MATH 3080: Statistical Report Assignment No.4

1. (Sample assignment problem) Cuckoos place their eggs in other birds' nests for hatching and rearing. Several observations indicate that cuckoos choose the “adoptive parents” carefully, such that the cuckoo eggs are similar in size and appearance to the eggs of the adoptive species. In order to examine this further, researchers investigated 154 cuckoo eggs and measured their size ([Latter, 1905](http://e.pub/vsaknoohmscav5hpi6za.vbk/OPS/loc_015.xhtml#eid17657)). The unit is half millimeters. The width of the eggs ranges from 30 half millimeters to 35 half millimeters. The eggs were adopted by three different species: wrens, redstarts, and whitethroats.

The data set is available at <https://vps63.heliohost.us/e-stat/>. Go under the title “Textbook Data Sets” → “Hatching of cuckoo eggs.”

*Study Questions*:

* 1. Make sure you understand the structure of the data—in the linear model as well as in the ANOVA. In particular, what are *n* and *k*?
	2. Analyze the data and draw conclusions. This includes: specification of linear model, hypotheses, and *p*-value; numerical results in the form of relevant estimates, confidence intervals, and interpretations.
1. The electric conductance was measured for 32 pieces of soap in 4 groups (8 pieces in each group). The content of fatty acid differs between the groups. Quality of soap is mainly determined by its content of fatty acid, which can be determined with a chemical analysis. It is much easier to measure the electric conductance, and it is therefore of interest if there is a simple relation between the two.

The data set is available at [https://vps63.heliohost.us/e-stat/](http://math.tntech.edu/e-stat/). Go under the title “Textbook Data Sets” → “Quality of soap.”

*Study Questions*:

1. Fit a linear model with fatty acid as explanatory variable and make the corresponding residual plot. Based on the hypothesis test for slope, does a linear relationship between fatty acid and conductance seem appropriate?
2. Produce ANOVA, and carry out hypothesis test. Is the conclusion consistent with (a)?
3. Calculate 95% confidence intervals for pairwise differences. What are they? Can you find significant difference between group 2 and 3? Why or why not? How about differences of any other pair of groups?