# Logistic Regression

### Building a Model with a single predictors

library(readr)  
sleep = read.csv("https://raw.githubusercontent.com/JA-McLean/STOR455/master/data/SleepStudy.csv")

1. Construct a model predicting *AllNighter* by *ClassesMissed*. Include a summary of this model. Use this model to perform a hypothesis test to determine if there is significant evidence of a relationship between *AllNighter* and *ClassesMissed*.

allnighter = glm(AllNighter ~ ClassesMissed, family = binomial, data = sleep)  
summary(allnighter)

##   
## Call:  
## glm(formula = AllNighter ~ ClassesMissed, family = binomial,   
## data = sleep)  
##   
## Deviance Residuals:   
## Min 1Q Median 3Q Max   
## -1.1200 -0.5224 -0.4986 -0.4758 2.1140   
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -2.12138 0.23121 -9.175 <2e-16 \*\*\*  
## ClassesMissed 0.09924 0.04587 2.164 0.0305 \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 199.69 on 252 degrees of freedom  
## Residual deviance: 195.45 on 251 degrees of freedom  
## AIC: 199.45  
##   
## Number of Fisher Scoring iterations: 4

Hypothesis test

anova(allnighter, test = "Chisq")

## Analysis of Deviance Table  
##   
## Model: binomial, link: logit  
##   
## Response: AllNighter  
##   
## Terms added sequentially (first to last)  
##   
##   
## Df Deviance Resid. Df Resid. Dev Pr(>Chi)   
## NULL 252 199.69   
## ClassesMissed 1 4.244 251 195.44 0.03939 \*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Null hypothesis: The slope to the relationship between *AllNighter* and *ClassesMissed* is zero.

Alternative hypothesis: The slope to the relationship between *AllNighter* and *ClassesMissed* is nonzero.

1. For a student that has missed 9 classes, what is the probability the model predicts that the student has pulled an all nighter?

sleepmod = glm(AllNighter~ClassesMissed, data=sleep, family=binomial)  
predict(sleepmod, data.frame(ClassesMissed = 9), type="response")

## 1   
## 0.2264939