Math/Stat 3850 – Take Home Quiz 3

This quiz should take you approximately 25 minutes. You may use R, the internet, and any reference material, but do not work together and do not get help (except from Dr. Clair).

1. In a recent article in *Nature*, scientists gave heavy drinkers treatment with the hallucinogenic drug ketamine. They found that the treatment reduced the urge to drink ($P = 0.008$).
   Which type of error might possibly have occurred with this study: Type I or Type II? If this error occurred, what would that say about ketamine treatment?

2. Suppose a population is normal with mean $\mu = 1300$ and standard deviation $\sigma = 800$. We want to test the hypothesis $H_0 : \mu = 1800$ versus $H_a : \mu \neq 1800$ using a sample of size $n = 20$ and the usual significance level of $\alpha = 0.05$.
   (a) What percent of the time does a $t$-test correctly reject $H_0$?

   (b) What percent of the time does a Wilcoxon test correctly reject $H_0$?

   (c) Which test is more powerful in this situation?
The next two questions use the data from the `quantreg` library, that you may need to install. Once you’ve loaded the library with `library(quantreg)`, type `data(Mammals)`. Then you will have a data frame `Mammals`, which contains information on the weight and running speed of various species of mammals.

10. 3. (a) What is the correlation between weight and speed?

(b) Fit a linear model to explain speed from weight. Is the relationship between speed and weight significant? Report a $P$-value with your answer.

(c) Plot the data and the regression line. Does the linear model appear to fit this data?

10. 4. (a) Fit a linear model to explain log(speed) from log(weight). Is the relationship between log(speed) and log(weight) significant? Report a $P$-value with your answer.

(b) Plot the log data and the regression line. Does the linear model appear to fit this data?

(c) Overall, do larger mammals run faster?
5. The data frame `quakes` is built into R, and contains information on earthquakes in the Pacific Ocean, near Fiji. The variable `mag` is the magnitude or strength of the earthquake. The variable `stations` is the number of observation stations reporting the earthquake.

Fit a linear model to explain `stations` as a function of `mag`.

(a) What is the equation of the regression line?

(b) Predict the number of stations that would report a 6.0 magnitude earthquake.