Stat 372 (W15) - Assignment #2:

(Due: Thur. Feb. 12 at noon (12:00 pm) in appropriate STAT 372 slot in Drop Box 14 outside MC 4066/4067)

The *gdp* dataset consists of the seasonally adjusted quarterly gross domestic product (GDP) ($1000) for the U.S. from 1990 to 2000 inclusive.

1) Plot the time series and the correlogram (acf plot). Comment.
2) Fit a linear regression model to this time series to account for the observed trend. Comment on the fit of the model.
3) Use the *predict* function to give a 95% prediction interval for the GDP in the first quarter of 2001.
4) Forecast the **annual** GDP for the U.S. in 2001 (no prediction interval is required).
5) Plot the correlogram of the time series of fitted residuals.
   a) Does the fitted model account for all the autocorrelation in the GDP values exhibited in the acf plot in 1)?
   b) What does this plot tell us about the assumption of independence of the residuals of the linear model?
   c) Does it appear that a seasonal (i.e. quarterly) component is needed in the model?
   d) Why is it not surprising that the time series does not exhibit a seasonal component? (Hint: Refer to the description of the dataset given above)
6) As an exercise, fit a relevant seasonal component to the data to confirm (or contradict) your findings in 5). Comment on your results. Be sure to refer to the p-values of the appropriate model parameters (we will not be using this model in subsequent questions).
7) Fit an MA(1) or AR(1) model - whichever you deem to be most appropriate based on the correlogram in 5) - to the time series of fitted residuals from the model in 2)
8) Forecast the residual associated with the first quarter of 2001, and use this forecast to revise your original GDP forecast in 3) (no prediction interval is required).
9) Instead of fitting an MA(1) or AR(1) model to the residuals, use a EWMA smooth ($\alpha = 0.20$) on the residuals to revise your GDP forecast for the first quarter of 2001 (no prediction interval is required).
10) Briefly describe how one might obtain approximate 95% prediction intervals for the revised forecasts in 8) and 9) (you do not need to calculate the intervals).