Assignment 1

Last name: DU
First name: MIN
Student ID: 1002602230
Course section: STA302H1F-Summer 2017

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Q1 (4 pts) - Typing mathematical notations.

Q1-a: Show that $\sum_i^n (X_i - \bar{X}) = 0$

Proof:

$$\begin{aligned}\sum_{i=1}^{n}(X_i - \bar{X}) &= \sum_{i=1}^{n} X_i - \sum_{i=1}^{n} \bar{X} \\ &= \sum_{i=1}^{n} X_i - n\bar{X} \\ &= \sum_{i=1}^{n} X_i - \sum_{i=1}^{n} X_i \\ &= 0\end{aligned}$$

Q1-b (2 pts): Show that $\sum_i^n (X_i - \bar{X})^2 = \sum_{i=1}^n X_i^2 - n\bar{X}^2$

Proof:

$$\begin{aligned}\sum_{i=1}^{n}(X_i - \bar{X})^2 &= \sum_{i=1}^{n}(X_i^2 - 2X_i\bar{X} + \bar{X}^2) \\ &= \sum_{i=1}^{n} X_i^2 - \sum_{i=1}^{n} 2X_i\bar{X} + \sum_{i=1}^{n} \bar{X}^2 \\ &= \sum_{i=1}^{n} X_i^2 - 2n\bar{X}^2 + n\bar{X}^2 \\ &= \sum_{i=1}^{n} X_i^2 - n\bar{X}^2\end{aligned}$$

Q1-c (2 pts): Show that $\sum_i^n (X_i - \bar{X})(Y_i - \bar{Y}) = \sum_{i=1}^n X_i Y_i - n\bar{X}\bar{Y}$

Proof:

$$\begin{aligned}\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y}) &= \sum_{i=1}^{n}(X_iY_i - X_i\bar{Y} - \bar{X}Y_i + \bar{X}\bar{Y}) \\ &= \sum_{i=1}^{n} X_iY_i - 2n\bar{X}\bar{Y} + n\bar{X}\bar{Y} \\ &= \sum_{i=1}^{n} X_iY_i - n\bar{X}\bar{Y}\end{aligned}$$