STAT 514 Homework 5

Due: Oct 5

1. Suppose you performed an ANOVA with $a = 4$ treatments and $n = 5$ observations per treatment. If the $MS_E = 16$ and $\alpha = 0.05$, what would the minimum difference have to be between any two means for you to conclude they were significantly different if

   (a) You performed the LSD comparison procedure?

   (b) You performed the Bonferroni comparison procedure?

   (c) You performed Tukey's multiple comparison procedure (use Table VII)?

   (d) You performed Scheffe's procedure?

   (e) Explain the relationship between power and the minimum difference. Also state which of the above four is the most powerful and least powerful comparison procedure.

2. A clay tile company is interested in studying the effect of cooling temperature on strength. The company has five ovens which produce the tiles, four tiles were baked in each oven and then randomly assigned to one of the four cooling temperatures. The data are shown below.

Cooling Temp	Oven 1	2	3	4	5	mean
5°	3	10	7	4	3	5.4
10°	3	8	12	2	4	5.8
15°	9	13	15	3	10	10
20°	7	12	9	8	13	9.8
Mean	5.50	10.75	10.75	4.25	7.50	7.75

   (a) Which type of design was employed? Describe how the fundamental principles of experimental design were followed in this design.

   (b) If $MS_E = 6.275$, compute the F-statistic to determine if there is a difference among the four cooling temperatures (use $\alpha = 5\%$).

   (c) Estimate the relative effiency, and interpret your result.

   (d) If there is a difference among the four temperatures, perform pairwise comparisons using Tukey's procedure, please calculate by hands first, then use SAS to verify your calculations.

(e) Suppose the company believes there is a jump in the strength at 12.5° but otherwise cooling temperature has no effect, that is, 5° and 10° are not different, neither are 15° and 20° , but these two groups of temperatures have different effects. Find a set of orthogonal contrasts that would allow you to test this.

(f) Test these contrasts using SAS (or by hand). State your conclusions.

3. An experiment was designed to study the performance of four different detergents for cleaning clothes. The following "cleanness" readings (higher=cleaner) were obtained with specially designed equipment for three different types of common stains The con-

	stain 1	stain 2	stain 3
detergent 1	45	43	41
detergent 2	47	46	52
detergent 3	48	50	55
detergent 4	42	37	49

clusion from ANOVA is the detergents are different. However one research suspects that it may not be proper to assume an additive model. Use Tukey's test for non-additivity to settle this issue.