STA305/1004 Experimental Design – Midterm Review/Practice Problems

February 4, 2013

Major concepts:

1. Randomization as a technique to reduce experimental bias.
2. Randomization distribution and randomization test for one-sample, two-sample problems.
3. One-sample, paired, and two-sample t-test
4. Power and sample size for one-sample, two-sample, k-sample (i.e., ANOVA) comparisons.
5. One-way ANOVA including multiple comparisons.

Be able to understand all the R output that I have discussed in class or you have generated on the homework assignments.

Extra problems:

1. Consider an experimental setup with 5 treatments and 12 observations per treatment. The sum of squares due to treatment is 300 and the sum of squares due to error is 500. Complete an ANOVA table for this experiment. What is the p-value corresponding to the hypothesis test that all the means are equal?
2. Show that the total sum of squares is equal to the sum of squares due to treatment and the sum of squares due to error.
3. Show that the mean square due to error is an unbiased estimator of σ^2 in the one-way ANOVA model.
4. What are the assumptions behind the one-way ANOVA model?
5. In a study of two groups A and B with 3 responses in each group how would you calculate all possible distributions of the responses into two sets? What is this distribution called? How would you calculate a p-value for testing if the mean response for group A is different than the mean response for group B? See the example in the Feb. 4 class.
6. What is the difference between a two-sample and a paired experiment?
7. What are the possible ways that power can be increased? Be specific.
8. What is the multiple comparisons problem? What is meant by familywise error rate?
9. Conduct an ANOVA of the pedestrian data (Dean and Voss, pg. 63). Make sure you understand how to interpret the output from R. Are any of the pairwise comparisons significant? What can you conclude about the relationship between wait time and button pushing?

10. Conduct an ANOVA on the candy data collected in class. Ask similar questions to 9. (above) about this data set.