Homework 5 – Stat 230 – Fall 2022

Due date: Friday, October 14

Complete the following exercises and submit your assignment via gradescope (linked on the course webpage).

Problems to start after class Oct 7

Q1

How do bats make their way about in the dark? Echolocation requires a lot of energy. In this problem, you will explore how energy expenditure is related to body mass from 20 energy studies on three types of flying vertebrates: echolocating bats, non–echolocating bats and non–echolocating birds.

```
bats <- read.csv("https://aloy.rbind.io/data/bats.csv")
```

(a) Fit a multiple linear regression model with `log(Energy)` as the response variable and `log(Mass)` and `Type` as the predictor variables. Report the fitted regression equation.

(b) What indicator variables did R create to represent the categorical variable `Type`?

(c) Based on the fitted model you reported in part (a), write a fitted model equation for each type of flying vertebrates (echolocating bats, non–echolocating bats and non–echolocating birds).

(d) Conduct the sums of squares F-test that can be used to determine whether `Type` is associated with the energy after accounting for mass. State the hypotheses, p-value, and conclusion in terms of the problem (that is, say things about the flying vertebrates).

Q2

Data were collected on the volume of users on the Northampton Rail Trail in Florence, Massachusetts. Variables in the data set include the number of crossings on a particular day (measured by a sensor near the intersection with Chestnut Street, `volume`), the average of the min and max temperature in degrees Fahrenheit for that day (`avgtemp`), and a dichotomous indicator of whether the day was a weekday or a weekend/holiday (`weekday`).

```
railtrail <- read.csv("http://aloy.rbind.io/data/RailTrail.csv")
```

Consider the following full linear model predicting the volume on the Northampton Rail Trail.

```
rail_lm <- lm(volume ~ hightemp + lowtemp + cloudcover + precip, data = railtrail)
```

(a) Test whether `cloudcover` can be dropped from the regression model given that `precipitation`, `hightemp`, and `lowtemp` are retained. Use an appropriate F test. State the hypotheses, p-value, and conclusion in terms of the problem (that is, say things about the rail trails and an appropriate population). [Note: you should know how to do this by hand given the ANOVA table. However, R will do the test for you with the code `anova(model1, model2)`.]

(b) Test whether both `lowtemp` and `cloudcover` can be dropped from the model given that `hightemp` and `precipitation` are retained. Use an appropriate F test. State the hypotheses, p-value, and conclusion in terms of the problem (that is, say things about the rail trails and an appropriate population).