

STAT 514 Homework 7

Due: Oct 24

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.

additive	car				
	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 $\alpha = 5\%$.
 - (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 $\tau_i - \tau_j$).
 - (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

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lsmeans trt / pdiff adjust = tukey;
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 - (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. **Optional** A virologist has asked you to help design an experiment to compare the effects of two different media (A and B) and two different incubation times (12 and 18 hours)

on the growth of a specific bacteria. (Since the two factor both have only 2 levels, we could treat it as one factor with 4 levels of treatments.) She has access and money to do 24 different runs (single combination of the two factors like media A for 12 hours) but can only do as many as 6 runs a day.

- (a) Based on this information, propose two potential **balanced** designs that use all 24 runs and present an ANOVA table with sources and degrees of freedom.
- (b) Suppose the experimenter wants to minimize the length of a 95% confidence interval for a treatment difference $(\mu_i - \mu_j)$. Which of the two designs proposed in (a) is better? Explain.