**Contrasts and Multiple Comparisons**

*Do the following problem by hand, you may use R only as a calculator and to find critical values. Upload a pdf/scan/picture of your work into Blackboard*

The effective life of insulating fluids at an accelerated load of 35kV is being studied. Test data have been obtained for the four types of fluid. The data from this experiment is given below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Fluid Type | Life (in hr) at 35kV Load | | | | | |
| 1 | 17.6 | 18.9 | 16.3 | 17.4 | 20.1 | 21.6 |
| 2 | 16.9 | 15.3 | 18.6 | 17.1 | 19.5 | 20.3 |
| 3 | 21.4 | 23.6 | 19.4 | 18.5 | 20.5 | 22.3 |
| 4 | 19.3 | 21.1 | 16.9 | 17.5 | 18.3 | 19.8 |

Previous calculations using this have shown that SSTr=30.17 and SSE=63.99

1. How many degrees of freedom are there in treatments?
2. A set of many orthogonal contrasts would completely partition the SSTr?
3. Test the contrast that the mean of fluids 1 and 2 differs from that of fluids 3 and 4 at alpha=0.05 level of significance
4. Consider the contrast that the mean of fluids 1 and 4 differs from that of fluids 2 and 3, is this orthogonal to the contrast in 3? Why or why not?

Suppose that we ran an ANOVA and rejected the null hypothesis, concluding that at least one of the mean lives of the fluids significantly differed from the others.

1. Using an LSD test with alpha=0.05, which pairs of fluids significantly differ in mean lifetime?