Demand Forecasting

Forecasting means predicting future.

Forecasts
- Short range (Forecasts upto couple of months)
- Medium Range (1-2 months to 1 year)
- Long Range (>1 year)
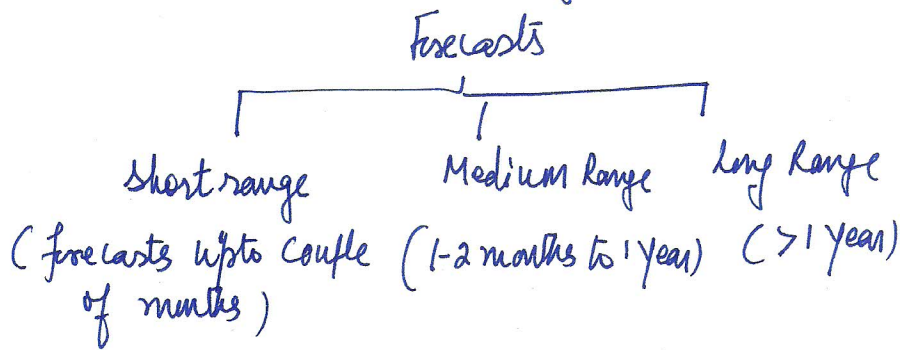
Forms of Forecast Movements

(Trend)

(cycle)

(Seasonal)

(Trend with Seasonal Pattern)
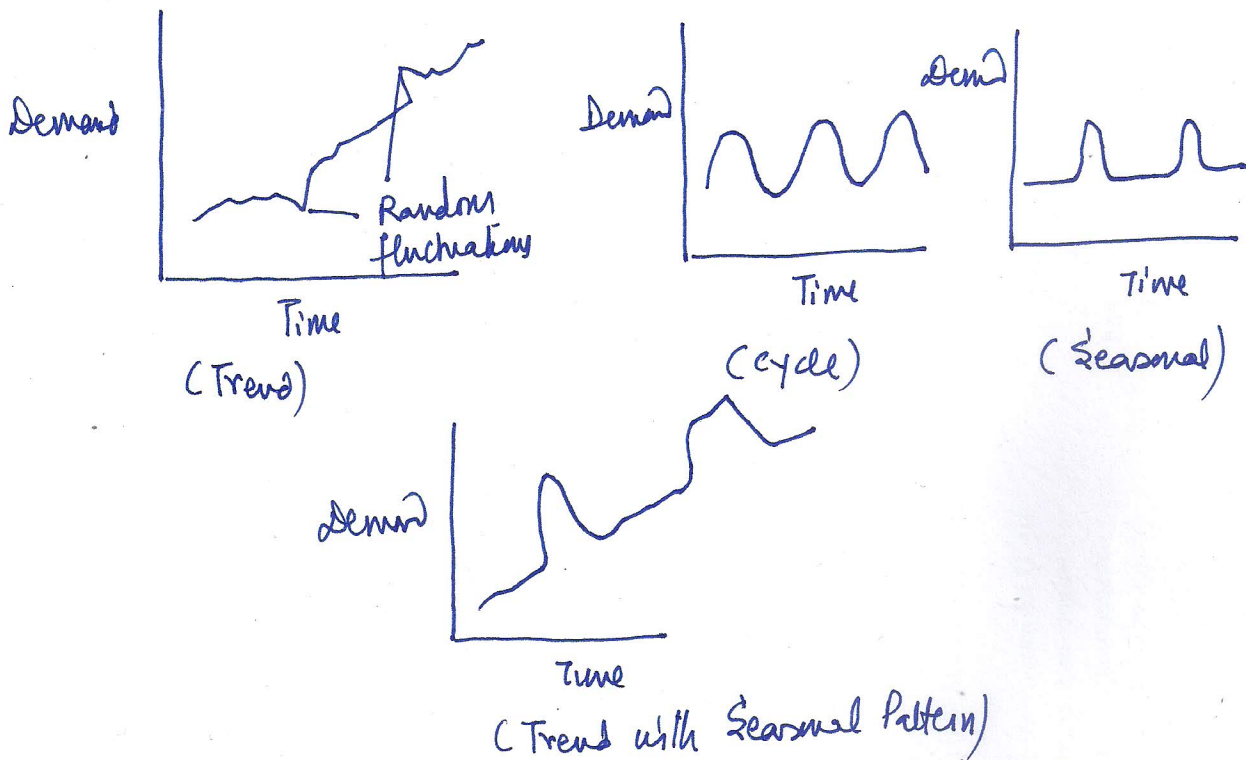
Trend: Long term movement of an item being forecast.

Random variations: Variations that are not predictable & have no pattern

Cycle: Undulating movement (up and down) that repeats over a lengthy time span

Seasonal Pattern: up and down repetitive movement within a trend occurring periodically

Forecasting Methods

Qualitative Methods

- **Sales force opinion Method** : Sales force is in direct touch with market (Consumers and distributors). They have first hand Information about development of new trends.

