1. A model of annual labor supply for a random sample of workers in 1990 is given by
\[ hours_t = \beta_0 + \beta_1 WAGE_t + \beta_2 NLY_t + \beta_3FSIZE + u_t, \quad t = 1, \ldots, 200 \]

where \( hours \) is annual hours of employment, \( WAGE \) is the hourly wage rate, \( NLY \) is annual non-labor income, and \( F \) is family size.

a. Estimate the model by \( OLS \) and obtain the White heteroscedastic consistent variance/covariance matrix standard errors.

b. Conduct the following tests for heteroscedasticity at the 5% level of significance:
   (1) the White test.
   (2) the Breusch-Pagan test corresponding to \( \sigma^2_u = h(\alpha_0 + \alpha_1FSIZE_t) \)
   (3) the Goldfeld-Quandt test for \( \sigma^2_u \) increasing with \( F_t \) (use the first and last 70 observations, omitting the middle 60 observations).

c. Estimate the model on the assumption that \( \sigma^2_u = \sigma^2FSIZE_t \).

2. Consider again the following time series model of the demand for imports:
\[
\ell n(IMPORTS)_t = \beta_0 + \beta_1 \ell n(GDP)_t + \beta_2 \ell n(PT)_t + \beta_3 \ell n(POP)_t + u_t, \quad t = 1, \ldots, 35
\]
\[ u_t = \rho u_{t-1} + \varepsilon_t, \quad |\rho| < 1 \]

a. Test for first-order autocorrelation at the 5% level of significance using
   (1) the Durbin-Watson test
   (2) a large sample \( \chi^2 \) test.

b. Estimate the model by the Prais-Winsten transformation and by the purely quasi-first difference transformation using estimates of \( \rho \) obtained from
   (1) the Durbin-Watson statistic
   (2) the regression of the \( OLS \) residuals on their lagged values.