



**MSCA 31006 Time Series Analysis and Forecasting**

Assignment #3 - ARIMA

Due Date – Beginning of Session #4

Total Points: 6%

**Instructions:**

- Total number of points is 36. The assignment's final grade will be multiplied by 1/6 to calculate its weight on the final grade.
- Mark the question number and your final answer clearly (use a textbox.)
- Remember to show and explain your work (*If you can't explain it, you don't understand it.*)
- Please submit your solution through Canvas.

For this exercise, we will use the annual World's bank US GDP (Gross domestic product) 1960 – 2017 dataset (Data set: usgdp.rda).

**(1 points) Question 1:**

Load the usgdp.rda dataset and split it into a training dataset (1960 - 2012) and a test dataset (2013 - 2017)

**(5 points) Question 2:**

Plot the training dataset. Is the Box-Cox transformation necessary for this data?

**(5 points) Question 3:**

Plot the 1<sup>st</sup> and 2<sup>nd</sup> order difference of the data. Apply KPSS Test for Stationarity to determine which difference order results in a stationary dataset.

**(5 points) Question 4:**

Fit a suitable ARIMA model to the training dataset using the auto.arima() function. Remember to transform the data first if necessary. Report the resulting  $p, d, q$  and the coefficients values.

**(5 points) Question 5:**

Compute the sample Extended ACF (EACF) and use the Arima() function to try some other plausible models by experimenting with the orders chosen. Limit your models to  $q, p \leq 2$  and  $d \leq 2$ . Use the model summary() function to compare the Corrected Akaike information criterion (i.e., AICc) values (Note: Smaller values indicated better models).



*Master of Science in Analytics*

**(5 points) Question 6:**

Use the model chosen in Question 4 to forecast and plot the GDP forecasts with 80 and 95 % confidence levels for 2013 - 2017 (Test Period).

**(5 points) Question 7:**

Compare your forecasts with the actual values using  $\text{error} = \text{actual} - \text{estimate}$  and plot the errors. (Note: Use the forecast \$mean element for the forecast estimate)

**(5 points) Question 8:**

Calculate the sum of squared errors.