1. (Wooldridge 10.1) Decide if you agree or disagree with each of the following statements and give a brief explanation of your decision:

(a) Like cross-sectional observations, we can assume that most time series observations are independently distributed.

(b) The OLS estimator in a time series regression is unbiased under the first three Gauss-Markov assumptions.

(c) A trending variable cannot be used as the dependent variable in multiple regression analysis.

(d) Seasonality is not an issue when using annual time series observations.

2. (Wooldridge 10.5) Suppose you have quarterly data on new housing starts, interest rates, and real per capita income. Specify a model for housing starts that accounts for possible trends and seasonality in the variables.

3. (Wooldridge 10.7) In Example 10.4, we wrote the model that explicitly contains the long-run propensity, $\theta_0$, as

$$gfrt = a_0 + \theta_0 pe_t + \delta_1(pe_{t-1} - pe_t) + \delta_2(pe_{t-2} - pe_t) + u_t$$

, where we omit the other explanatory variables for simplicity. As always with multiple regression analysis, $\theta_0$ should have a ceteris paribus interpretation. Namely, if $pe_t$ increases by one (dollar) holding $(pe_{t-1} - pe_t)$ and $(pe_{t-2} - pe_t)$ fixed, $gfrt$ should change by $\theta_0$.

- If $(pe_{t-1} - pe_t)$ and $(pe_{t-2} - pe_t)$ are held fixed but $pe_t$ is increasing, what must be true about changes in $pe_{t-1}$ and $pe_{t-2}$?

- How does your answer in part (a) help you to interpret $\theta_0$ in the above equation as the LRP?

4. (Wooldridge 10.8) In the linear model given in equation (10.8), the explanatory variables $x_t = (x_{t1}, ..., x_{tk})$ are said to be *sequentially exogeneous* (sometimes called weakly exogeneous) if

$$E(u_t|x_t, x_{t-1}, ..., x_1) = 0, t = 1, 2, ...$$
so that the errors are unpredictable given current and all past values of the explanatory variables.

(a) Explain why sequential exogeneity is implied by strict exogeneity.

(b) Explain why contemporaneous exogeneity is implied by sequential exogeneity.

(c) Are the OLS estimators generally unbiased under the sequential exogeneity assumption? Explain.

(d) Consider a model to explain the annual rate of HIV infections as a distributed lag of per capita condom usage for a state, region, or province:

\[ E(HIV_{t} \mid pccon_{t}, pccon_{t-1}, ...) = \alpha_{0} + \delta_{0}pccon_{t} + \delta_{1}pccon_{t-1} + \delta_{2}pccon_{t-2} + \delta_{3}pccon_{t-3} \]

Explain why this model satisfies the sequential exogeneity assumption. Does it seem likely that strict exogeneity holds too?