Family (Last) Name ______________________

Given (First) Name Jerry

Student Number ______________________

# STA 302s13 Quiz 9A

1. (2 points) What is $E(\mathbf{YY}')$ for the general linear model? Start with an item on the formula sheet.

$$cov(Y) = E(YY') - \mu_y \mu_y' \Rightarrow E(YY') = cov(Y) + \mu_y \mu_y'$$

$$= \sigma^2 I_n + X\beta\beta' X'$$

2. (8 points) For the general linear regression model, are $\widehat{\boldsymbol{\epsilon}}$ and $\mathbf{Y}$ independent? Answer Yes or No and prove your answer.

$$C(\hat{\varepsilon}, Y) = E\{(\hat{\varepsilon} - 0)(Y - X\hat{\beta})'\}$$

$$= E\{\hat{\varepsilon} Y'\} - E\{\hat{\varepsilon}\} X\beta = E\{\hat{\varepsilon} Y'\} - 0$$

$$= E\{(Y - \hat{Y}) Y'\} = E\{(Y - X(X'X)^{-1}X'Y) Y'\}$$

$$= E\{(I_n - X(X'X)^{-1}X') YY'\} = (I - X(X'X)^{-1}X') E(YY')$$

$$= (I - X(X'X)^{-1}X')(\sigma^2 I_n + X\beta\beta' X')$$

$$= \sigma^2 I + X\beta\beta' X' - \sigma^2 X(X'X)^{-1}X' - X(X'X)^{-1}X'X\beta\beta' X'$$

$$= \sigma^2 I + X\beta\beta' X' - \sigma^2 X(X'X)^{-1}X' - X\beta\beta' X'$$

$$= \sigma^2 (I - X(X'X)^{-1}X') \neq 0$$

No, not independent.