STAT 514 Homework#7 (Due Thursday 10/29/15 BEFORE CLASS)

- **0.** Problem 5 from Homework#6.
- 1. A pork producer is interested in a = 4 different chemical treatments to reduce PSE meat. Since each animal carcass can only be split in half (k = 2), generate the blocks necessary for this experiment assuming there will be a total of six blocks. What is the name of this design in this situation?
- 2. An engineer is studying the mileage performance characteristics of 5 types of gasoline additives. In the road test he wishes to use cars as blocks; however, because of a time constraint, he must use an incomplete block design. He runs the balanced design with the five blocks that follow.

			car		
additive	1	2	3	4	5
1		17	14	13	12
2	14	14		13	10
3	12		13	12	9
4	13	11	11	12	
5	11	12	10		8

- (a) Verify that this is a balanced incomplete block design.
- (b) Test if there is a difference between the five additives? draw your conclusions using α = 5%.
- (c) Obtain the estimates of treatment means (i.e., the adjusted means or the least square means).
- (d) Calculate the standard error of the difference between two treatment mean estimates (i.e. the standard error of $\hat{\tau}_i - \hat{\tau}_j$).
- (e) Calculate the critical difference for Tukey's pairwise comparisons and draw the conclusions. Are they consistent with the results from SAS with the options

lsmeans trt / pdiff adjust=tukey;

- (f) Suppose the engineer wants to know whether the combination of additives 1 and 2 has the same characteristics as the combination of additives 4 and 5. Use a proper contrast to address this issue and offer your answer.
- 3. An experiment is conducted to study the influence of operating temperature and three types of face-plate glass on the light output of an oscilloscope tube. The following data are collected:

	Temperature				
GlassType	100	$1\bar{2}5$	150		
1	58.0,56.8,57.0	107, 106.7, 106.5	129.2,128.0,128.6		
2	$55,\!53,\!57.9$	$107,\!103.5,\!105$	117.8,116.2,109.9		
3	54.6, 57.5, 59.9	106.5, 107.3, 108.6	101.7, 105.4, 103.9		

- (a) Write down the statistical model. Use ANOVA to test if the involved factorial effects are significant. State the hypotheses and use $\alpha = 5\%$.
- (b) Obtain the estimates of the main effects and interactions.
- (c) Use proper plots to check assumptions.
- (d) Generate the interaction plot for glass type and temperature and interpret the interaction.
- (e) Use the Bonferroni procedure to perform pairwise comparison for glass type level means (i.e., row means). What is your conclusions?
- (f) Use Tukey's method for the pairwise comparison between treatment (or cell) means. Report your results.
- (g) It is clear that glass type is a categorical factor and temperature is a continuous factor. Use regression to derive the functional relationships between the response (light output) and temperature for the three types of glass separately.