Statistics 100C   **Instructor: Nicolas Christou**

Homework 18

Please access the following data in `R` (copy and paste the following lines to access the data and to define the response and predictor variables):

```
a <- read.table("http://www.stat.ucla.edu/~nchristo/statistics100C/body_fat.txt", header=TRUE)

#Response variable:
y <- a$y

#Predictor variables:
x1 <- a$x11
x2 <- a$x12
x3 <- a$x13
x4 <- a$x14
x5 <- a$x15
```

Answer the following questions:

a. Assume there is an intercept in the model $\mathbf{y} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\epsilon}$. Construct and compute the following: $\mathbf{X}, \mathbf{X}'\mathbf{X}, \hat{\boldsymbol{\beta}}, \mathbf{H}, \hat{\mathbf{Y}}, \mathbf{e}, S_e^2$.

b. Using the F statistic for the general linear hypothesis test (use $\alpha = 0.05$)
$H_0 : \beta_2 = \beta_4 = \beta_5 = 0$
H_a : At least one of these betas is not equal to zero.

c. Repeat (b) using the extra sum of squares principle (full and reduced model).

d. Suppose we know that $\sigma^2 = 50$ and $\boldsymbol{\beta} = \begin{pmatrix} -42.0 \\ 2.4 \\ -0.5 \\ 1.9 \\ 0.1 \\ -1.6 \end{pmatrix}$.

Compute the Type II error β and the power of the test of question (b).

e. Estimate the model ($\boldsymbol{\beta}$ and σ^2) of question (a) under the set of linear constraints of the form $\mathbf{C}\boldsymbol{\beta} = \boldsymbol{\gamma}$, where
$\mathbf{C} = \begin{pmatrix} 2, 1, 1, 1, 2, 3 \\ 0, 2, 5, 1, 1, 1 \end{pmatrix}$ and $\boldsymbol{\gamma} = \begin{pmatrix} 15 \\ 25 \end{pmatrix}$.