

STA 206 Homework 6

1. ② True? The least-squares estimated regression coefficients of the X variables may not be 0 but the expected value of the respective coefficients should be 0. Ex: $\hat{\beta}_1 \neq 0$ but $E[\hat{\beta}_1] = 0$.

③ True. The data will be fit well if appropriate but the errors on the coefficients may be large.

④ True. This is an effect of multicollinearity.

⑤ False. A statistically significant variable would reduce variation enough to show up in the F test.

⑥ True. Its variance covariance matrix between the coefficients is

$$\sigma^2 \frac{1}{\beta} = \sigma^2 \begin{bmatrix} 1/n & 0 \\ 0 & 1 \end{bmatrix} \Rightarrow \sigma_i^2 \text{ for } \hat{\beta}_i$$

⑦ True. LS coefficient should be close to zero and with $VIF = 1$, no inflated bounds as well.

⑧ True. High $R_k^2 \Rightarrow$ High $VIF \Rightarrow$ large standard errors

3. For a model with 2 X variables, the VIFs are

$$VIF_1 = \frac{1}{1-R_1^2} \quad \text{and} \quad VIF_2 = \frac{1}{1-R_2^2}.$$

Note that $R_1^2 = R_{1,2}^2$, the correlation between 1 and 2 squared.

As $R_2^2 = R_{1,2}^2$, is also the squared correlation between 1 and 2, $R_1^2 = R_2^2$. It follows that $VIF_1 = VIF_2$.