HW6

Math 189

Friday of Week 6, 05/06/2022

1. In this problem, you are asked to do a hypothesis test problem in a simple linear model. In the `Auto` data set in the `ISLR2` package, we want to use `acceleration` to predict `mpg`.

   Denote by Y the `mpg` variable, and by X the `acceleration` variable. We consider the linear model:

   $$Y = \beta_0 + \beta_1 X + \epsilon.$$

   a) What is the estimated value of β_1, and what is the estimated standard error of β_1?

   b) Test whether $\beta_1 = 0$. What is your test statistic and p-value?

   c) Assume that $Var(\epsilon) = \sigma^2$. What is the estimated value of σ? And what is the estimated value of σ^2?

   d) Using t-type quantile to construct a 95% confidence interval for β_1.

2. In this problem, you are asked to work on some questions on multiple linear regression. We continue considering the `Auto` data set as in Q1. The model formula is `mpg ~ cylinders + displacement + horsepower + weight + acceleration + year + origin`.

   a) What is the number of predictors p in this model?

   b) What is the estimated value of β_1, β_2, $\ldots$, β_p?

   c) Suppose that we want to test $\beta_j = 0$ for $j = 1, \ldots, p$, separately. What are the associated p-values? From these p-values, which variables are helpful in predicting `mpg`?

   d) We want to test whether $\beta_1 = \cdots = \beta_p = 0$. Specify the value of F test statistic, and find the p-value. What are the degrees of freedom in the F distribution?

   e) Suppose we want to test the coefficients of the variables `cylinders`, `horsepower` and `acceleration` are all 0. Find the F test statistic, and calculate the p-value. What are the degrees of freedom in the F distribution?