

Homework 6

QSCI 482: Hypothesis Testing & Estimation for Ecologists & Resource Managers

1. A scientist wants to see if the following "survival times" (hours of operation prior to failure) for a particular component in a machine follow what is known as the "exponential distribution." This distribution, which describes certain types of survival data, is defined for values of time greater than or equal to zero according to the following cumulative distribution function: $rel_F_i = 1 - e^{-t/k}$, where t denotes survival time and k is average time to failure. We wish to test whether the following random sample of 10 survival times is consistent with an exponential distribution with an average time to failure of $k = 50$ days.

The data: 20.5, 64.4, 58.3, 15.4, 32.4, 95.1, 20.1, 8.3, 58.3, 8.0

- [a] Setting the level of significance at $\alpha=0.10$, what is the tabulated critical value for the best test of the data against the stated exponential (with $k = 50$) distribution?
- [b] Perform the test. State your conclusion in terms of the context of the research question.
- [c] How large a sample size n would be needed to declare as significant a difference as small as 0.20, between the observed relative cumulative frequency and the expected relative cumulative frequency, if the level of significance were to be set at 0.02?
2. Twelve orange pulp silage samples were obtained, one each from twelve batches of silage and were then randomly divided into four groups of three samples. One of the groups was left as an untreated control, while the other three were treated with formic acid, beet pulp, and sodium chloride (NaCl), respectively. One of the responses of interest to the scientists involved in this study was the moisture content of the silage after treatment. Observed moisture contents (in percent) are shown below:

	Control	Formic Acid	Beet Pulp	NaCl
	80.5	89.1	77.8	76.7
	79.3	75.7	79.5	77.2
	79.0	81.2	77.0	78.6
Group Means:	79.6	82.0	78.1	77.5

- [a] Write down the null and alternate hypotheses for these data.
- [b] Compute the overall (grand) mean and estimated treatment effects, i.e., the $\hat{\tau}_i$'s, and derive SS for treatments from these quantities.
- [c] Complete an ANOVA table for these data. Test the hypotheses from part [a] using 0.10 as the significance level. State your conclusion in terms of the original question.
- [d] Is it a good idea to explore these data further, for example, by computing confidence intervals for the group means using Fisher's Protected Least Significant Differences method? Why or why not?