

## HOMEWORK #10

DUE MON NOV 18

Copters! One last time! **Woo hoo!**

<https://sciences.ucf.edu/biology/d4lab/wp-content/uploads/sites/125/2019/09/helicopter-data.txt>

1. We analyzed our copter data before with lm, where we fussed with transformations to approach normality and homogeneity of variance. Analyze the same basic model again (i.e.,  $\text{Time} \sim \text{Step} + \text{fwl} * \text{fbw} * \text{ffold} + \text{fgroup}$ ), but use GLMs to permit other distributions. Explain which distribution is most plausible, and include residuals plots to help justify your choice. [2 pts]
2. Now carry forward with that *distribution*, but change the way you treat the effect of steps. We handled Step as a covariate and Group as blocks (above), which essentially assumes a common effect of Step on all treatments.
  - But what if you handle Step as a random effect (which also requires making Step a factor)? This may make sense if you think of results being nested within step levels.
  - Or what if Step remains numerical but is used as a random slope effect within random Group (Step | fgroup) - because some groups may have hit some steps more often?

Compare those two mixed effect models to the glm in #1 above. Explain your result in terms of how to best understand the experimental results. [3 pts]

A new data set:

<http://sciences.ucf.edu/biology/d4lab/wp-content/uploads/sites/125/2017/01/carrots.txt>

3. Six carrot plants (ID 1-6) were grown from seed hydroponically (i.e., in water) that had fertilizer added. Another six carrot plants were grown identically but without fertilizer (controls, total N = 12). Roots of each plant were measured (cm) for length every two weeks for 10 weeks (thus  $12 \times 5 = 60$  rows of data), when the experiment ended. Analyze this simple repeated-measures experiment and tell us: did fertilizer significantly increase carrot root length? If so, how much did fertilizer increase carrot root length after accounting for repeated measures? [3 pts]
4. Now analyze the carrot experiment as if every week's measurements were independent samples of different plants (i.e., pretend you did not use a repeated-measures analysis). How would your answer to #3 above change? Why the difference? [2 pts.]