STAT 217: Quiz 26

1. To orient themselves with respect to their surroundings, some bats use echolocation. Such a trait has evolved in very few animal species, perhaps because of the high energy costs involved in producing pulses. Zoologists collected data on in-flight energy expenditure (watts) and body mass (g) from 20 energy studies on three types of flying vertebrates: echolocating bats, non-echolocating bats, and non-echolocating birds. Below is the first five rows of data:

```
##    MASS                   TYPE ENERGY
## 1 779.0  non-echolocating bats  43.70
## 2 628.0  non-echolocating bats  34.80
## 3 258.0  non-echolocating bats  23.30
## 4 315.0  non-echolocating bats  22.40
## 5  24.3 non-echolocating birds   2.46
## 6  35.0 non-echolocating birds   3.93
```

   (a) What is the response variable and what are the explanatory variables? Label each as quantitative or categorical.

   (b) Let's first consider the parallel lines model. Write out the TRUE multiple linear regression ADDITIVE model (with β's). You will need to use indicator variables. Make sure to define each indicator variable.

   (c) Based on the additive model you defined in (b), write out the TRUE simple linear regression model for echolocating bats.

   (d) In terms of betas, what is the slope and y-intercept for the SLR line for echolocating bats?

(e) Based on the additive model you defined in (b), write out the TRUE simple linear regression model for non-echolocating bats.

(f) In terms of betas, what is the slope and y-intercept for the SLR line for non-echolocating bats?

(g) Based on the additive model you defined in (b), write out the TRUE simple linear regression model for non-echolocating birds.

(h) In terms of betas, what is the slope and y-intercept for the SLR line for non-echolocating birds?

(i) Sketch a plot like the one I showed in class. For each line, label the slope and the y-intercept. Briefly discuss why the additive model is called a "parallel lines model".

2. Repeat parts (b) through (i) for an interaction or "separate lines" model. Please do this on a separate sheet of paper.