

STT3851 Homework 6

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- 1) For a simple linear regression model, we are given the following information:

$$\sum_{i=1}^7 (x_i - \bar{x})^2 = 2000, \quad \sum_{i=1}^7 e_i^2 = 967$$

Calculate $SE(\hat{\beta}_1)$ the standard error of $\hat{\beta}_1$.

- 2) Show that the LS estimate, $\hat{\beta}_1$ can be written as:

$$\hat{\beta}_1 = \frac{\sum_{i=1}^n x_i y_i - n \bar{x} \bar{y}}{\sum_{i=1}^n x_i^2 - n \bar{x}^2}$$

- 3) Load the **Auto** data set from the ISLR library. Consider a simple linear regression model predicting **mpg** using **weight**.

1. Obtain $\sum y_i$, $\sum x_i$, $\sum x_i^2$, $\sum x_i y_i$, $\sum y_i^2$, n using R.
2. Obtain the estimated regression function by finding LS estimates $\hat{\beta}_1$ and $\hat{\beta}_0$ using part 1).
3. Plot the estimated regression function and the data.
4. Does a linear regression function appear to give a good fit here?
5. Verify that your fitted regression line goes through the point (\bar{X}, \bar{Y}) .
6. Obtain the residual for the first case.
7. Compute $\sum e_i^2$ and MSE (You can use *R* here but do not use the *lm()* function directly).