Fall 2013. STP 531 Final Exam (take home)

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Note.

- You cannot talk to anyone about this exam except for the instructor
- You must return this exam and any related work to my office by 3:00PM on Thursday, 12/12/2013.
- Your must type your solutions and print them out; pages must be numbered. For each problem, your solution should have two parts:
  - part I (summary section, up to two pages, supported by tables and/or figures), directly address the question of interest and clearly state your results. You will present a summary that can be used by an intelligent person without referring to other documents or conducting additional calculations.
  - part II (analysis section, up to five pages) show your work here; this should consist of a logical progression of steps; each step should be summarized in words, and with supporting SAS codes, SAS output, and/or mathematical formulae. Include relevant SAS output only and clearly point out the parts that you are referring to. Do not present the data.
- Your test score will depend on both parts of your solutions. I will look for the answers from the first part and check your detailed steps presented in the second part.

1. An experiment was designed to study the effect of different varieties of wheat on the variation in the growth of plants (Y). A set of five greenhouse benches was set up as blocks, and within each block four varieties of interest was planted. The data on measurements of plant heights (in inches) are given below.

	Variety			
Block	1	2	3	4
1	9.7	11.8	6.3	4.6
2	6.6	9.7	5.3	3.4
3	7.6	10.9	4.7	2.7
4	8.1	11.3	5.5	3.6
5	5.4	10.7	4.5	2.8

   - (a) State an appropriate model and its assumptions.
   - (b) Test whether or not the main effect of variety is present. State the hypotheses, test statistics, p-value and conclusion. Use $\alpha = 0.05$.
   - (c) Obtain confidence intervals for all pairwise comparisons between the treatment (variety) means; use the most efficient multiple comparison procedure with a 90% family confidence coefficient. Interpret your results.
   - (d) Estimate the difference in the mean plant height for the first two groups of variety ($\mu_{\cdot 1} - \mu_{\cdot 2}$) with a 95% confidence interval. Interpret your findings.
   - (e) Test for $H_0 : \mu_{\cdot 1} = \mu_{\cdot 2}$ vs. $H_a : \mu_{\cdot 1} \neq \mu_{\cdot 2}$ with $\alpha = 0.05$. State the test statistics, p-value and your conclusion. Does your conclusion agree with the result of (d)? Explain.
   - (f) Test for $H_0 : \mu_{\cdot 1} \geq \mu_{\cdot 2}$ vs. $H_a : \mu_{\cdot 1} < \mu_{\cdot 2}$ with $\alpha = 0.025$.
   - (g) Comment on the efficiency of the blocking variable.

2. As in the previous problem, suppose the four varieties are randomly selected from a population.

   - (a) State an appropriate model and its assumptions.
   - (b) Report the analysis of variance table
   - (c) Test whether there are differences in plant heights between varieties. State the hypotheses, test statistics, p-value and conclusion. Use $\alpha = 0.05$.

3. An experimenter would like to compare the effects of the four diets on the weight gain y (pounds per day) of pigs. The data can be found in Diet.txt. The four columns in the data set are, respectively, diets, initial age (1: ≤ 77 days, and 2: > 77 days), initial weight (pounds) and the weight gain. For this problem, use the initial weight as the only concomitant variable, and ignores the initial age group.

   - (a) Write down an appropriate model and assumptions. Check the appropriateness of the model.

- (b) Create an ANOVA table and discuss, in as much detail as possible, the results that you observe.
- (c) Obtain a point estimate and a 95% confidence interval for the slope of the regression line.
- (d) Obtain a 95% confidence interval to estimate the mean weight gain for pigs in the second treatment group (diet of the second type) with an initial weight of 58 pounds.
- (e) Obtain confidence intervals for all pairwise comparisons between the treatment means; use the most efficient multiple comparison procedure with a 90% family confidence coefficient. State your finding.

4. As in the previous problem, now include both initial weight (as concomitant variable) and initial age group (as blocking variable). hint. the concepts in Ch. 22 and Ch. 23 can be extended to deal with this problem.

   - (a) State an appropriate model. Test whether or not the main effects of diet are present by assuming that all level combinations of diet and initial age are equally important. Use $\alpha = 0.1$.
   - (b) Suppose that, in the target population, 70% of the pigs are 77 days or younger. Test whether or not the main effects of the diets are present in this target population. Use $\alpha = 0.1$.
   - (c) As in (b), Obtain a 95% confidence interval for the mean weight gain of pigs with an initial weight of 58 pounds, and the second type of diet.
   - (d) Test whether or not the mean weight gain obtained considered in (c) is positive. State the hypotheses, test statistics, p-value and conclusion.