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# Author: DeAndre Thomas
# Professor: Dr. Anastasopoulos
# Purpose: Homework 8
# Class: IST 772
# Date: 06/03/2022
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# Question 1

myCars<- data.frame(mtcars[,1:6])

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# Question 2

cor(myCars)

# The weight variable would be best predictor of mpg as it has the
# strong (negative/inverese) correlation of -0.868.

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# Question 3

lmOut<- lm(mpg~wt+hp, data = myCars)
lmOut
summary(lmOut)

# The R-Squared value is 0.815. A R-Squared value as such would be
# considered a significantly strong one. The weight, as we
# estimated before, has the strongest correlation to miles per
# gallon, as it has a coefficient value (B-weight value) of
# -3.878. , while the horsepower has a one of -0.032.

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# Question 4

coeffs<- coefficients(lmOut)
coeffs

wt<- 3
hp<- 110
mpg1<- coeffs[1] + (coeffs[2] * wt) + (coeffs[3] * hp)
mpg1

myCars1<- data.frame(wt = 3, hp = 110)
predict(lmOut, myCars1)

# Per the new linear model, if a car weight 3 tons and this car has
# a horsepower of 110, the predicted miles per gallon value would
# be 22.1 miles per gallon.
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# Question 5

library(BayesFactor)

lmMCMCout<- lmBF(mpg~wt+hp, data = myCars)
summary(lmMCMCout)

# The Bayes Factor for linear model prediction finds that there is
# significant odds (788547604 ±0) in favor of weight and horsepower
# predicting the miles per gallon of a vehicle.

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# Question 6

lmMCMCout1<- lmBF(mpg~wt+hp, data = myCars
                  , posterior = TRUE, iterations = 10000)
summary(lmMCMCout1)

# Due to the quantile values for weight and horsepower being less
# than 0, and never greater, we can further conclude that  both
# variables are significant variables in predicting miles per
# gallon.

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# Question 7

install.packages("car")
library(car)
?vif()

# The Variance Inflation Factor (VIF) allows one the measure the
# the amount of multicollinearity between predictor variables in
# linear model. Multicollinearity is when when (independent)
# varibales have high correlation, and when used in a linear model,
# the results can be skewed, unreliable, and/ or undesirable.
# Using VIF will help prevent the use of highly correlated
# independent variables.

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# Question 8

vif(lmOut)

# The ideal model with low multicollinearty would have VIF values
# no higher than 5-10. In the above model, the VIF of both
# variables, weight and horsepower have VIF values of 1.767. Thus,
# these variables are not highly correlated.

# colnames(myCars)
vif(lm(mpg~cyl+disp+hp+drat+wt, data = myCars))
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# In the above model, the varibales with the highest VIF values
# are cyl, with a value of 7.869, and disp, with a value of
# 10.464. Thus, those variables should not be included when
# creating a linear model of this data set; those variables could
# create skewed, unreliable, and/or undesirable results.
```