Math 584 Quiz 10 Spring 2019 Name_____

1) Consider the multiple linear regression model $\boldsymbol{Z} = \boldsymbol{W}\boldsymbol{\eta} + \boldsymbol{\epsilon}$ where $\boldsymbol{W}$ has full rank $p-1$, $E(\boldsymbol{\epsilon}) = \boldsymbol{0}$, and $Cov(\boldsymbol{\epsilon}) = \sigma^2 \boldsymbol{I}_n$.

a) What is the (formula for the) projection matrix $\boldsymbol{P}$ onto the column space of $\boldsymbol{W}$?

$\underline{P} = W(W^TW)^{-1}W^T$

b) What is the OLS estimator $\hat{\boldsymbol{\eta}}$? $= (W^TW)^{-1}W^T\underline{Z}$

c) What is the vector of fitted values $\hat{\boldsymbol{Z}}$? $= \underline{P}\underline{Z} = W(W^TW)^{-1}W^T\underline{Z} = W\hat{\eta}$

d) What is the residual vector $\boldsymbol{e}$? $(I-P)\underline{Z} = \underline{Z} - \underline{\hat{Z}}$

60

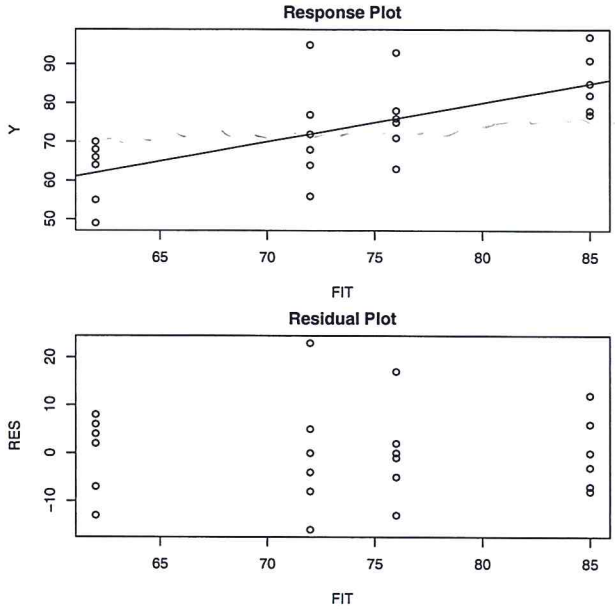

Figure 1: Plots for Donut Data

2) Following Snedecor and Cochran (1967, p. 259) studied the amount of fat absorbed by donuts using 4 types of fat. Let μ_i denote the mean amount of fat$i$ absorbed by doughnuts, $i = 1, 2, 3$ and 4. The least squares estimators of μ_i for the one way Anova model were $\overline{Y}_{10} = 72$, $\overline{Y}_{20} = 85$, $\overline{Y}_{30} = 76$, and $\overline{Y}_{40} = 62$.

a) Do the plots suggest that linearity is reasonable?

yes

b) Let R_i be the range of the ith dot plot. Then $R_1 = 39$, $R_2 = 20$, $R_3 = 30$, and $R_4 = 21$. Is $\max(R_1, R_2, R_3, R_4) < 2\min(R_1, R_2, R_3, R_4)$?

yes $39 < 2(20) = 40$

c) Why does the response plot suggest that μ_4 is the smallest of the four means?

The sample means of the other 3 dot plots lie above the largest value of the 1st dot plot.

40