MA 542 REGRESSION ANALYSIS
SPRING 2018

HW-2 Due: R 1/29

1. Chapter 1, page 33, question 1.7

2. Chapter 1, page 38, question 1.42

3. Let b_1 be the *mle* of β_1 in model (1.24). Note that $b_1 = \sum k_i Y_i$ where $k_i = \frac{X_i - \bar{X}}{\sum (X_i - \bar{X})^2}$. Prove the following properties.

   a) $\sum_{i=1}^{n} k_i = 0$.

   b) $\sum_{i=1}^{n} k_i X_i = 1$.

   c) $\sum_{i=1}^{n} k_i^2 = \frac{1}{\sum (X_i - \bar{X})^2}$.

4. Let b_0 be the *mle* of β_0 in model (1.24). Prove the following properties.

   a) $E(b_0) = \beta_0$.

   b) $Var(b_0) = \sigma^2\{b_0\} = \sigma^2 \left[1/n + \frac{\bar{X}^2}{\sum (X_i - \bar{X})^2} \right]$.

   c) What is the estimated variance of b_0.

5. Let $E(Y_h)$ be the mean response of the model (1.24) at $X = X_h$. Note that the point estimator for $E(Y_h)$ is $\hat{Y}_h$ (the fitted value at $X = X_h$). Prove the following properties.

   a) $E(\hat{Y}_h) = E(Y_h)$.

   b) $Var(\hat{Y}_h) = \sigma^2\{\hat{Y}_h\} = \sigma^2 \left[1/n + \frac{(X_h - \bar{X})^2}{\sum (X_i - \bar{X})^2} \right]$.

   c) What is the estimated variance of $\hat{Y}_h$.

6. Chapter 2, page 92, question 2.6 (replace part (e) with $Q\#$ 2.15 part (a))
Do not use a computer software for this problem
For parts b and d, use the four steps discussed in the class.

7. Chapter 2, page 92, question 2.5 (replace part (e) with $Q\#$ 2.14 part (a))
You may use R for this problem
For parts b and d, use the four steps discussed in the class.