Homework 9

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

1. Fifteen mice were randomly selected from a population and randomly divided into three sets of five each. The mice from each group were to placed, one by one, into a standard maze and would be timed how long it took to completely travel through the maze to receive a food reward. The maze would have different color doors, however, for each group. The researchers were interested in the effects of door color on time.

Door color	Time to complete maze (mice 1 through 5)				
Red	9	11	10	9	15
Green	20	21	23	17	30
Black	6	5	8	14	7

   a) Plot the means for these treatments vs. door color to examine what is happening.

   b) Assume that the variances of populations of mouse maze completion times have a common value. Calculate an estimate for this value (s_p^2).

   c) Letting μ_1, μ_2 , and μ_3 denote the population maze completion times for red, green, and black doors, respectively, based on the scatter plot in a) above, do you think that the null hypothesis H_o: $\mu_1 = \mu_2 = \mu_3$ would be rejected?

   d) Describe the ANOVA assumptions for testing the hypothesis in c).

   e) Test the null hypothesis in c) above using 0.10 significance level. What do you conclude (be sure to state in terms of data at hand).

   f) What size difference in maze completion time could we detect if we tested using the same sample size, same number of treatment groups, assuming the same variance, but with significance level set to 0.01 and a desired power of 95%?

2. The following data are frequencies of ferrets with and without a particular disease in two different geographic areas. Test the null hypothesis (*.10* level of significance this time) that the prevalence of the disease is the same in both areas. Do this in *three* ways: compute X^2, X^2 (Yates) and X^2 (Cochran-Haber). Compare the three values of the test statistic and comment on their relationship to each other. Also, compute the estimated probability of disease for Area 1, Area 2, and the 2 areas pooled together.

AREA	W/ DISEASE	W/O DISEASE
Area 1	26	54
Area 2	20	72

3. A horticulturist performed a field experiment to study the effect of fungicide treatments applied to plots upon which azaleas were to be grown. The fungicides were applied to plots before inoculation in four complete block arrangements. Uniform plants were inoculated (with fungus), planted, and after several weeks they were dug up and root weights determined. The results (in grams) were:

	Treatment				
Block	1	2	3	4	5
1	14	21	19	22	24
2	13	18	14	21	18
3	11	23	18	22	17
4	10	21	15	18	17

   a) Construct the ANOVA table under the mixed effects model (random blocks, fixed treatments).

   b) At the 0.10 significance level, test the null hypothesis of equal root weights under the different fungicide treatments

   c) Calculate the estimated standard error for the difference between two observed treatment means.

4. The Yum E. Nut company produces a mixed nut product on a machine that is supposed to mix peanuts, hazelnuts, cashews, and pecans in the ratio 5:2:2:1. A routine quality control sample can was randomly chosen from the process line and was found to contain 269 peanuts, 112 hazelnuts, 74 cashews, and 45 pecans. At the 0.05 level of significance, test the hypothesis that the machine is mixing the nuts in the stated ratio.

5. Three California beaches were cleared of all visible seabird carcasses and then censused for dead birds every day for three months. Individual carcasses were tagged so no was counted more than once. Carcasses were categorized as:

   F = Freshly dead (no decomposition set in)
   B = Blue-skinned (bacterial composition begun)
   M = Maggoty (insect larval decomposition begun)
   D = Dried (carcass without flesh)

   Following are data for large gull species.

	CARCASS CONDITION				
BEACH	F	B	M	D	TOTAL
Seadrift	12	16	3	21	52
Limantour	3	2	9	16	30
RCA	12	9	2	9	32
TOTAL	27	27	14	46	114

   Is there any relationship between carcass condition and beach? Follow the 8 hypothesis testing steps as given in the course reader for the analysis. (Use .05 level of signficiance.)