STAT 514 Homework 9

Due: Nov 14

1. An experiment was performed to investigate the capability of a measurement system. Ten parts were randomly selected, and two randomly selected operators measured each part three times. The tests were made in random order, and the data below resulted. You can also find data set file "measure.dat".

	Operator 1			Operator 2		
Parts	1	2	3	1	2	3
1	50	49	50	50	48	51
2	52	52	51	51	51	51
3	53	50	50	54	52	51
4	49	51	50	48	50	51
5	48	49	48	48	49	48
6	52	50	50	52	50	50
7	51	51	51	51	50	50
8	52	50	49	53	48	50
9	50	51	50	51	48	49
10	47	46	49	46	47	48

   (a) Test the variance components.

   (b) Find the estimates of the variance components using the analysis of variance method.

2. Analyze the data in previous problem, assuming that the operators are fixed, using the restricted form of the mixed models.

   (a) Test the variance components.

   (b) Find the estimates of the variance components using the analysis of variance method.

   (c) Find an exact 95 percent confidence interval on σ^2 .

   (d) Find approximate 95 percent confidence intervals on the variance components using the Satterthwaite method.

3. Consider a balanced three-factor ANOVA study with factors A, B, and C. Suppose both A and B have fixed effects but C has random effects. Following "Rules for Expected Mean Squares", work out the EMS table, and propose an F-test for each set of the main effects. Assume that we use the restricted mixed effects model.

4. A rocket propellant manufacturer is studying the burning rate of propellant from three production processes. Four batches of propellant are randomly selected from the output of each process, and three determinations of burning rate are made on each batch. The results follow. You may also find data set file "rocket.dat".

	Process 1				Process 2				Process 3			
Batch	1	2	3	4	1	2	3	4	1	2	3	4
	25	19	15	15	19	23	18	35	14	35	38	25
	30	28	17	16	17	24	21	27	15	21	54	29
	26	20	14	13	14	21	17	25	20	24	50	33

(a) Explain why "batch" is nested under "process".

(b) Analyze the data and draw conclusions.