**EASTERN MEDITERRANEAN UNIVERSITY**



**Department of Industrial Engineering**

**IENG584 Advanced Quality Engineering**

**HOMEWORK 2 Spring 2018-19**

1. The tensile strength of a fiber used in manufacturing cloth is of interest to the purchaser. Previous experience indicates that the standard deviation of tensile strength is 2 psi. A random sample of eight fiber specimens is selected, and the average tensile strength is found to be 127 psi.
2. Test the hypothesis that the mean tensile strength equals 125 psi versus the alternative that the mean exceeds 125 psi. Use *α=0.05*.
3. What is the *P*-value for this test?
4. Discuss why a one-sided alternative was chosen in part (a).
5. Construct a 95% lower confidence interval on the mean tensile strength.
6. The service life of a battery used in a cardiac pacemaker is assumed to be normally distributed. A random sample of 10 batteries is subjected to an accelerated life test by running them continuously at an elevated temperature until failure, and the following lifetimes (in hours) are obtained: 25.5, 26.1, 26.8, 23.2, 24.2, 28.4, 25.0, 27.8, 27.3, and 25.7.
7. The manufacturer wants to be certain that the mean battery life exceeds 25 h. What conclusions can be drawn from these data (use *α=0.05*.)
8. Construct a 90% two-sided confidence interval on mean life in the accelerated test.
9. Construct a normal probability plot of the battery life data. What conclusions can you draw?
10. Construct a 95% lower confidence interval on mean battery life. Why would the manufacturer be interested in a one-sided confidence interval?
11. Ferric chloride is used as a flux in some types of extraction metallurgy processes. This material is shipped in containers, and the container weight varies. It is important to obtain an accurate estimate of mean container weight. Suppose that from long experience a reliable value for the standard deviation of flux container weight is determined to be 4 lb. How large a sample would be required to construct a 95% two-sided confidence interval on the mean that has a total width of 1 lb?
12. The output voltage of a power supply is assumed to be normally distributed. Sixteen observations taken at random on voltage are as follows: 10.35, 9.30, 10.00, 9.96, 11.65, 12.00, 11.25, 9.58, 11.54, 9.95, 10.28, 8.37, 10.44, 9.25, 9.38, and 10.85.
13. Test the hypothesis that the mean voltage equals 12 V against a two-sided alternative using *α=0.05*
14. Construct a 95% two-sided confidence interval on *µ.*
15. Test the hypothesis that *=11* using *α=0.05*.
16. Construct a 95% upper confidence interval on .
17. Does the assumption of normality seem reasonable for the output voltage?
18. A random sample of 500 connecting rod pins contains 65 nonconforming units. Estimate the process fraction nonconforming.
19. Test the hypothesis that the true fraction defective in this process is 0.08. Use *α=0.05*
20. Find the *P*-value for this test.
21. Construct a 95% upper confidence interval on the true process fraction nonconforming.
22. A new purification unit is installed in a chemical process. Before its installation, a random sample yielded the following data about the percentage of impurity:  and *n1=10*. After installation, a random sample resulted in  and *n2=8*.
23. Can you conclude that the two variances are equal? Use *α=0.05*
24. Can you conclude that the new purification device has reduced the mean percentage of impurity? Use *α=0.05*
25. An experiment was conducted to investigate the filling capability of packaging equipment at a winery in Newberg, Oregon. Twenty bottles of Pinot Gris were randomly selected and the fill volume (in ml) measured. Assume that fill volume has a normal distribution. The data are as follows: 753, 751, 752, 753, 753, 753, 752, 753, 754, 754, 752, 751, 752, 750, 753, 755, 753, 756, 751, and 750.
26. Do the data support the claim that the standard deviation of fill volume is less than 1 ml? Use *α=0.05*.
27. Find a 95% two-sided confidence interval on the standard deviation of fill volume. (c) Does it seem reasonable to assume that fill volume has a normal distribution?
28. A high-voltage power supply should have a nominal output voltage of 350 V. A sample of four units is selected each day and tested for process-control purposes. The data shown in Table 6E.2 give the difference between the observed reading on each unit and the nominal voltage times ten; that is,

*xi* = (observed voltage on unit *i* - 350)10

1. Set up and *R* charts on this process. Is the process in statistical control?
2. If specifications are at 350 V5 V, what can you say about process capability?
3. Is there evidence to support the claim that voltage is normally distributed?



1. The data shown in Table 6E.3 are the deviations from nominal diameter for holes drilled in a carbon-fiber composite material used in aerospace manufacturing. The values reported are deviations from nominal in ten-thousandths of an inch.



1. Set  up and *R* charts on the process. Is the process in statistical control?
2. Estimate the process standard deviation using the range method.
3. If specifications are at nominal 100, what can you say about the capability of this process? Calculate the PCR *Cp*.