STAT W4201 001, Homework 5

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Code is attached here and also posted at https://github.com/BrianWeinstein/advanced-data-analysis. Where relevant, code snippets and output are are included in-line.

Problem 1: Ramsey 7.18

(a) *Find the standard error of prediction for the prediction of pH at 5 hours after slaughter.*
The calculations in Display 7.12 give us $\hat{\beta}_0 = 6.9836$, $\hat{\beta}_1 = -0.7257$, $\hat{\sigma} = 0.08226$, $n = 10$, $\overline{X} = 1.190$, $s_X^2 = 0.6344$.
Therefore, the standard error of prediction for the pH at 5 hours is

$$\begin{aligned}\text{SE}\left[\text{Pred}\{Y|X_0 = \log(5) = 1.609438\}\right] &= \hat{\sigma}\sqrt{1 + \frac{1}{n} + \frac{(X_0 - \overline{X})^2}{(n-1)s_X^2}} \\ &= (0.08226)\sqrt{1 + \frac{1}{10} + \frac{(1.609438 - 1.190)^2}{9 \cdot 0.6344}} \\ &= 0.0875\end{aligned}$$

(b) *Construct a 95% prediction interval at 5 hours after slaughter.*
The prediction of pH level at 5 hours is,

$$\begin{aligned}Pred\{Y|X_0 = \log(5) = 1.609438\} &= \beta_0 + \beta_1 \cdot \log(5) \\ &= 6.9836 - 0.7257 \cdot 1.609438 \\ &= 5.8156.\end{aligned}$$

A 95% prediction confidence interval at 5 hours is given by

$$\begin{gathered}5.8156 \pm t_8(0.975) \cdot \text{SE}\left[\text{Pred}\{Y|X_0 = \log(5)\}\right] \\ 5.8156 \pm 2.3060 \cdot 0.0875 \\ 5.8156 \pm 0.2017 \\ \Rightarrow [5.6139, 6.0173].\end{gathered}$$

Problem 2: Ramsey 7.24

Problem 3: Ramsey 7.28

Problem 4: Ramsey 8.17

Problem 5: Ramsey 8.20

Problem 6: Ramsey 9.12