PRACTICAL – 16

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AIM: To obtain 1-step ahead forecasted values for the next three months using exponential smoothing method.

EXPERIMENT:

The instant paper clip office supply company sells and delivers office supplies to companies, schools and agencies. The office supply business is competitive, and the ability to deliver order promptly is a big factor in getting new customers and maintaining old ones. The manager of the company wants to be certain that they adequate inventory in stock in order to deliver promptly. Therefore the manager wants to be able to forecast the demand for deliveries to upcoming months. From the records of previous orders, management has accumulated the following data for the past 12 months.

810, 920, 980, 1100, 970, 1110, 1080, 1150, 1340, 1560, 1420, 1590

(a) Obtain the one – step ahead forecast value for the next three months using exponential smoothing. Take the median of the first six months as starting demand and the smoothing constants as 0.15, 0.25 and 0.35.
(b) Which one of the smoothing constant would result in a better forecast?

THEORY:

- Exponential smoothing is a time series forecasting method for univariate data. Forecasts produced using exponential smoothing methods are weighted averages of past observations, with the weights decaying exponentially as the observations get older.
- Equation $F_{t+1} = \alpha D_t + (1- \alpha)F_t$, is used to forecast the values for the next months. Here, F is forecasted value, D is demand and α is smoothing constant.
- For t=1, F_t is the first forecasting value, obtained by calculating median of the first 6 observations.

WHAT WOULD BE THE SIZE OF α :

A measure of effectiveness of exponential smoothing can be obtained under the assumption that the process is completely stable, so that $X_1, X_2, \ldots$ are independent, identically distributed random variables with variance σ^2. It then follows that (for large t)

$$\text{var}[F_{t+1}] \approx \frac{\alpha\sigma^2}{2-\alpha} = \frac{\sigma^2}{(2-\alpha)/\alpha},$$

so that the variance is statistically equivalent to a moving average with $(2-\alpha)/\alpha$ observations. For example, if α is chosen equal to 0.1, then $(2-\alpha)/\alpha = 19$. Thus, in terms of its variance, the exponential smoothing method with this value of α is *equivalent* to the moving-average method that uses 19 observations.

Or $\frac{(2-\alpha)}{\alpha} = n$ (no. of observations)

And we can find the value of α .

- Here, the values of α have been already given as 0.15, 0.25 and 0.35

CALCULATIONS:

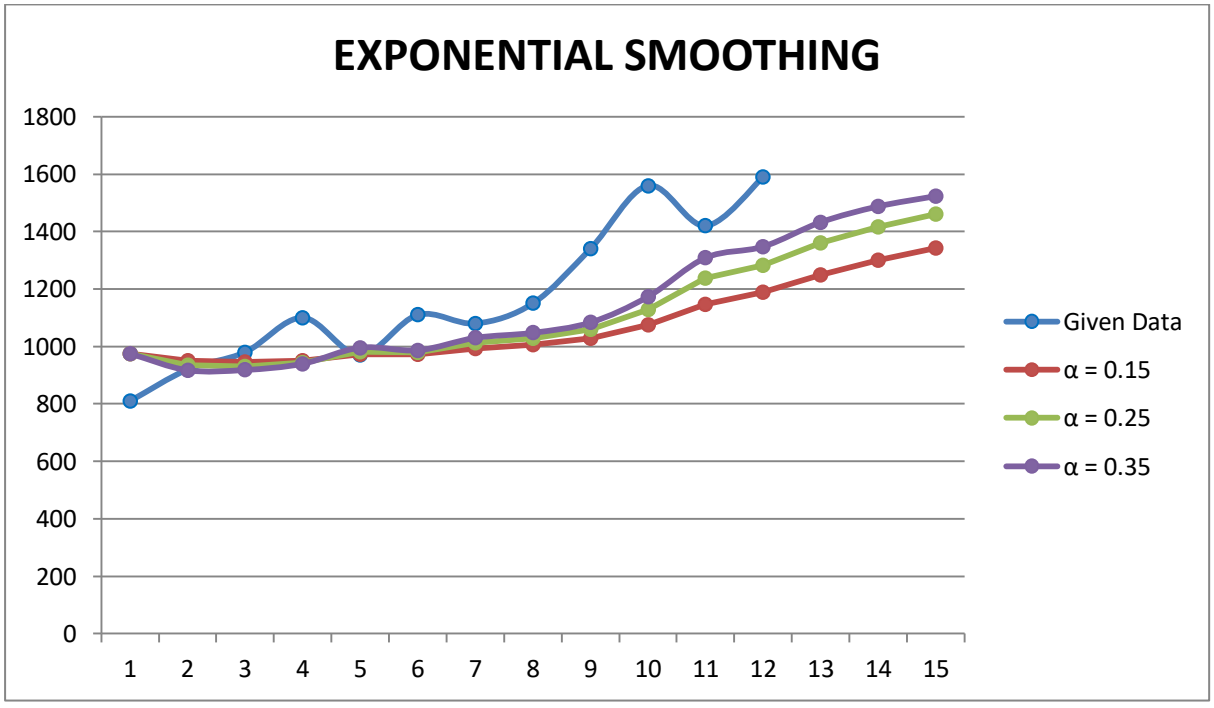
Table 16.1

Given Data	
t	yt
1	810
2	920
3	980
4	1100
5	970
6	1110
7	1080
8	1150
9	1340
10	1560
11	1420
12	1590
13	
14	
15	

Table 16.2

Exponential Smoothing		
α= 0.15	α= 0.25	α= 0.35
975	975	975
950.25	933.75	917.25
945.7125	930.3125	918.2125
950.8556	942.7344	939.8381
973.2273	982.0508	995.8948
972.7432	979.0381	986.8316
993.3317	1011.779	1029.941
1006.332	1028.834	1047.461
1027.882	1059.125	1083.35
1074.7	1129.344	1173.177
1147.495	1237.008	1308.565
1188.371	1282.756	1347.567
1248.615	1359.567	1432.419
1299.823	1417.175	1487.572
1343.349	1460.381	1523.422

Graph 16.1



RESULT:

- Table 16.2 shows the exponential smoothing done for the data given in Table 16.1, for the given values of α (0.15, 0.25, and 0.35).
- Graph 16.1 has been plotted to compare the values obtained for different smoothing constants.
- Value forecasted for the next 3 months is:

t	α= 0.15	α= 0.25	α= 0.35
13	1248.615	1359.567	1432.419
14	1299.823	1417.175	1487.572
15	1343.349	1460.381	1523.422

CONCLUSION:

- Result obtained for α = 0.15 will give a better forecast.
- The logical weights are assigned to all the variables, means more weight has been given to recent values and less to previous.
- Hence we can say that the value of α should be minimum and logical to get the best forecast value.