CSC425 – Time series analysis and forecasting

Homework 4
Due on Saturday October 17th, 2015
Total Points: 28

Reading assignment:

1. Chapter 2 sections 2.6, 2.7, 2.8 on ARIMA models.
2. Review course documents posted under weeks 4 and 5 Contents.

Problem 1 [14 points]

The dataset *ALSALESRAW.csv* contains actual monthly sales values $\{X_t\}$ for autos and light trucks in the US from 2/1/1976 to 12/1/2014.

a) Create a time plot for monthly sales and analyze trends
b) Analyze if the series is stationary using both the ACF function and the Dickey Fuller test to check if TS is unit-root non-stationary.
c) Use the BIC order selection method to identify the order of the "best" ARIMA(p,1,q) model.
d) Fit the selected ARIMA model, and analyze good ness of fit:
   - Check if all coefficients are significant.
   - Conduct a residual analysis

   Discuss results and explain if you are satisfied with the model chosen by the BIC criterion. If the model is not adequate, find a better model.
e) Do you believe that the time series has a linear trend? If you include the drift (or constant term) in the ARIMA model, is the drift significant? Discuss if your findings suggest that the time series follows a linear time trend.
f) Write down the model expression
g) Plot the model forecasts and discuss if the forecasted trend is consistent with the past process behavior.
h) Use the backtesting procedures to compute the RMSE and the MAPE for the model. Interpret the result of MAPE.

Problem 2 [12 pts]

The file sugarprice.csv contains monthly sugar prices ($) in US cents per pound from September 2000 to August 2015.

a. Plot the observed time series and its ACFs (20 lags). Analyze trends and patterns shown by the data.
b. Analyze if the series is stationary using both the ACF function and the Dickey Fuller test to check if TS is unit-root non-stationary.
c. Use the BIC order selection method to identify the order of the "best" ARIMA(p,1,q) model.
d. Fit the selected ARIMA model, and analyze good ness of fit:
   - Check if all coefficients are significant.
   - Conduct a residual analysis

Discuss results and explain if you are satisfied with the model chosen by the BIC criterion. If the model is not adequate, find a better model.

e. Write down the model expression and discuss if your findings suggest that the time series follows a linear time trend.
f. Plot the model forecasts and discuss if the forecasted trend is consistent with the past process behavior.
g. Use the backtesting procedures to compute the RMSE and the MAPE for the model. Interpret the result of MAPE.

"Reflection" Problem [2 pts]

Post a message on the discussion board reflecting on the topics in hwork 4. Indicate the assignment in this module you found to be the easiest, the one you found to be the hardest, and why. I created a new discussion topic called "Hwork 4 Reflection Comments".

Submission instructions

Submit the homework at the Course Web page http://d2l.depaul.edu.

1. Keep a copy of all your submissions!
2. Submit the R code along with your answers. You can zip the R file with your word document.
3. If you have questions about the homework, email me BEFORE the deadline.
4. The assignment will lose 10% of the points per day, after the due date.
5. Assignments submitted three days after the deadline will not be accepted.