Assignment 5

Due date : 6/10/2022

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1. (Ex 12-16, p 488) The article “Characterization of Highway Runoff in Austin, Texas, Area” (J. of Envir. Engr., 1998: 131–137) gave a scatter plot, along with the least squares line, of x = rainfull volume (m3) and y = runoff volume (m3) for a particular location. The accompanying values were read from the plot.

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1. Does a scatter plot of the data support the use of the simple linear regression model?
2. Calculate point estimates of the slope and intercept of the population regression line.
3. Calculate a point estimate of the true average runoff volume when rainfall volume is 50.
4. Calculate a point estimate of the standard deviation .
5. What proportion of the observed variation in runoff volume can be attributed to the simple linear regression relationship between runoff and rainfall?

2. (Slightly modified version of Ex 12-52, p 507) Plasma etching is essential to the fine-line pattern transfer in current semiconductor processes. The article “Ion Beam- Assisted Etching of Aluminum with Chlorine” (J. of the Electrochem. Soc., 1985: 2010– 2012) gives the accompanying data (read from a graph) on chlorine flow (x, in SCCM) through a nozzle used in the etching mechanism and etch rate (y, in 100 A/min).



1. Fit the simple linear regression model to this data.
2. Estimate the true average change in etch rate associated with a 1-SCCM increase in flow rate using a 95% confidence interval, and interpret the interval.
3. What proportion of observed variation in % removed can be attributed to the model relationship?
4. Does the simple linear regression model specify a useful relationship? Carry out an appropriate test of hypotheses using a significance level of 0.05.
5. Calculate a 95% CI for, the true average etch rate when flow = 3.0. Has this average been precisely estimated?
6. Calculate a 95% PI for a single future observation on etch rate to be made when flow = 3.0. Is the prediction likely to be accurate?
7. Would the 95% CI and PI when flow = 2.5 be wider or narrower than the corresponding intervals of parts (c) and (d)? Answer without actually computing the intervals.
8. Would you recommend calculating a 95% PI for a flow of 6.0? Explain.

3. (Ex 10-6, p 401) The article “Origin of Precambrian Iron Formations” (Econ. Geology, 1964: 1025–1057) reports the following data on total Fe for four types of iron formation (1 = carbonate, 2 = silicate, 3 = magnetite, 4 = hematite).

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Carry out an analysis of variance F test at significance level .01, and summarize the results in an ANOVA table.

4. (A slightly changed form of Ex 10-18, p 408) Consider the accompanying data on plant growth after the application of five different types of growth hormone.

1: 12 17 7 14

2: 20 13 20 17

3: 18 15 20 17

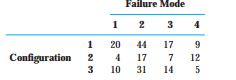
4: 7 11 18 10

5: 6 11 15 8

a. Perform an test at level α=0.05.

b. What happens when Tukey’s procedure is applied?

5. (Ex 14-30, p 620) Three different design configurations are being considered for a particular component. There are four possible failure modes for the component. An engineer obtained the follow- ing data on number of failures in each mode for each of the three configurations. Does the configuration appear to have an effect on type of failure?



6. (Ex 14-16, p 612) In a genetics experiment, investigators looked at 300 chromosomes of a particular type and counted the number of sister-chromatid exchanges on each (“On the Nature of Sister-Chromatid Exchanges in 5-Bromodeoxyuridine- Substituted Chromosomes,” Genetics, 1979: 1251–1264). A Poisson model was hypothesized for the distribution of the number of exchanges. Test the fit of a Poisson distribution to the data by first estimating and then combining the counts for x = 8 and x = 9 into one cell.

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