STA 4320 – Homework 2

Prof. He Jiang

Name: _____
Student Number: _____

For the current assignment, Your report should be no longer than the following amount of pages: 3

You do not have to submit this instruction page.

Please compile your coding into a single PDF file.

Please submit your compiled (PDF file) report to the corresponding assignment on Gradescope.

Please label your solution. If there is only 1 question, please label as well.

1. This question is based on the same dataset as the previous coding assignment, but focuses on the implementation of concepts and methods.

   The Auto dataset in the ISLR2[1] package contains Gas mileage, horsepower, and other information for $n = 392$ vehicles.

   We would like to use simple linear regression to investigate the relationship between the response, Y, mpg, and the independent variable, X, horsepower. The output of the regression result are shown below:

	Estimate	Std. Error	t value	Pr($>|t|$)
(Intercept)	$\hat{\beta}_0$	0.717499	55.66	<2e-16
x	$\hat{\beta}_1$	0.006446	-24.49	<2e-16

Residual standard error	4.906 on 390 degrees of freedom
Multiple R-squared	0.6059 Adjusted R-squared: 0.6049
F-statistic	599.7 on 1 and 390 DF, p-value: <2.2e-16

   For your convenience, $\sum X = 40952$, $\sum Y = 9190.8$, $\sum X^2 = 4857524$, $\sum Y^2 = 239305.7$, $\sum XY = 868718.8$.

   Grading Method

   The grading of this assignment will be based on: Completion.

   Submissions that are empty or did not show sufficient efforts will receive 0. Submissions that showed significant efforts will receive full amount of points.

   Tasks for this Assignment

   This is a by-hand assignment.

   (a) (3 points) Compute $\hat{\beta}_1$.

   (b) (3 points) Compute $\hat{\beta}_0$.

   (c) (2 points) Given the intercept, is the true slope parameter β_1 of the model significant? At the significance level of $\alpha = 1\%$, conduct a hypothesis test on:

   $H_0 : \beta_1 = 0$ v.s. $H_1 : \beta_1 \neq 0$

   Give a conclusion on whether it is or is not significant, and provide support.

   (d) (2 points) Construct a 95% confidence interval for the true slope coefficient β_1. Some R code that might be helpful are provided:

   qt(0.975, 391) [1] 1.96605 qt(0.975, 392) [1] 1.966034 pt(0.975, 391) [1] 0.8349185
   pt(0.975, 392) [1] 0.8349192

[1] This is the R package corresponding to our textbook.