

STAT 308 – Homework 3

For the problems in which calculations are needed, please include your R code with your answers, otherwise you will not be given full credit. Please upload your assignment by Thursday, September 22, 11:59 pm in a pdf file to Sakai.

- 1. Suppose we perform a simple linear regression where

$$n = 50, \bar{x} = -0.208, \bar{y} = 1.516, s_x = 2.354, s_y = 3.185$$

$$\hat{\beta}_0 = 1.745, \hat{\beta}_1 = 1.102, s_{Y|X} = 1.868, s_{\hat{\beta}_0} = 0.265, s_{\hat{\beta}_1} = 0.113$$

- a. Calculate a 95% confidence interval for β_1 .
- b. Find a test statistic and p-value for testing $H_0 : \beta_1 = 0$ vs. $H_a : \beta_1 > 0$.
- c. Calculate a 95% confidence interval for $\mu_{Y|X}$ when $x = 3$.
- d. Calculate a 95% prediction interval for Y when $x = 3$.

- 2. Suppose I have a dataset, for which I perform a simple linear regression of Y on X .

- a. I calculate 95% confidence and prediction intervals for our predicted value of Y for $x = 2$, which gives us $\hat{Y}_{x=2} = -2.199$, and our two intervals $(-2.59, -1.80)$ and $(-4.25, -0.14)$. Which one is the prediction interval? Explain your reasoning.
- b. Now, suppose I wish to calculate a 95% confidence interval for the predicted value of Y for $x = \bar{x}$. Will this width of this confidence interval (the difference between upper and lower values of the interval) be larger or smaller? Explain your reasoning.

- 3. Reconsider the dataset **AdRevenue.csv** as well as our simple linear regression model of ad revenue (in millions of dollars) based on circulation (in millions).

- a. Calculate a 95% confidence interval for β_1 . Interpret this interval in the context of the problem.
- b. Perform a hypothesis test for a linear relationship between ad revenue and circulation. Be sure to properly state your hypotheses, your test statistic, p-value, and a decision and conclusion at $\alpha = 0.05$.
- c. Calculate a 95% confidence interval for the predicted ad revenue when there are 2.5 million subscriptions in circulation. Interpret this interval in the context of the problem.
- d. Calculate a 95% prediction interval for a randomly selected magazine with 2.5 million subscriptions in circulation. Interpret this interval in the context of the problem.