"STAT-S631 – Exam 2 – Take-home"

Due November 17, 2017 at 5pm

Intructions:

- Please start your document with the following statement: "On my honor, I have not had any form of communication about this exam with any other individual (including other students, teaching assistants, instructors, etc.)" and sign by hand (if work was done partially or completely by hand and scanned) or typing your name (if work was done all typed).
- While in order to get full credit you need the appropriate output/results, you need to pay special attention to explanations/interpretations, when required. Correct output/results with no interpretation would receive zero points, and incomplete or incorrect explanations/interpretations will also be penalized.
- All your answers should be presented in the **first 2 pages** of your submission paper. You will not receive credit for answers outside those two pages. In addition, you are strongly encouraged to have succinct answers. Lengthy answers are neither required nor desired (and they are prone to contain incorrect statements that would be penalized).
- Supporting material (R syntax used, relevant output, graphs, etc.) is also required to get full credit and should be added/attached after your answers pages (unless a question explicitly requires otherwise). There is no limit of space for supporting material.
- Submit your solutions to Canvas as a single PDF file no later than 5pm on Friday, November 17th. Do not wait until the very last minute since late submissions will not be graded.

Questions

The file `takehome2.txt` contains data on in-flight energy expenditure and body mass from 20 energy studies on three types of flying vertebrates: echolocating bats, non-echolocating bats and non-echolocating birds. The data contains the following variables:

- `Energy`: The log of In-flight Energy expenditure (where Energy was originally measured in W)
- `Type`: A factor with 3 levels indicating the type of flying vertebrate: non-echolocating bats, nonecholocating birds, and echolocating bats
- `Mass`: Mass (in gr.)

For the following questions, use `Energy` as the response variable. In addition, use a "log" transformation in `Mass` if/when you deem appropriate.

1. (10 points) Use OLS and one-factor design (or one-way design).
   a. Determine if the expected response is significantly different when comparing each and any two factor levels?
   b. Is it meaningful to use `Type` to explain changes in `Energy`?
2. (10 points) Regress `Energy` on `Mass` using OLS.
   a. Is it appropriate to use a polynomial of degree 2?
   b. Is it meaningful to use `Mass` to explain changes in `Energy`?
3. (10 points) Use OLS and both predictors.
   a. Should you use a model with interactions?
   b. Choose the most appropriate model you can come up with. Justify your answer.
4. (10 points) Use your selected model in part 3.
   a. Is the assumption of constancy of variance (homoscedasticity) appropriate? Perform at least two reasonable tests to justify your response.
   b. Compare two 98% confidence intervals for the coefficient of `Mass`, by using OLS or OLS corrected with the sandwich estimator.