6.6.2 create a matrix of scatter plots for these three other than time variables. Part (b) asks you to discuss their relationships. Create a correlation matrix for this purpose of the three variables other than the time variable and verify the correlation coefficient value between petroleum imports and the percent of petroleum products by doing **HAND CALCULATIONS**.

6.7.2) Construct a normal probability plot of the height data from problem 6.2.4. Interpret the normal probability plot.

88.5	91.1	88.2	91.8	89.8
94.7	86.7	88.5	88.4	92.7
84.3	93.4	93.3	92.6	93.3
90.1	96.1	87.4	93.7	86.7
89	89.6	91.1	96.5	91
89.8	90.4	90.5	84.3	90.9
91.6	91.6	100.3	93.2	89.9
90.3	90.7	87.6	88.6	91.8
90	88.6	92.7	88.7	89.7
91.5	88.3	87.9	92.7	92.2
89.9	94.2	93	89.3	

98.8	85.3	94.4	91
88.3	90.1	90.4	87.5
90.4	89.3	91.2	87.8
91.2	91.1	86.7	88.3
90.6	92.2	94.2	89.2
92.2	83.4	90.8	92.3
87.7	91	90.1	88.9