Stat ST485/685, Project 4
Due: Wednesday, November 10

(57 points) In this project, you will attempt to estimate and remove trend using the three techniques; (a) least squares estimation, (b) moving average with equal weights, and (c) differencing. For each approach, I ask you to evaluate the residuals and judge whether or not the trend has been removed.

The data file is project4_data.txt.

Be sure to label all plots.

1. *Least squares estimation*

   (a) Compute a least squares estimate for a quadratic trend model.

      i. Give the coefficients.
      ii. Plot the data together with the estimated trend model.
      iii. Plot the residuals obtained by subtracting the model from the data.
      iv. Do the residuals show trend?

   (b) Compute a least squares estimate for a cubic trend model.

      i. Give the coefficients.
      ii. Plot the data together with the estimated trend model.
      iii. Plot the residuals obtained by subtracting the model from the data.
      iv. Do the residuals show trend?

   (c) Which trend model is better, quadratic or cubic?

2. *Moving average*

   Apply a moving average with $q = 2$ and equal weights (Example 4.2.2.1) to the data.

   (a) Plot the moving average and the original data on the same plot.

   (b) Plot the residuals obtained by subtracting the series obtained by the moving average from the original data.

   (c) Do the residuals show trend?

3. *Differencing*

   (a) Apply a single difference to the data.

      i. Plot the residuals.
      ii. Do you think the plot of the residuals shows evidence of trend?
      iii. Fit a quadratic to the residuals using least squares, give the coefficents, and plot the fit with the residuals. Does this suggest that the residuals have trend?

   (b) Apply a second order difference to the data (You can obtain this data by applying a single difference to the data obtained from (a)).

      i. Plot the residuals.
      ii. Do you think the plot of the residuals shows evidence of trend?
      iii. Fit a quadratic to the residuals using least squares, give the coefficents, and plot the fit with the residuals. Does this suggest that the residuals have trend?