Ma 322: Biostatistics
Homework Assignment 9

Prof. Wickerhauser

Due Friday, April 6th, 2012

Read Chapter 15, "ANOVA and Regression," pages 263–287 of our text.

NOTE: It should be possible to cut and paste the data from this document into a text file, or into an `R` variable by use of the `scan()` function.

1. The following data are frequencies of bats found with and without rabies in two different geographic areas:

Area	With rabies	Without rabies
E	18	112
W	11	139

   (a) Using the Yates-corrected χ^2 test at the $\alpha = 0.05$ significance level, test H_0: the incidence of rabies is the same in both areas.

   (b) Use the Fisher exact test at the 0.05 level to test if the E population bats are more likely to have rabies than those in the W population.

2. A follow-on study was performed on the same bats data, similar to that of Problem 1 but with the additional tabulation of gender:

	With rabies		Without rabies	
Area	Male	Female	Male	Female
E	6	12	49	63
W	9	2	84	55

   (a) Test for mutual independence at the $\alpha = 0.1$ significance level.

   (b) Test for partial independence at the $\alpha = 0.05$ significance level.

3. The following fake data mimics a study of amino acids in six imaginary species of millipedes:

   Alanine concentration in millipede hæmolymph (mg/100 ml)

Species 1	Species 2	Species 3	Species 4	Species 5	Species 6
21.5	14.5	16.0	14.8	12.1	14.4
19.6	17.4	20.3	15.6	11.4	14.7
20.9	15.0	18.5	13.5	12.7	13.8
22.8	17.8	19.3	16.4	14.5	12.0

(a) Test, at the $\alpha = 0.05$ significance level, the hypothesis H_0: There is no difference in mean alanine concentration among the species. Use one-factor ANOVA.

(b) Test, at the $\alpha = 0.05$ significance level, the hypothesis H_0: There is no difference in mean alanine concentration between species A and B. Use pairwise t-tests for every pair A, B.

(c) Test, at the $\alpha = 0.05$ significance level, the hypothesis H_0: There is no difference in mean alanine concentration between species A and B. Use Tukey's HSD test for every pair A, B.

4. Test for all factor and interaction effects in the following 3×2 fixed-effects analysis of variance with equal replication:

Response to Factors A and B					
a1		a2		a3	
b1	b2	b1	b2	b1	b2
34.1	35.6	38.6	40.3	41.0	42.1
36.9	36.3	39.1	41.3	41.4	42.7
33.2	34.7	41.3	42.7	43.0	43.1
35.1	35.8	41.4	41.9	43.4	44.8
34.8	36.0	40.7	40.8	42.2	44.5

5. Test for all factor and interaction effects in the following $4 \times 3 \times 2$ fixed-effects analysis of variance, where a_i is the level of factor A, b_i is the level of factor B, and c_i is the level of factor C.

Response to Factors A, B and C											
	a1			a2			a3			a4		
	b1	b2	b3	b1	b2	b3	b1	b2	b3	b1	b2	b3
c1:												
	4.1	4.6	3.7	4.9	5.2	4.7	5.0	6.1	5.5	3.9	4.4	3.7
	4.3	4.9	3.9	4.6	5.6	4.7	5.4	6.2	5.9	3.3	4.3	3.9
	4.5	4.2	4.1	5.3	5.8	5.0	5.7	6.5	5.6	3.4	4.7	4.0
	3.8	4.5	4.5	5.0	5.4	4.5	5.3	5.7	5.0	3.7	4.1	4.4
c2:												
	4.8	5.6	5.0	4.9	5.9	5.0	6.0	6.0	6.1	4.1	4.9	4.3
	4.5	5.8	5.2	5.5	5.3	5.4	5.7	6.3	5.3	3.9	4.7	4.1
	5.0	5.4	4.6	5.5	5.5	4.7	5.5	5.7	5.5	4.3	4.9	3.8
	4.6	6.1	4.9	5.3	5.7	5.1	5.7	5.9	5.8	4.0	5.3	4.7