ADS 506 Module 3 Exercises: Chapters 5 & 6

This assignment is due on Day 7 of the learning week. The assignment for this module is a mixture of programming and written work. Complete this entire assignment in R Markdown. You will need to include the question and number that you are answering within your submitted assignment. **Once completed, you will knit your deliverable to a Word/PDF file.**

Chapter 5: Smoothing Methods (Pages 113-116): #8 & 9

8. *Forecasting Australian Wine Sales:* Figure 5.14 shows time plots of monthly sales of six types of Australian wines (red, rose, sweet white, dry white, sparkling, and fortified) for 1980-1994. Data available in AustralianWines.csv. The units are thousands of liters. You are hired to obtain short-term forecasts (2-3 months ahead) for each of the six series, and this task will be repeated every month.

    a. Fortified wine has the largest market share of the six types of wine. You are asked to focus on fortified wine sales alone and produce as accurate a forecast as possible for the next two months.
        - Start by partitioning the data using the period until December 1993 as the training period.
        - Apply Holt-Winter's exponential smoothing (with multiplicative seasonality) to sales.

    c. Create a time plot for the residuals from the Holt-Winter's exponential smoothing.

9. *Natural Gas Sales:* Figure 5.15 shows a time plot of quarterly natural gas sales (in billions of BTU's) of a certain company, over a period of 4 years. The company's analyst is asked to use a moving average model to forecast sales in Winter 2005.
    a. Reproduce the time plot with the overlaying MA(4) line.
    b. What can we learn about the series from the MA line?
    c. Run a moving average forecaster with adequate season length. Are forecasts generated by this method expected to over-forecast, under-forecast, or accurately forecast actual sales? Why?

Chapter 6: Regression Models: Trend & Seasonality (Pages 136-141): #6

6. *Forecasting Australian Wine Sales*: Figure 6.26 shows time plots of monthly sales of six types of Australian wines (red, rose, sweet white, dry white, sparkling, and fortified) for

1980-1994. The data is available in AustralianWines.csv. The units are thousands of liters. You are hired to obtain short-term forecasts (2-3 months ahead) for each of the six series, and this task will be repeated monthly.

b. Fortified wine has the largest market share of the six types of wine considered. You are asked to focus on fortified wine sales alone and produce as accurate as possible forecasts for the next 2 months.
    - Start by partitioning the data using the period until December 1993 as the training period.
    - Fit a regression model to sales with a linear trend and seasonality.

i. Create the "actual vs. forecast" plot. What can you say about model fit?
ii. Use the regression model to forecast sales in January and February 1994.