

1) Suppose that $Y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \beta_4 x_{i4} + \epsilon_i$. Testing $H_0 : \beta_2 = \beta_4 = 0$ is equivalent to testing $H_0 : \mathbf{A}\boldsymbol{\beta} = \mathbf{0}$. What is \mathbf{A} ?

2) Find shorth(5) for the following data set of residuals. Show work.

-8 -7 -4 -3 0 1 3 4 6 8

3) Let $\mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\epsilon}$ where $\mathbf{Y} = (Y_1, Y_2, Y_3)'$, $\boldsymbol{\beta} = (\beta_1, \beta_2)'$, $E(\boldsymbol{\epsilon}) = \mathbf{0}$, and $\text{Cov}(\boldsymbol{\epsilon}) = \sigma^2 \mathbf{I}$. If $\mathbf{X} = \begin{bmatrix} 2 & 0 \\ 1 & 2 \\ 0 & 1 \end{bmatrix}$, is $\boldsymbol{\beta}$ estimable? Explain briefly.

4) Suppose that $\mathbf{Y} = (Y_1, Y_2)'$, $\text{Var}(\mathbf{Y}) = \sigma^2 \mathbf{I}$, $E(Y_1) = E(Y_2) = \beta_1 - 2\beta_2$. Show whether or not the following functions are estimable. Hint $E(\mathbf{Y}) = \mathbf{X}\boldsymbol{\beta}$, so find \mathbf{X} .

a) β_1

b) β_2

c) $-\beta_1 + 2\beta_2$

d) $4\beta_1 - 8\beta_2$