HW 3 **Due: See canvas**

1. Researchers examined the time in minutes before an insulating fluid lost its insulating property. The following data are the breakdown times for 30 samples of the fluid, which had been run randomly allocated to receive one of the two voltages of electricity:
   12 samples were randomly assigned to 26kV and 18 samples to 28kV.
   Following table gives the summary statistics of the times (in minutes) and log-times:

Voltages →	26kV	28kV	26kV	28kV
	Time (in minutes)		log-Time	
Mean	450.89	425.93	5.699	5.620
s.d.	539.86	397.42	0.914	1.098

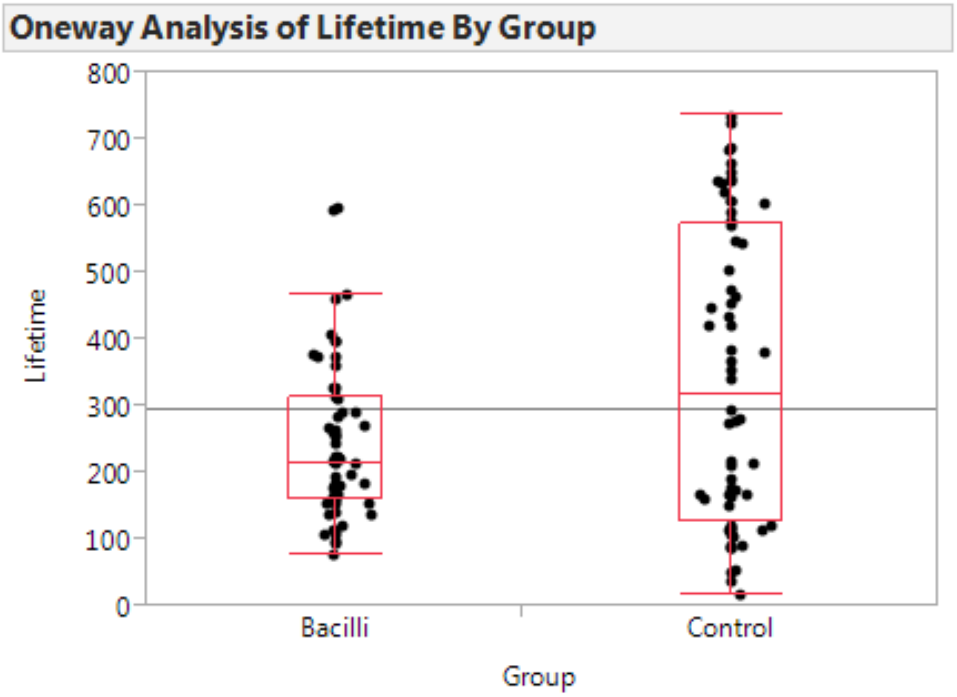
   a) Is there any evidence that the original responses (i.e. time) are not normally distributed? Explain.
   b) Test for a difference between the median breakdown times at two voltages. Clearly write your null and alternate hypotheses, explaining notations you use. Report the pooled t-statistic and the p-value (show all computations).
   c) Provide a conclusion in the context of the problem.

2. A pharmaceutical company is conducting an experiment to test the effects of a new antibiotic on bacterial counts in tissue cultures. Forty randomly selected cultures were laced in vials and infected with a low quantity of bacterial cells. Of these forty, 25 were randomly selected and given a dose of antibiotic. The other 15 were given a similar quantity of distilled water. On completion of the experiment, full bacterial counts were made in each vial. Summary statistics for the bacterial counts are provided below. You may assume that log counts are normally distributed.

Treatment	Mean of log counts	s.d. of log counts
Antibiotic	2.87	0.69
Distilled water	3.27	0.86

   a) Provide a pooled estimate of standard deviation (for observations on the log scale).
   b) Do these data suggest that the new antibiotic has an effect on bacterial counts in tissue cultures? [Answer this question by writing down the null and the alternate hypotheses, provide the pooled t-ratio and p-value and a conclusion – show all your work]
   c) Provide a 90% confidence interval for the ratio between the median bacterial counts for the water and antibiotic treated cultures. Interpret this interval within the scientific context given by this problem.

3. (Sleuth 4.25) The following boxplots and summary statistics are of the survival times (in days) of guinea pigs that were randomly assigned to a control group or to a treatment group that received a dose of tubercle bacilli. Scientist are interested to see if the treatment has an effect on



Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Bacilli	58	242.534	117.931	15.485	211.53	273.54
Control	64	345.234	222.197	27.775	289.73	400.74

the mean survival time?

a) Write down the null and alternate hyotheses for testing the effect of treatment on the survival times.
b) Compute the Welch's t-ratio and its degrees of freedom.
c) Use a t-table to provide a bound on the p-value (use nearest integer degrees of freedom).
d) Provide a conclusion in the given context.
e) Provide a 95% confidence interval for the difference between mean survival times and provide its interpretation.