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 $\sum y_i, \quad \sum x_i, \quad \sum x_i^2, \quad \sum x_i y_i, \quad \sum y_i^2, \quad n$ 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).