1. **Question 1**: Suppose $y = x\beta + \varepsilon$, identical for males and females except that the variance of ε is twice as large for males as for females (note that there is no intercept). You run two regressions, one using your 50 observations on males and the other using your 50 observations on females. For the male observations you get an estimate of 2 with variance 1, and for the female observations you get an estimate of 3 with variance 2. You average your two coefficient estimates to produce the estimate of 2.5.

   Just before you hand in your assignment, a fellow student tells you that your estimation method is incorrect because it produces a biased estimate and ignores the different ε variances. He says that you should have used GLS. It is too late for you to figure out how to do GLS in this case, so you ask him if there is a quick fix. He recommends reporting a weighted average of the male and female estimates, with twice the weight on the female estimate as on the male estimate (i.e., 2/3 on female and 1/3 on male). Evaluate your colleague's opinion:

   (a) Is your estimate biased? (explain briefly)

   (b) Should you have used GLS? (explain briefly)

   (c) Is a quick fix possible here? If yes, what would it be? (Hint: think of the appropriate weights)

   (d) Is his weighted average "better" than your simple average? (Hint: think of what "better" means in finite samples)

   (e) What estimate would you have obtained had you used GLS? (Hint: think of the structure of the variance covariance matrix)

2. **Question 2**: This application is based on Application 1 in Greene Chapter 9 (Chapter 8 in the 6th edition). The data is found on p.288 (p.178 in the 6th edition) and is posted on the class website.

   (a) Compute the ordinary least squares regression of y on a constant, x_1, and x_2. Be sure to compute the conventional estimator of the asymptotic covariance matrix of the OLS estimator as well.

   (b) Compute the White estimator of the appropriate asymptotic covariance matrix for the OLS estimates.

   (c) Test the presence of heteroskedasticity using White's general test. Do your results suggest the nature of the heteroskedasticity?

   (d) Use the Breusch/Pagan/Godfrey Lagrange multiplier test to test for heteroskedasticity.

   (e) Re-estimate the parameters using a two-step FGLS estimator. Use Harvey's formulation, $Var(\varepsilon_i \mid x_{i1}, x_{i2}] = \sigma^2 \exp(\gamma_1 x_{i1} + \gamma_2 x_{i2})$.