STAT 205, Spring 2015

Homework 6

Out: Tuesday March 24. Due in: Thursday April 2

In an 1898 Biology lecture at Wood Hole, Massachusetts, Hermon Bumpus reminded the audience that the process of natural selection for evolutionary change was an unproved theory. As evidence in support for natural selection, he presented measurements on house sparrows brought to his Brown University laboratory after an uncommonly severe winter storm. Some of the birds had died, and some had survived. Bumpus asked whether those that perished did so because they lacked physical characteristics enabling them to withstand the intensity of that particular instance of selective elimination.

The data we will look at are the humerus (wing bone attached to shoulder) lengths for the n_1 = 24 adult male sparrows that perished and the n_2 = 35 adult males that survived; the humerus lengths are fractions of an inch, so a measurement of 659 means 0.659 inch.

a. In R obtain side-by-side boxplots for the humerus lengths in the two samples. Does it appear that male sparrows who survive the storm have larger wings? In R, use something like:

```
boxplot(perished,survived,names=c("perished","survived"))
```

b. In R obtain the two normal probability plots for those that survived and those that perished. Are the data approximately normal in each group? Are the assumptions met for the t-procedures?

c. Define the two populations of interest here, and their population means μ_1 and μ_2.

d. In R, use the `t.test` function to obtain a P-value for testing $H_0 : \mu_1 = \mu_2$ vs. $H_A : \mu_1 \neq \mu_2$. Do you accept or reject H_0 at the 5% level? Why?

e. Report and interpret the 95% confidence interval for the difference in population mean humerus lengths for those that perished and those that survived. Does the confidence interval include zero? How does this relate to the outcome of part (d)?

```
perished=c(659,689,703,702,709,713,720,729,726,726,720,737,739,731,738,
           736,738,744,745,743,754,752,752,765)
survived=c(687,703,709,715,728,721,729,723,728,723,726,728,736,733,730,
           733,730,739,735,741,741,749,741,743,741,752,752,751,756,755,
           766,767,769,770,780)
```