Homework 3

Due Date: 3:00 PM Monday January 30

General Instructions:

You may work on the assignment in groups of up to 3 students from the class.

Include a title page with the names and student ID numbers of all group members.

Submit your homework by the time it is due in lecture or in my mailbox in 4118 MSB.

Include all used computer code in an appendix at the end of the assignment.

Assignment:

The file *oil.txt* contains the values of US field production of crude oil (in thousands of barrels) in the years 1900 - 2012.

1. Plot the data against time. Comment on what you see. Is there evidence of a trend, unequal variance, or a seasonal component?

2. Consider the transformations $\sqrt{Y}, log(Y), Y^{1/3}, Y^{-1}$. Make a plot of each transformation. Would you rather work with one of these, or with the original data? Make your choice, and complete the rest of the data you chose.

3. Use a cubic (degree 3) regression model to estimate the trend. Remove the estimated trend from the data, and plot the detrended data against time.

4. Use LOESS with span set to 0.20 to estimate the trend of the data you chose in part 2 . Remove the estimated trend from the data, and plot the detrended data against time.

5. Use a moving average of order 5 to estimate the trend of the data you chose in part 2. Remove the estimated trend from the data, and plot the detrended data against time.

6. Compare the plots from parts 3, 4, and 5. Did different methods of estimating trend lead to different looking residuals? Come up with a possible reason for what you see.

7. Use detrended data from part 4. Make a sample ACF plot with horizontal bars at $\pm 1.96/\sqrt{n}$. Comment on what you see. Does it appear that the detrended data came from an i.i.d. process?

8. Use detrended data from part 4. Use the Box-Ljung test to check if there is evidence that the detrended data did not come from an i.i.d. process. Include the hypothesis, the p-value, and your conclusion.