Stat ST485/685, Project 5
Due: Wednesday, November 24

(45 points) You will analyze a simulated data set consisting of 10 periods of data from a process with a period of 12. This mimics a data set with measurements taken every month over a year for 10 years. You will estimate and remove trend and seasonality in two ways, then analyze the residuals to see if they fit an IID noise model.

The data file is project5_data.txt.

Be sure to label all plots and include your code after your answers. You may label the vertical axis as "data" or "trail use" or something similar.

1. Plot the data. Do you see trend and/or seasonality?
2. *Least squares estimation*
   (a) Compute a least squares estimate for a linear trend model and a single trigonometric polynomial,
   $$a_0 + a_1 t + b_1 \cos(\pi t/6) + b_2 \sin(\pi t/6).$$
   Give the coefficients of the fit.
   (b) Plot the fitted model together with the data.
   (c) Plot the residuals.
   (d) Plot the sample acf of the residuals for 40 lags. Does the plot support the hypothesis that the residuals are samples from an iid time series?
   (e) Compute the Ljung-Box and McLeod-Li statistical tests for randomness using 20 lags in the residuals. Do these support rejection of the hypothesis that the residuals are samples from an iid time series?
   (f) Make a conclusion about whether or not the residuals are samples from an iid series and justify your answer.
3. *Differencing*
   (a) Apply a lag 12 difference to the data. Do not list the values, just indicate that you differenced the data.
   (b) Plot the differenced data.
   (c) Plot the sample acf of the differenced data using 40 lags. Does the plot support the hypothesis that the differenced data are samples from an iid time series?
   (d) Compute the Ljung-Box and McLeod-Li statistical tests for randomness using 20 lags in the differenced data. Do these support rejection of the hypothesis that the differenced data are samples from an iid time series?
   (e) Make a conclusion about whether or not the differenced data are samples from an iid series and justify your answer.