KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS & STATISTICS
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STAT 310: Linear Regression
Semester 161
Quiz 1 (Computational)
Sunday December 17, 2016
3:00 pm

Name: ID #:

Q.No.1:- (2+5+5 = 12 points) Open the excel file that should contain a response variable (y) and three predictors.
(i) Find $\boldsymbol{y'y}$ and $\widehat{\boldsymbol{\beta}}'\boldsymbol{X'y}$

(ii) Using partial F test (extra sum of squares method) check the significance of X_1 and X_3 at $\alpha = 0.001$. Use the p-value approach.

H_0:

H_1:

Test Statistic: F_0= with v_1= and v_2=

P-value=

Decision:

(iii) Suppose that the fitted multiple regression model is $\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \hat{\beta}_2 x_2 + \hat{\beta}_3 x_3$. Find the correlation coefficient between $\hat{\beta}_1$ and $\hat{\beta}_3$.

Q.No.2:- (2+1 = 3 points) Transform all the variables using unit length scaling and denote them by y_0, w_1, w_2 and w_3.

(i) Write the result for $W'W$ matrix.

Hint: The off-diagonal elements of $W'W$ will be the correlation coefficients between the original (untransformed) variables.

(ii) Write down the standardized regression model.

Some useful formulas

$$\widehat{\boldsymbol{\beta}} = (\boldsymbol{X'X})^{-1}\boldsymbol{X'y}, \qquad \boldsymbol{H} = \boldsymbol{X}(\boldsymbol{X'X})^{-1}\boldsymbol{X'}, \qquad \boldsymbol{Var - Cov}(\widehat{\boldsymbol{\beta}}) = \sigma^2(\boldsymbol{X'X})^{-1}$$

$$SST = \boldsymbol{y'y} - \frac{(\sum y_i)^2}{n}, \quad SSR = \widehat{\boldsymbol{\beta}}'\boldsymbol{X'y} - \frac{(\sum y_i)^2}{n}$$

$$SSE = \boldsymbol{y'y} - \widehat{\boldsymbol{\beta}}'\boldsymbol{X'y}, \quad MSE = \frac{SSE}{n-k-1} = \hat{\sigma}^2$$

$$F_0 = \frac{SSR/k}{SSE/(n-k-1)} = \frac{MSR}{MSE}$$

$$R^2_{adj} = 1 - \frac{SSE/(n-p)}{SST/(n-1)}, \quad \hat{\beta}_j \pm t_{\frac{\alpha}{2},n-k-1}\, se(\hat{\beta}_j), \quad PRESS = \sum\left(\frac{e_i}{(1-h_{ii})}\right)^2, \quad R^2_{prediction} = 1 - \frac{PRESS}{SST}$$

$$\hat{\mu}_{y|x=x_0} \pm t_{\frac{\alpha}{2},n-k-1}\sqrt{\hat{\sigma}^2\boldsymbol{x_0'}(\boldsymbol{X'X})^{-1}\boldsymbol{x_0}}, \qquad \hat{y}_0 \pm t_{\frac{\alpha}{2},n-k-1}\sqrt{\hat{\sigma}^2(1 + \boldsymbol{x_0'}(\boldsymbol{X'X})^{-1}\boldsymbol{x_0})}$$