Math/Stat 3850 – Take Home Quiz 3

This quiz should take you approximately 25 minutes. There are 4 questions worth a total of 50 points. You may use R, the internet, and any reference material, but do not work together and do not get help (except from Dr. Clair).

(10) 1. The built in data set mtcars has quantitative variables disp (engine displacement), hp (horsepower), wt (weight), drat (rear axle ratio) and qsec (quarter mile time).

Among these five variables find:

Solution: cor(select(mtcars, disp, hp, wt, drat, qsec)) shows all correlation coefficients at once.

(a) Two that have a strong positive correlation.

Solution: disp is strongly + correlated with hp and with wt. hp and wt not bad at $r = 0.66$.

(b) Two that have a weak positive correlation.

Solution: drat and qsec have $r = 0.09$

(c) Two that have a weak negative correlation.

Solution: wt and qsec have $r = -0.17$. None of the others are really “weak”.

(d) Two that have a strong negative correlation.

Solution: drat is strongly - correlated with disp and with wt. hp and qsec are also strongly - correlated.

(20) 2. This question concerns the rmr data set from library(ISwR), which contains the resting metabolic rate and body weight data for 44 women.

(a) Give the equation for the regression line to estimate metabolic rate from body weight.

Solution: metabolic.rate = 811.23 + 7.06 body.weight

(b) Make a scatterplot of this data showing the regression line from part (a). Write your code here.

Solution:
(c) Interpret the slope of the regression line in terms of metabolic rate and body weight.

**Solution:** For each additional kg of body weight, we expect 7.06 additional kcal/day of metabolic rate.

(d) What metabolic rate do you predict for a body weight of 50kg?

**Solution:** 1164.203 kcal/day
The next two questions use the data `ex1111` from `library(Sleuth 3)` giving cesium concentrations in soil and in mushrooms collected in central Italy after the 1986 Chernobyl nuclear accident. Researchers wished to investigate the cesium transfer from contaminated soil to plants by describing mushroom concentration as a function of soil concentration.

3. (10) (a) Give the equation of the regression line explaining Mushroom cesium concentration from Soil cesium concentration.

Solution: \[ \text{Mushroom} = 16.7 + 0.096 \text{ Soil} \]

(b) Is the relationship between Mushroom and Soil concentration significant? Give the P-value.

Solution: Yes, the slope of the regression line is non-zero (P = 0.006).

4. (10) Take a closer look at the data in `ex1111`. Describe your investigations.

What overall conclusion about cesium transfer from soil to mushrooms can you make?

Solution: There is one outlier in this data. Looking at the residuals from the regression in question (3), the outlier does not fit the pattern of the other points and has very high leverage as well. Removing the outlier, the slope of the regression line becomes negative and not significant (P = 0.42). Any conclusion of a relationship between soil and mushroom cesium level is due solely to this one data point, and so highly questionable.