Homework 6B

Name _____

(Due November 16)

1. (15 pts) Consider the time series data (t6-9 energy bills.txt) (Quarterly Bills for the School System)

   (a) Handling first-order autocorrelation. Find the first-order autocorrelation and first-order Durbin-Watson test statistics by using both formula and r code. Test whether the error terms are positively autocorrelated.

   (b) When the error terms are autocorrelated, the following model is considered

   $$y_t^\star = Tr_t + Sn_t + \epsilon_t$$
   $$= \beta_0 + \beta_1 t + \beta_2 t^2 + \beta_3 Q_2 + \beta_4 Q_3 + \beta_5 Q_5 + \epsilon_t$$

   where

   $$\epsilon_t = \phi \epsilon_{t-1} + a_t$$

   Here a_t is a random shock with mean 0 that satisfies the constant variance, independence, and normality assumptions. (a_t is often called a white noise) and Q_2, Q_3, Q_4 are seasonal dummy variables. For example,

   $$Q_2 = \begin{cases} 1 & \text{if period } t \text{ is quareter 2} \\ 0 & \text{otherwise} \end{cases}$$

   Use ARIMA in R to obtain point estimates $b_0, b_1, \cdots, b_5$, and $\hat{\phi}_1$ of the model parameters $\beta_0, \beta_1, \beta_2, \cdots, \beta_k$, and ϕ_1.

   (c) Use the formula given in pages 310-311 write the prediction equations for the model, and use it to calculate $\hat{y}_{41}$ and $\hat{y}_{42}$ and 95% prediction intervals for y_{41} and y_{42}.