

1. Consider  $Y \sim N(X\beta, \sigma^2 I_n)$  where  $X \in R^{n \times p}$  and  $1_n \in \mathcal{R}(X)$ .

(1) Show that  $SSM = Y'(XX^+ - 1_n 1_n^+)Y$  is an SS.

(2) Show that  $SSM$  is part of  $SSTO = Y'(I - 11^+)Y$ .

(3) Find an SS such that  $SSTO = SSM + SS$ .

2. For model  $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \epsilon$  consider a test on  $H_0 : \begin{pmatrix} -0.5 & 10 & 0 & -20 \\ 0 & 0 & 1 & 0 \end{pmatrix} \beta = 0$ .

Write your report with `y`, `x1`, `x2`, `x3` in file "ex.txt".