

Assignment 2

1. For the multiple linear regression estimator, show that the matrix H is (i) symmetric; and (ii) idempotent.
2. Consider the multiple linear regression model with two independent variables,

$$y = X\beta + \epsilon.$$

Suppose that $\epsilon \sim N(0,2)$. The following data was observed.

x_1	x_2	y
4.49	2.92	-5.32
3.04	4.33	-9.24
3.94	4.27	-5.89
2.63	1.92	1.15
4.55	2.47	-1.47
3.88	2.36	1.91
2.92	3.21	-3.99
2.82	4.22	-6.82
3.17	1.80	1.49
2.91	2.35	-0.89

- a. Compute the covariance for the least squares regression estimators. That is, find $V(\hat{\beta})$.
- b. Using the above data, find the estimate of $V(\hat{\beta})$.
- c. What is the variance for the 1st and 3rd residuals (hint: read section 4.2.2).?
- d. What is the covariance between the first and third residual?

3. In the week 3 live lecture, we discussed an application from the Center for Radiative Shock Hydrodynamics. The data for the experiment are in the file `data_computer_experiment.csv` on Canvas. Estimate a linear regression model for the experiment discussed in the live lecture.
 - a. What is the estimated variance for the least squares estimator of the regression coefficient for the thickness of the beryllium disk?
 - b. What is the estimated covariance between the least squares estimators of the regression coefficients for the thickness of the beryllium disk and the wall opacity?
 - c. Perform regression diagnostics on this model to answer the following questions:
 - i. Check the constant variance assumption for the errors.
 - ii. Check the normality assumption.
 - iii. Check for large leverage points.
 - iv. Check for outliers.
 - v. Check for influential points.
 - vi. Check the structure of the relationship between the predictors and the response.