

Regression Analysis Assignments

- **Assignment 1 due by October 2, 2024**

1. (100 pt.) Consider a simple linear regression model $y_i = \beta_0 + \beta_1 x_i + \varepsilon_i$. The least squares estimators of β_0 and β_1 are $\hat{\beta}_0$ and $\hat{\beta}_1$, respectively, where

$$\hat{\beta}_1 = \frac{\sum (x_i - \bar{x}) y_i}{\sum (x_i - \bar{x})^2} \quad \text{and} \quad \hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}.$$

- (a) (10 pt.) Show that $\hat{\beta}_0$ is a linear combination of y_i .
- (b) (10 pt.) Show that $E(\hat{\beta}_1) = \beta_1$.
- (c) (20 pt.) Show that $E(\hat{\beta}_0) = \beta_0$.
- (d) (20 pt.) Show that $\text{Cov}(\bar{y}, \hat{\beta}_1) = 0$.
- (e) (20 pt.) Show that $\text{Var}(\hat{\beta}_1) = \frac{\sigma^2}{\sum (x_i - \bar{x})^2}$.
- (f) (20 pt.) Show that $\text{Var}(\hat{\beta}_0) = \sigma^2 \left[\frac{1}{n} + \frac{\bar{x}^2}{\sum (x_i - \bar{x})^2} \right]$.

- **Assignment 2 due by October 16, 2024**

1. (75 pt.) Do Problem 2.4 using SAS.
2. (25 pt.) Do Problem 2.5 using SAS.