HW 7

1. (Problem 3.32 in Time Series Analysis and Its Application) **Weekly Crude oil prices in dollars per barrel** are in oil. The data oil is located in astsa package. Answer the following questions and fit an ARIMA(p, d, q) model to the growth rate performing all necessary diagnostics.

   (a) Use R to check the stationarity of the data and determine any transformation if the values produced by the transformation be considered stationary. Give appropriate reasons and support your answer with R code. (2 points)

   (b) Identify the best ARIMA model for the time series data . Give appropriate reasons why the model fits into the time series data with R code. The point is based on your logical reason. (2 points)

   (c) Perform the diagnostic checking. Give appropriate explanation of diagnostic check result along with R code. (2 points)

   (d) Forecast the point estimate and 95% prediction interval of values for the next 6 weeks of sales with R code. (you may either use Arima or Sarima in R) (2 points)

2. **The 90 weekly sales for Roosevelt Toothpaste** starts y_1, y_2, ..., y_{90} are presented in Excel File **"Toothpaste.xlsx"**. The following question is asked to forecast the future sales using ARIMA Model.

   (a) Use R to check the stationarity of the data and determine any transformation if the values produced by the transformation be considered stationary. Give appropriate reasons and support your answer with R code. (2 points)

   (b) Identify the best ARIMA model for the time series data . Give appropriate reasons why the model fits into the time series data with R code. The point is based on your logical reason. (2 points)

   (c) Perform diagnostic checking. Give appropriate explanation of diagnostic check result along with R code. (2 points)

   (d) Forecast the point estimate and 95% prediction interval of values for the next 6 weeks of sales with R code. (you may either use Arima or Sarima in R) (2 points)

3. (3 pts) The 50 weekly data $y_1, ..., y_{50}$ is analyzed to forecast the future y's and we constructed the following ARMA(1,2) model

$$(1 - 0.5B)y_t = (1 + 0.2B - 0.15B^2)w_t.$$

   In order to forecast the next y_t, we obtained the last three observed (y_t) and two estimated ($\hat{y}_t$) values such that

$$y_{48} = 1, \quad y_{49} = 2, \quad y_{50} = 1, \quad \hat{y}_{48} = 1.5, \quad \hat{y}_{49} = 1.2$$

   Show that next estimated values at $t = 51, 52, 53$ are

$$\hat{y}_{51} = 0.333, \quad \hat{y}_{52} = 0.202, \quad \hat{y}_{53} = 0.101$$

   Hint: Recall that $w_t = y_t - \hat{y}_t$ if we know y_t, and $w_t = 0$ if t is time after the last observation.