1. File Table94.txt contains variables y, x_1, x_2, x_3, x_4, x_5, x_6. Consider model

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \epsilon, \ \epsilon \sim N(0, \sigma^2)$$

and null hypothesis $H_0 : \begin{pmatrix} 1 & 2 & -1 & 0 \\ 0 & 0 & 1 & -1 \end{pmatrix} \beta = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$.

(1) Find SSE, DF of SSE, MSE, SSII_0 and SSII_3. (Use SAS)

    SSE= 97.65789,   (DF of SSE)= 8,   MSE= 12.20724

    $\text{SSII}_0 = 212.25159$, $\text{SSII}_3 = 10.94040$.

(2) Find the model reduced by H_0.

$$H_0 : \begin{pmatrix} 1 & 2 & -1 & 0 \\ 0 & 0 & 1 & -1 \end{pmatrix} \beta = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \Longleftrightarrow \left\{ \begin{array}{ccc} \beta_0 + 2\beta_1 - \beta_2 & = & 0 \\ \beta_2 - \beta_3 & = & 0 \end{array} \right. \Longleftrightarrow \left\{ \begin{array}{ccc} \beta_0 & = & \beta_2 - 2\beta_1 \\ \beta_3 & = & \beta_2 \end{array} \right.$$

Under H_0,

$$\begin{array}{rcl} y & = & \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \epsilon \\ & = & \beta_2 - 2\beta_1 + \beta_1 x_1 + \beta_2 x_2 + \beta_2 x_3 + \epsilon = \beta_1(x_1 - 2) + \beta_2(x_2 + x_3 + 1) + \epsilon. \end{array}$$

So the reduced model is

$$y = \beta_1(x_1 - 2) + \beta_2(x_2 + x_3 + 1) + \epsilon, \ \epsilon \sim N(0, \sigma^2).$$

(3) For the reduced model find SSE_r, (DF of SSE_r) (Use SAS).

    $\text{SSE}_r = 353.11014$ and   (DF of SSE_r)=10.

2. Consider the model in 1.

(1) Let F_0 and F_3 be the test statistics for testing on $H_0 : \beta_0 = 0$ and $H_0 : \beta_3 = 0$ respectively. Based on the results in (1) of 1, calculate the values of F_0 and F_3.

    $F_0 = \frac{SSII_0}{MSE} = \frac{212.25159}{12.20724} = 17.38735$ $F_3 = \frac{SSII_3}{MSE} = \frac{10.94040}{12.20724} = 0.89622$.

(2) Let F be the test statistic for testing on H_0 in 1. Based on the results in (1) and (3) of 1, calculate the value of F.

    $F = \frac{(SSE_r - SSE)/q}{MSE} = \frac{(353.11014 - 97.65789)/(10-8)}{12.20724} = \frac{127.72613}{12.20724} = 10.46$

(3) Find the table by SAS for testing H_0 in 1 to verify your calculation in (2) of 2.

	DF	MS	F	$Pr > F$
Numerator	2	127.72613	10.46	0.0059
Denominator	8	12.20724		