Assignment 1

Problem 1:
What is the covariance matrix, $Cov[\hat{\beta}, \hat{\beta} - b]$, of the GLS estimator $\hat{\beta} = (X'\Omega^{-1}X)^{-1}X'\Omega^{-1}y$ and the difference of it and the OLS estimator, $b = (X'X)^{-1}X'y$? The result plays a pivotal role in the development of specificatipn tests in Hausman (1978).

Problem 2:
This application is based on the data set 'data.xlsx'.

1. 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 as well.
2. Compute the White estimator of the appropriate asymptotic covariance matrix for the OLS estimates.
3. Test for the presence of heteroscedasticity using White's general test. Do your results suggest the nature of the heteroscedasticity?
4. Use the Breusch-Pagan Lagrange multiplier test of our slides to test for heteroscedasticity.
5. Reestimate the parameters using a two-step FGLS estimator. Use Harvey's formulation, $Var[\varepsilon_i|x_{i1}, x_{i2}] = \sigma^2 \exp(\gamma_1 x_{i1} + \gamma_2 x_{i2})$.

Problem 3:
In random sampling from the exponential distribution $f(y) = (1/\theta)e^{-y/\theta}$, $y \geq 0$, $\theta > 0$, find the maximum likelihood estimator of θ and its asymptotic variance.