- **Expert Opinion Method** : In this method, opinions of experts are taken. These experts provide their projections based upon their very long experience in a particular market/product area. They give their projections on the basis of their subjective judgements.

- **Delphi Method** : In this method, a panel of experts is formed. They are sure'd several rounds of questionnaires and their anonymous responses are aggregated and shared with the group after each round. They have revise their responses. Finally they give a consensus forecast. This technique is systematic, structured and Interactive in nature. It was developed by RAND Corporation shortly after world war II. It was primarily used for technological forecasting. What products will be feasible, what will be their demand etc.

Quantitative Methods

Time Series Methods

These are statistical techniques that make use of historical data accumulated over a period of time for making future forecasts.

a) **Moving Average Method** : It uses several values of recent past to develop a forecast. It tends to dampen or smooth out random increases and decreases occured in one period.

$$MA_n = \frac{\sum_{i=1}^{n} D_i}{n} \qquad \left(\begin{array}{l} n = \text{no. of periods in moving Average} \\ D_i = \text{data in period } i \end{array} \right)$$

Month	orders delivered
Jan	120
Feb	90
Mar	100
Apr	75
May	110
Jun	50
Jul	75
Aug	130
Sep	110
Oct	90

Let us assume 3 time periods in a block.

$$MA_3 = \frac{\sum_{i=1}^{3} D_i}{3} : \frac{120+90+100}{3} = \frac{310}{3} = 103.3$$

Forecast for April

Forecast for May $= \frac{90+100+75}{3} = \frac{265}{3}$

Forecast for June $= \frac{100+75+110}{3} = \frac{285}{3}$

Forecast for July $= \frac{75+110+50}{3} = \frac{235}{3}$

Forecast for VIII $= \frac{130+110+90}{3} : \frac{330}{3} = 110.$ orders

If we make a block of 5 time periods Then forecast for NOV

$$MA_5 = \frac{\sum_{i=1}^{5} D_i}{5} : \frac{50+75+130+110+90}{5} : \frac{455}{5} = 89 = 91 \text{ orders}$$

Month	order Per Month	3 Months Moving Av	5 Months Moving Av
Jan	120		
Feb	90		
Mar	100		
Apr	75	103.3	
May	110	88.3	
Jun	50	95.0	99
Jul	75	78.3	85
Aug	130	78.3	82
Sep	110	85	88
Oct	90	105.0	95
Nov		110	91

Less no of time periods in a block reflects more recent data. More no. of time periods in a block smooth out random fluctuations to a larger extent. The method is simple to apply and more suited for stable demand conditions.

Weighted Moving Average

Moving average method can be adjusted for more recent data to reflect more closely recent fluctuations

$$WMA_n = \sum_{i=1}^{n} W_i D_i$$

W_i = Weights assigned to i_{th} period. / $\sum W_i = 1.00$

e.g. If weights are 0.5, 0.33 & 0.17 for Oct, Sep & Aug then

$$WMA_3 = (0.50 \times 90) + (0.33 \times 110) + (0.17 \times 130) = 103.4 \text{ orders}$$

weights are assigned through trial and error experimentation.

No. of periods in a block are also decided through trial and error experimentation.

Exponential Smoothing method

It is an averaging method in which most recent past data are weighted more strongly than distant past data. It reacts most strongly to immediate changes in data.

$$F_{t+1} = \alpha D_t + (1-\alpha) F_t$$

F_{t+1} = Forecast for next period

D_t = actual demand in the present period

F_t = forecast for present period

α = weighting factor or smoothing constant

The value of α is subjectively decided. Its value varies between 0 and 1. Value of α closer to zero signifies the dampening of recent fluctuations. Value of α closer to 1 signifies strong reaction or consideration of recent demand fluctuations. Most commonly used values range from 0.01 to 0.50.

Period	Month	Demand	Forecast $\alpha = 0.30$
1	Jan	37	
2	Feb	40	37.00
3	Mar	41	37.90
4	Apr	37	38.83
5	May	45	38.28
6	Jun	50	40.29
7	Jul	43	43.20
8	Aug	47	43.14
9	Sep	56	44.30
10	Oct	52	47.81
11	Nov	55	49.06
12	Dec.	54	50.84
13	Jan	....	51.79

For the first period, there is no actual demand is taken as its forecast.

$$F_2 = (0.80 \times 37) + (0.70 \times 37)$$
$$= 37$$

$$F_3 = (0.30 \times 40) + (0.7 \times 37)$$
$$= 12 + 25.9 = 37.9$$

$$F_4 = (0.3 \times 41) + (0.7 \times 37.9)$$
$$= 12.3 + 26.53$$
$$= 38.83$$

... and so on.