Stat/For/Hort 571 **Larget and Nordheim** **December 19, 2004**

Final Exam

Name:_____

For the section that you *attend* please indicate:

Instructor:(circle one) Larget Nordheim

Teaching assistant:(circle one) Cheng Wilkinson Zhang

Instructions:

1. This exam is open book. You may use textbooks, notebooks, class notes, and a calculator (but not a laptop computer).
2. Do all your work in the spaces provided. If you need additional space, use the back of the preceding page, indicating *clearly* that you have done so.
3. To get full credit, you must show your work. Partial credit will be awarded.
4. Some partial computations have been provided on some questions. You may find some *but not necessarily all* of these computations useful. You may assume that these computations are correct.

For graders' use:

Question	Possible Points	Score
1	25	
2	25	
3	16	
4	18	
5	16	
Total	100	

1. A study was undertaken to assess the effect of a new soil formulation, with differing levels of a soil additive, on the plant weight (in grams) of red clover. There were five treatments. Treatment A was a standard soil formulation. Treatment B used the new soil formulation without additive. Treatments C, D, and E used the new soil formulation along with 1, 2, and 3 units of additive respectively. A design appropriate for a one-way ANOVA was conducted and 7 plants (assume all are independent) were obtained for each treatment. Some useful summary statistics are presented below.

treatments	A	B	C	D	E
sample means	244.85	276.29	281.57	282.57	287.14

$SSTrt = 8098.17$ and $SSErr = 24960.57$.

   (a) Perform the 'usual' F-test with these data. State the null and alternative hypotheses appropriate for this test and interpret the results of the test.

   (b) Consider the following two contrast null hypotheses:

      i. $H_0 : \mu_A - 1/4(\mu_B + \mu_C + \mu_D + \mu_E) = 0$
      ii. $H_0 : -3\mu_B - \mu_C + \mu_D + 3\mu_E = 0$

      Interpret in words that relate to the scientific structure of the problem what is represented by each of these hypotheses.

   (c) Using the Bonferroni approach for multiple comparisons, test each of the two null hypotheses in part (b) versus the two-sided alternative with an experiment-wise error rate of 5%.

2. A designed study was undertaken to relate the rate of oxygen consumption in birds to different temperatures. Ten adult birds (same species) were randomly assigned to some given temperatures (in degrees celsius) and the consumption was determined in ml/g/hr.

temp	X	-6	-3	0	2	4	4	6	6	8	8
rate	Y	4.7	4.0	4.1	3.6	3.7	3.4	3.4	2.8	2.9	3.1

   Some partial computations that may be useful are: $\sum (x_i - \bar{x})^2 = 196.90$; $\sum (y_i - \bar{y})^2 = 3.08$; $\sum (x_i - \bar{x})(y_i - \bar{y}) = -22.93$.

   (a) Compute the slope of a simple linear regression line for Y on X and interpret it.

   (b) Perform a test of the null hypothesis that Y does not depend on X versus the two-sided alternative. Interpret the results.

   (c) Consider using the fitted line to estimate the mean rate. Find a 95% confidence interval for the true mean rate of oxygen consumption at a temperature of +5. Interpret the interval. Before the study was conducted an avian physiologist hypothesized that the true rate of oxygen consumption at +5 was 3.0. What can you say about this hypothesis?

3. A geneticist (Dr. Q) intends to study the success rate of a difficult gene insertion method. The success rate of this insertion is expected to be about 0.02. Dr. Q's experimental approach is to conduct 4 independent trials at a time. Think of each group of 4 independent trials as a 'set'. Dr. Q intends to conduct a number of such sets. It can be assumed that the all the sets are independent of each other so that all trials can be thought of as independent. Let n be the number of sets that Dr. Q will perform. How big does n need to be so that there is a probability of 0.80 that Dr. Q will observe at least one successful insertion among all the trials conducted?

4. The underlined portions of the following statements are either TRUE or FALSE. Indicate which answer, TRUE or FALSE, you feel is more appropriate and give a justification for it. Note – no credit will be awarded without justification!

   (a) An experiment was conducted that resulted in a one-way ANOVA analysis. The response variable was the temperature of freezing for a beaker containing a given solution. The units were degrees celsius and all of the observed data were large negative numbers. Prof X conducted an analysis of these data. In testing that all the means are the same, a value of $F = -4.50$ was obtained. Upon being questioned that a negative could not be correct, Prof X responded that since all of the data were negative, a negative value for F was reasonable. <u>You agree with Prof X.</u>

   (b) You wish to conduct an experiment that will be analyzed by simple linear regression. You may assume that the 'usual assumptions' are all met. Your goal is to estimate the slope with the greatest precision. You have the choice of conducting the experiment with 10 data points with the following X-values: 2,3,4,4,5,5,6,6,7,8 or with 6 data points with the following X-values: 0,2,4,6,8,10. <u>To meet the stated goal, you will choose the 10 data point approach with the corresponding X-values.</u>

5. A scientist wishes to compare two drugs in terms of the glucose levels in the anterior chambers of the eyes of dogs. There will be n dogs in the study. For each dog one of the drugs will be randomly assigned to the right eye and the other to the left. The differences in glucose levels are known to be approximately normally distributed with a variance of 1.8 $(mg/dLi)^2$. The null hypothesis is that the two drugs have the same effect versus the one-sided alternative that drug B results in a higher glucose level. The hypothesis will be rejected if the observed difference between the sample mean for drug B and that for Drug A is 0.3mg/dLi or larger. How large does n need to be so that there is a power of 90% when the true difference in glucose level is 0.5 mg/dLi?