HW 5

1. (10pt) For the 23 space shuttle flights that occurred before the Challenger mission disaster in 1986, the data Shuttle.csv shows the temperature in fahrenheit (^{o}F) at the time of the flight and whether at least one primary O-ring suffered thermal distress.

   (a) (2pt) Use logistic regression to model the effect of the temperature on the probability of thermal distress. That is, fit the model

   $$\text{logit}(\pi(\text{TD}|\text{Temperature})) = \beta_0 + \beta_1 \text{Temperature}$$

   $$\pi(\text{TD}|\text{Temperature}) = P(\text{Termal Distress} = 1|\text{Temperature})$$

   (b) (2pt) Estimate β_1, the effect of temperature on the probability of thermal distress. Interpret your result.

   (c) (2pt) Construct a 95% confidence interval to describe the effect of the temperature on the odds of thermal distress (i.e. construct a 95% interval for e^{β_1}), Interpret your result

   (d) (2pt) Predict the probability of thermal distress at 31^{o}F, the temperature at the time of the Challenger flight.

   (e) (2pt) At what temperature does the predicted probability equal 0.5?

2. The data in the file adolescent.csv appeared in a national study of 15 and 16 year-old adolescents. The event of interest is ever having sexual intercourse. The goal is to study the effect if any of race and gender on having sexual intercourse (Yes, No). Consider the following model

   $$\text{logit}(\pi(\text{Intercourse=Yes}|\text{Gender, Race})) = \beta_0 + \beta_1 \text{Gender} + \beta_2 \text{Race}$$

   (a) (2pt) Estimate β_1 and β_2 and interpret your result

   (b) (2pt) Construct a 95% confidence interval to describe the effect of gender on the odds of Intercourse controlling for race (i.e. construct a 95% interval for e^{β_1}), Interpret your result

   (c) (2pt) Construct a 95% confidence interval to describe the effect of race on the odds of Intercourse controlling for gender (i.e. construct a 95% interval for e^{β_2}), Interpret your result

   (d) (2pt) Test $H_0 : \beta_1 = \beta_2 = 0$ against H_a : at least one of them is not zero. Use $\alpha = 0.05$.

   (e) (2pt) Test $H_0 : \beta_1 = 0$ against $H_a : \beta_1 \neq 0$. Use $\alpha = 0.05$.