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#
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# Purpose: Homework 9
# Class: IST 772
# Date: 06/10/2022
#
#####

# Question 1
?mtcars
dfc<- mtcars
glmOut<- glm(formula = vs ~ gear + hp
              , family = binomial(link = "logit"), data = dfc)
summary(glmOut)

# In predicting the engine shape while utilizing the horsepower
# and gear as independent variables, we would fail to reject
# the null hypothesis that one cannot determine the shape of an
# engine based on horsepower and gear variables. The intercept
# (p-value = 0.06) of the model and gear variable
# (p-value = 0.39) have p-values higher than 0.05, meaning that
# we fail to reject the null hypothesis. However, hp has a
# p-value of 0.01, possibly indicating that horsepower alone
# may be a determinant in engine shape.

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# Question 5

# install.packages("BaylorEdPsych")
# library(BaylorEdPsych)
# PseudoR2(glmOut)
# I successfully installed the BaylorEdPsych package, but could not
# install the BaylorEdPsych library. Thus, I could not run line 34.

install.packages("https://cran.r-project.org/src/contrib/Archive/
BaylorEdPsych/BaylorEdPsych_0.5.tar.gz", repos=NULL, type="source")
library(BaylorEdPsych)
PseudoR2(glmOut)

# The Pseduor2 provides similar information at the R-squared value
# would for a linear model in categorical models. The McFadden
# score (0.63), Cox.Snell score (0.42), and Nagelkerke score (0.78)
# all indicate that the model is strong.

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# Question 6
install.packages("car")
library(car)
data(Chile)
dfChile <- data.frame(Chile)
ChileN <- dfChile[dfChile$vote == 'N',]
ChileY <- dfChile[dfChile$vote == 'Y',]
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ChileYN <- rbind(ChileY, ChileN)
ChileYN <- ChileYN[complete.cases(ChileYN),]
ChileYN$vote <- factor(ChileYN$vote, levels = c('N','Y'))
chiLM <- glm(vote ~ age + statusquo, family = binomial(), data = ChileYN)
summary(chiLM)

install.packages("MCMCpack")
library(MCMCpack)
ChileYN$vote <- as.numeric(ChileYN$vote) - 1
chiBayes <- MCMClogit(formula = vote ~ age + statusquo, family = binomial(),
data = ChileYN)
summary(chiBayes)

# The Logistic Model and Bayes model indicate that the status quo is
# the best predictor. The p-value of the logistic regression model
# (2e-16) is significantly lower than the typical alpha level. The Bayes
# model supports the logistic mode in that the status quo's HDI ranges
# from 2.9-3.5. Being so, one can suggest that this is a strong predictor
# in the outcome of ones vote.

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# Question 7

statusQuoLogOdds <- as.matrix(chiBayes[, "statusquo"])
statusOdds <- apply(statusQuoLogOdds, 1, exp)
hist(statusOdds)
abline(v=quantile(statusOdds,c(.025)),col='black')
abline(v=quantile(statusOdds,c(.975)),col='black')

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Histogram of statusOdds

