**IE 360 Course Project**
**Due Date: May 28, 2019**

For the project you are required to form groups of four students. Please send your group information to Zeynep Şuvak (zeynep.arslan@boun.edu.tr) by May 7, 2019.

Please download the data given in the file "EP-IE360-Project.xls" from the web page. This file contains monthly beer sales (in liters) from January 1988 until December 2000 (169 months), and a number of potential independent variables (1998-2001). Your task is to forecast the sales for 2001 (every month) by using two methods: Method A: Forecasting with regression, Method B: Forecasting with time series analysis. Before you start with forecasting you should perform and show the following steps:

1. Plot the time series of "Beer Sales". Comment on the shape of the time series. Specifically, do you think the time series is stationary with respect to its mean and variance?

2. Plot the autocorrelation function of the time series (get autocorrelations for at least 24 lags). What do you think the autocorrelation values at different lags indicate?

## METHOD A: FORECASTING WITH REGRESSION

1. Decide if you need a preliminary transformation to induce stationarity.

2. In addition to existing variables, you may need to define seasonality and trend related variables. You may also want to include "lagged" variables. That is, you may want to use $Y_{t-1}$ (or any $X_{t-1}$) to explain $Y_t$.

3. You may consider excluding some months (but you should only do so based on statistical evidence) from your analysis.

4. You should try various models (stepwise regression can be used) and come up with a model that explains beer sales in terms of independent and trend/seasonality variables.

5. You should present all the statistical evidence supporting the validity of your analysis (residual analysis, Durbin-Watson statistics, collinearity checks, significance of coefficients, etc.).

6. Using the fitted model forecast beer sales for 2001 (all months).

## METHOD B: FORECASTING WITH TIME SERIES ANALYSIS

1. You should first check if you need a preliminary transformation to induce stationarity.
2. You should utilize time series plot, ACF and PACF plots in order to determine regular and seasonal differencing to be applied.
4. You should come up with an initial ARIMA model based on inspection of ACF and PACF plots.
5. You should performs a neighborhood search of the initial model. That is, a search around initial AR, MA, and seasonal AR, seasonal MA terms by increasing or decreasing them. Limit yourself to six such candidate models.
6. These candidate models should always be accompanied with ACF and PACF plots.
7. You should decide on the "best" model to use in forecasting.
8. You should present all the statistical evidence supporting the validity of your analysis.
9. Forecast beer sales in 2001 (all months) with the selected method.

## WHAT YOU SHOULD SUBMIT?

1. An introductory section describing the observations from the time series plot and autocorrelation plots.
2. A hard-copy report (you should also submit a pdf version of the report) containing all your analysis, tables, figure and forecasts (separate sections for Method A and Method B).
3. A section that compares results obtained by two methods.
4. A final set of forecasts for January-December 2001, based on your conclusions on both methods and your judgement (you should present a short supporting argument for your judgemental modifications).
5. An Excel file containing your forecast figures for Method A, Method B, and final forecasts of part (4) above.