STAT-S 631 **Assignment 9** **Due date: 11/03/17**

Recall that

1. From ALR 5.14,

2. Using your class notes and/or textbook, show the following equalities:

   a) $\mathbf{H}\mathbf{H}_R = \mathbf{H}_R$ and $\mathbf{H}\mathbf{X}_1 = \mathbf{H}_R\mathbf{X}_1 = \mathbf{X}_1$
   (Recall that $\mathbf{X} = (\mathbf{X}_1|\mathbf{X}_2)$ and $\mathbf{H}$ and $\mathbf{H}_R$ are the hat matrices for $\mathbf{X}$ and $\mathbf{X}_1$, respectively).

   b) $\mathbf{H} - \mathbf{H}_R$ is symmetric and idempotent.

   c) Under H_0, and only under H_0,
   $$\frac{1}{\sigma^2} SSreg \sim \chi^2_q$$
   with SSreg $= RSS_R - RSS_F$.
   (Hint: Under the null $\boldsymbol{\beta}_2 = \mathbf{0}$ and $E(\mathbf{Y}|\mathbf{X}) = \mathbf{X}_1\boldsymbol{\beta}_1$, or $E(\mathbf{Y} - \mathbf{X}_1\boldsymbol{\beta}_1) = \mathbf{0}$).

   d) SSreg and $\hat{\sigma}^2$ are independent.

   e) Use all previous parts to show that
   $$\frac{\frac{SSreg}{q}}{\frac{RSS}{n-p'}} \sim Fq, n - p'$$

3. From ALR 6.4. In addition, using the full model, perform the test
   $$H_0 : \beta_{02} - \beta_{03} = 14 \text{ and } \beta_{12} + \beta_{13} = .2$$
   with H_A : at least one equality doesn't hold. Show your work. In addition, how could you interpret this test?