

# Statistical Method

## Homework 6

Due data: 23:59, November 13, 2023

1. Using the "Carseats" data set to answer the following questions:
  - (a) Fit a multiple regression model to predict Sales using Price, Urban, and US.
  - (b) Provide an interpretation of each coefficient in the model.
  - (c) Write out the model in equation form, being careful to handle the qualitative variables properly.
  - (d) For which of the predictors can you reject the null hypothesis  $H_0 : \beta_j = 0$ ?
  - (e) Based on (d), fit a smaller model that only uses the predictors for which there is evidence of association with the outcome.
  - (f) How well do the models in (a) and (e) fit the data? Give the reason.
  - (g) Try to fit a better regression model using more predictors in data set? What is the adjusted  $R^2$ ? The analysis should provide the diagnostic figures of residuals showing the model satisfies the assumptions.
2. Suppose we have a data set with five predictors,  $X_1 = \text{GPA}$ ,  $X_2 = \text{IQ}$ ,  $X_3 = \text{Level}$  (1 for College and 0 for High School),  $X_4 = \text{Interaction between GPA and IQ}$ , and  $X_5 = \text{Interaction between GPA and Level}$ . The response is starting salary after graduation (in thousands of dollars). Suppose we use least squares to fit the model, and get  $\hat{\beta}_0 = 50$ ,  $\hat{\beta}_1 = 20$ ,  $\hat{\beta}_2 = 0.07$ ,  $\hat{\beta}_3 = 35$ ,  $\hat{\beta}_4 = 0.01$ , and  $\hat{\beta}_5 = -10$ .
  - (a) True or False
    - i. For a fixed value of IQ and GPA, high school graduates earn more, on average, than college graduates.
    - ii. For a fixed value of IQ and GPA, college graduates earn more, on average, than high school graduates.
    - iii. For a fixed value of IQ and GPA, high school graduates earn more, on average, than college graduates provided that the GPA is high enough.
    - iv. For a fixed value of IQ and GPA, college graduates earn more, on average, than high school graduates provided that the GPA is high enough
    - v. Since the coefficient for the GPA/IQ interaction term is very small, there is very little evidence of an interaction effect. Justify your answer.
  - (b) Predict the salary of a college graduate with IQ of 110 and a GPA of 4.0.