ECOM90024
Forecasting in Economics and Business
Tutorial 4

1.) The updating equations for Holt's multiplicative trend model are given by:

Level Equation: $l_t = \alpha y_t + (1-\alpha)(l_{t-1}b_{t-1})$

Trend Equation: $b_t = \beta \frac{l_t}{l_{t-1}} + (1-\beta)b_{t-1}$

Forecasting Equation: $\hat{y}_{t+h|t} = l_t b_t^h$

a.) Rewrite the above level and trend equations in their error correction forms and describe the role that the parameters, α and β play in updating the level and trend when new information arrives.

b.) Let $\alpha = 0.2$ and $\beta = 0.4$ and let the initial values of the trend and level be given by $l_0 = 1$ and $b_0 = 0.1$. Then, suppose that you have the following time series data set:

$$\{1,4,9,20,23\}$$

Using Excel, compute the smoothed time series according to the equations provided above.

c.) Using Excel, calculate the h = 4 step ahead point forecasts according to equations provided above equations.

2.) Using the ***rnorm*** command in R, generate and plot Gaussian white noise series that comprises of 200 observations. These will be a set of observations from the following data generating process,

$$Y_t = \varepsilon_t$$

$$\varepsilon_t \sim_{iid} N(0,1)$$

Then, using the ***acf*** and ***pacf*** commands in R, generate and plot the sample autocorrelation and partial autocorrelation functions associated with your generated series. Do they accord with the properties of the underlying data generating process?

3.) Using the data that you've generated in question 2, generate and plot a series that represents a set of observations from the following MA(1) process,

$$Y_t = \varepsilon_t + 0.9\varepsilon_{t-1} \qquad t = 2, 3, \dots, 200$$

$$\varepsilon_t \sim_{iid} N(0,1)$$

Then, generate and plot the sample autocorrelation and partial autocorrelation functions associated with your generated MA(1) series. Discuss your findings.

4.) Using the data that you've generated in question 2, generate and plot a series that represents a set of observations from the following AR(1) process,

$$Y_t = 0.9Y_{t-1} + \varepsilon_t \qquad t = 2, 3, \dots, 200$$

$$Y_1 = 1$$

$$\varepsilon_t \sim_{iid} N(0,1)$$

Then, generate and plot the sample autocorrelation and partial autocorrelation functions associated with your generated AR(1) series. Repeat the exercise using an autocorrelation coefficient of -0.9. Discuss your findings.