IENG/MANE 332 Production Planning-I

Homework 1

Due date: 10.04.2018 (Tuesday in tutorial hour)

Note 1: Some of the parameters in your homework questions are related to your student numbers. Let A be the last digit of your student number, B be the second digit from the end of your student number and C be the third one. Let's assume that your student number is E.g., if your student number is 134957 then you should take A = 7, B=5 and C=9 in the following homework questions.

Note 2: In your solutions if you have fractional numbers make rounding using 3 digits after the decimal seperator. For example if you compute any forecast value as 262.345676445 round it to 262.346.

Note 3: Use A4 papers. Write all of your answers by hand. Do not submit computer print-outs. Your writings should be clear and understandable. You should be meticulous while preparing your homeworks. Homeworks like a scribble will lose marks.

Note 4: In your solution, first write formula and show derails of your solution for each question.

Question 1: A company has the following demand records for the past 12 months.

Month	t	Demand (dt)
June 2016	1	243
July 2016	2	230 + A
August 2016	3	250 + B
September 2016	4	240 + C
October 2016	5	246
November 2016	6	230 + A
December 2016	7	240 + B
Jenuary 2017	8	249
February 2017	9	253
March 2017	10	240 + C
April 2017	11	230
May 2017	12	238

a) Plot the past data. Considering the demand in the time which type of demand process does the company have?

b) Forecasting method is LDP (Last Data Point) method.
   b.1. Compute the forecasts of the company for each month.
   b.2. Compute MAD, MAPE and MSE values using the forecasts and demands for the months.
   b.3. Forecast the demand of the next month, June 2017.

c) Change your method to Moving Average Method (N = 4).
   c.1. Compute the forecasts of the company for available months.
   c.2. Compute MAD, MAPE and MSE values using the forecasts and demands for the months.
   c.3. Forecast the demand of the next month, June 2017.

d) Assume that the company forecasted the demand of November 2016 at October 2016 first time and then it has been forecasting the demand by the Exponential method (α=0,4 and F_6 =240).
   d.1. Compute the forecasts of the company.
   d.2. Compute MAD, MAPE and MSE values using the forecasts and demands for the months from November 2016 to May 2017.
   d.3. Forecast the demand of the next month, June 2017.

Question 2: (20 points) A company has the following demand records for the past 12 months.

Month	t	Demand (dt)
June 2016	1	263
July 2016	2	270 + A
August 2016	3	255
September 2016	4	260
October 2016	5	260 + B
November 2016	6	270 + C
December 2016	7	277
Jenuary 2017	8	288
February 2017	9	300 + A
March 2017	10	307
April 2017	11	310 + B
May 2017	12	325

a) Plot the past data. Considering the demand in the time which type of demand process does the company have?
b) Assume that the company forecasted the demand of December 2016 at November 2016 first time and then it has been forecasting the demand by the double exponential smoothing method (α=0.2, β=0.4).
   b.1. Compute the forecasts of the company.
   b.2. Forecast the demand of the next month, June 2017.
   b.3. Repeat forecasting of periods with (α=0.2, β=0.6). use MAD, MSE, and MAPE variation methods and according to that values, which combination of α, β is better than other.

Question 3: (20 points) The demand of a product is given below for the past 8 periods. Plot the past data.
a) Accroding to the given past demands how many seasons are there in a year?
b) Forecast demand of 12^{th} and 16^{th} periods

t	1	2	3	4	5	6	7	8
Demand (d_t)	210	310 + A	360	290 + B	270	360 + C	420	330 + A

Question 4: (15 points) The HnG store sells suntan cream in a small touristic island. The owner of the store is interested in about how many cases of suntan cream he should order for the next week. He uses the number of the tourists arrive the island in a week to determine the size of his suntan cream order for the next week. He recorded the following data for some past weeks.

Week (t)	Number of the tourists arrived the island in the previous week	Demand of suntan cream (in cases)
1	610 + A	52 + A
2	845	72
3	606 + B	51 + B
4	514	61
5	440 + C	40 + C
6	748	80

a) He learned that in the current week 1260 tourists arrived the island. Use the linear regression model and determine the expected demand of suntan cream (in cases) from his store for the next week.
b) Plot residuals and calculate mean value of errors
c) Check normality of residuals by normal probability plot

$$\hat{b} = \frac{n\sum_{t=1}^{n} h_t d_t - \sum_{t=1}^{n} h_t \sum_{t=1}^{n} d_t}{n\sum_{t=1}^{n} h_t^2 - \left(\sum_{t=1}^{n} h_t\right)^2} \quad \text{(slope)} \qquad \hat{a} = \frac{1}{n}\sum_{t=1}^{n} d_t - \frac{\hat{b}}{n}\sum_{t=1}^{n} h_t \quad \text{(intercept)}$$