

Show **all** of your work on this assignment and answer each question fully in the given context.

**If you cannot submit your homework in the class, you can drop it at my office door in 3220 Snedecore Hall by Thursday at 03:30 PM.**

In this homework, you CAN use JMP to plot the data whenever it is asked in the question.

Please staple your assignment and write your name !

1. [Ch 3, Exercise 8, pg. 116] Back to problem 5 of homework two, the accompanying data are the times to failure (in millions of cycles) of high-speed turbine engine bearings made out of two different compounds. These were taken from "Analysis of Single Classification Experiments Based on Censored Samples from the Two-parameter Weibull Distribution" by J. I. McCool (\*The Journal of Statistical Planning and Inference\*, 1979).

compound <sub>1</sub>	3.03	5.53	5.60	9.30	9.92	12.51	12.95	15.21	16.04	16.84
compound <sub>2</sub>	3.19	4.26	4.47	4.53	4.67	4.69	5.78	6.79	9.37	12.75

- (a) Plot a side-by-side boxplot of the two compounds.[10 pts]
  - (b) Find all quantiles of compound 1 and use Normal quantile table attached to this homework to find the corresponding normal quantiles[10 pts]  
hint This part is similar to what we did in class working on ch 3 handout.
  - (c) Using the results in part b, plot theoretical Normal QQ-plot against quantiles of compound 1.[10 pts]
  - (d) Using the theoretical Normal quantile plot in part c, what can we say about the shape and distribution of compound 1 data? [5 pts]
  - (e) Give the coordinates of the upper right point that would appear on a regular graph paper. Also, give the coordinates of the lower left point that would appear on a normal plot of the compound 1 data. [5 pts]
2. Calculate the sample mean and sample variance for the following samples:
    - (a) Sample 1: -1.05, -1.0, -0.5, 0.15, 0.6, 0.65, 0.7, 1.25 [5 pts]
    - (b) Sample 2: -2.1, -2.0, -1.0, 0.3, 1.2, 1.3, 1.4, 2.5 [5 pts]
  3. Mechanical engineers were interested in studying the effects of 2 chemical compounds (low Ca, high Ca) and 3 uni-axial pressure (P1, P2, P3) on metal bars lifetime. A total of 12 specimen were assigned to the possible combinations with two metal bars in each treatment. The lifetime of the bars were recorded after each run of the experiment.
    - (a) How many possible combinations of *compound*  $\times$  *pressure* are there available for a full factorial study? Draw a table for this design to get full credit.[5 pts]
    - (b) What is the response variable in this study?[2 pts]
    - (c) What are experimental variables in this study? [2 pts]
    - (d) What type of experimental variables are they in part 3 above?(Be careful with this question, we already know they are experimental variables and not response variable)[2 pts]

- (e) For this full factorial study with two factors chemical compounds and uni-axial pressure, the six experimental runs are labeled as:

No. 1: low- P1,      No. 2: low-P2,      No. 3: low-P3,  
No. 4: high- P1,      No. 5: high- P2, and      No. 6: high- P3.

Based on the following random digits

49502 18963 63920 39544 25804

Which experiment should be done last?[4 pts]

**4. JMP assignment: chapter 3 section 2 problem 2 page 92**

Using the data of two turbin suppliers companies below, answer the questions using JMP.

Suplier I	Suplier II
0.52	0.89
0.37	0.99
0.92	1.45
2.89	1.47
3.62	1.58
0.65	2.27

- (a) Provide a scatter plot for the two data sets. [10 pts]  
(b) Plot a Normal QQ-plot of the supplier I data and interpret the shape and distribution of supplier I data.[5 pts]  
(c) Plot a Normal QQ-plot of the supplier II data and interpret the shape and distribution of supplier II data.[5 pts]

Total: 85 pts