**STAT535 Midterm**

**Fall 2017**

**Goal of the study:** To study the effect of practice on reaction time of picture naming and the neurocognitive function of the brain, in healthy older adults. For the purpose of this exam, we will only focus on the naming reaction time.

**Description of the experiment:** 18 participants were recruited from a local stroke support group and were subject to repeated picture naming while in a brain imaging scanner. All subjects underwent two runs of naming in the scanner, naming 160 pictures in each run. Ten of the subjects were tested twice approximately one month apart. The pictures were either experimentally manipulated or from a control set of pictures to form four groups of 40 pictures. See explanation for Col. E. below, and the attached paper (materials and methods section) for more information.

**Specific goal of this exam:** Using RT-Rev (colum L) as the response and session, run, TR condition (TR and UNTR only) and word class as covariates, answer the following questions:

1. Is there a significant difference in reaction time between the TR conditions (that is TR pictures vs UNTR pictures)
2. Is there a significant difference in reaction time between runs and sessions, as it is likely that participants got faster in the second run and then again in the second session, particularly in the second run of the second session.
3. Is naming of objects faster than naming of actions?

There are two sources of random errors in the observed reaction times: one is within-subject variation and the other is between-subject variation under the same combination of session, run, TR condition and word class. For the purpose of this exam, aggregate the reaction times for each subject under each combination of session, run, TR condition and word class. Based your analysis on this aggregated dataset. Use visualization to support your results.

Bonus (Extra credit): try to reproduce Figure 2 in the attached paper. In Figure 2, different colors represent different TR conditions. You can just use the two TR conditions: TR and UNTR and ignore the other conditions. Each cluster of boxplots represents a unique combination of word class and run. Finally, each boxplot represents the observed reaction times for that condition. The red dot and error bars on each boxplot represents estimated mean reaction time and confidence interval under that condition, calculated based on the linear model RT=session+run+TR.condition+word.class.

Description of the data file:

1. Col A: subject ID – these are the 3-letter codes we use for subjects. There are 18 subjects.
2. Col B: Session # – there were two possible sessions. Ten subjects came twice to be scanned while eight subjects only were scanned once.
3. Col C: Run # – all 18 subjects underwent two runs of naming in the scanner.
4. Col D: Target – these were the target names of pictures that we were expecting them to say. All eighteen subjects saw the same picture files in the same order.
5. Col. E: TR Condition – pictures were either experimentally manipulated (TR, UNTR, or CORR) or from a control set of pictures (control). Control pictures were just pictures that had been scrambled so that they no longer resembled anything real and subjects were trained to just say "NO" when pictures from the control blocks came up. They are usually the fastest response times since no actual label for the picture has to be retrieved. CORR pictures come from a set of very high frequency, orthographically and phonologically short words (hand, eye, fork , pen, book, etc…). These are usually named very quickly too. Then there were two matched sets of pictures –TR and UNTR – that came from lower frequency words. They were match on variables like word frequency, word length, and other variables that have been shown to effect word retrieval. Then one set (TR) was randomly assigned to be practiced before the scan. The subjects weren't aware that we were familiarizing them with one set intentionally. We just told them we were practicing naming those pictures until they were comfortable sitting very still, because they have to be very still inside the MRI magnet. The TR pictures should be faster than the UNTR pictures, since they were practiced and thus primed.
6. Col. F: Word class – half of the pictures were of actions (ACT) and half were objects (OBJ). If the picture was from the control set, it's neither an ACT or OBJ.
7. Col. G: Accuracy – if subjects correctly named the pictures, it is scored 1; if not, it is scored 0; if it's a control picture, where they just said 'no', or if they didn’t respond to a picture, it has NA in the cell.
8. Col. H: RT –  this is how long it took from the time of the picture being presented for the subject to respond.
9. Cols. I/J: These are two different Word Frequency database values – don't worry about these columns for now.
10. Col L: RT-rev –  this is the final RT. It's the same as the RT column **except** when a participant did not respond, then RT value = NA