

Moving Average

Types of moving average

- ① SMA (Simple moving avg)
- ② CMA (cumulative moving avg)
- ③ EMA or EWMA (Exponential moving avg)

Why We Calculate MA?

SMOOTHING of the data
 ↓
 { time series }
 Data

Simple moving avg

=

→ Moving ⇒ move over the time axis in specific window time

$$\text{Average} = [10, 12, 15, 13, 11]$$

$$\text{Average} = \frac{\text{add all the val}}{\text{No. of values}}$$

- ① Window size
- ② Average calculation

$$\text{Average} = \frac{10+12+15+13+11}{5} = 12.2$$

Time | value

Example

① Window = 3

② Avg

D ₁	10	NAN
D ₂	12	NAN
D ₃	15	→ 12.33
D ₄	13	→ 13.33
D ₅	14	→ 13
D ₆	16	→ 14.33
D ₇	17	→ 15.66

$$\text{1st avg} = \frac{D_1 + D_2 + D_3}{3} = \frac{10 + 12 + 15}{3} = 12.33$$

$$\text{2nd avg} = \frac{D_2 + D_3 + D_4}{3} = \frac{12 + 15 + 13}{3} = 13.33$$

$$\text{3rd} = \frac{D_3 + D_4 + D_5}{3} = \frac{15 + 17 + 14}{3} = 14$$

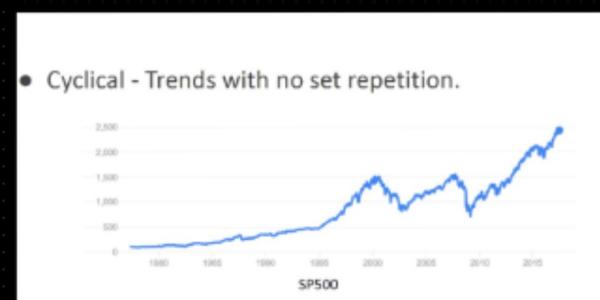
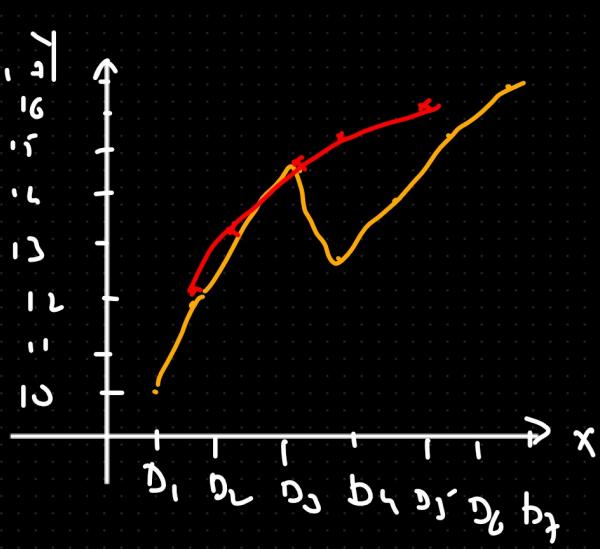
$$\text{4th} = \frac{D_4 + D_5 + D_6}{3} = \frac{13 + 14 + 16}{3} = 14.33$$

$$\text{5th} = \frac{D_5 + D_6 + D_7}{3} = \frac{14 + 16 + 17}{3} = 15.66$$

SMOOTHING \Rightarrow To remove all the effect from the data.

We can perform smoothing with the help of MA

- ① Pattern recognition from the data
- ② You can analysis the trend of the data
- ③ You can reduce the effect of outliers
- ④ changing the visualization



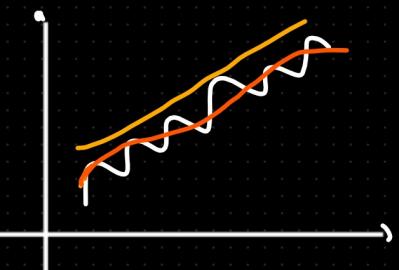
CMA \Rightarrow find out the avg. of all the data Point up to the given time stamp.

<u>CMA</u>		
- D_1	10	$D_1 = 10$
- D_2	12	$D_1 + D_2 / 2 = 10 + 12 / 2 =$
- D_3	15	$10 + 12 + 15 / 3 =$
$\rightarrow D_4$	14	$10 + 12 + 15 + 14 / 4 =$
D_5	16	$10 + 12 + 15 + 14 + 16 / 5 =$
D_6	17	$10 + 12 + 15 + 14 + 17 + 16 / 6 =$
D_7	18	$10 + 12 + 15 + 14 + 16 + 17 + 18 / 7 =$

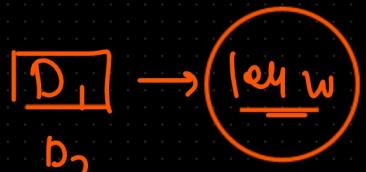
① we use CMA for the long time Period.

② it will give ~~no~~ exponential trend

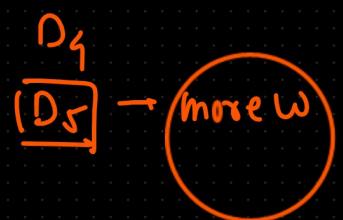
SMOOTHING



EMA OR EWMA \Rightarrow In EMA we give more weightage to the recent Data point or give more weightage to the recent time stamp.



D₃



$$V_t = \beta V_{t-1} + (1-\beta) \theta_t$$

V_t = EMA at time t

$$\beta \Rightarrow 0 < \beta < 1 \Rightarrow [0.9]$$

V_{t-1} = EMA at Previous time stamp

θ_t = Data at t time stamp

$$\begin{array}{c} V_0 \rightarrow D_1 | 25 = 0 \\ V_t \rightarrow D_2 | 13 = 1.3 \\ V_2 \rightarrow D_3 | 17 = 2.87 \\ V_3 \rightarrow D_4 | 31 \\ V_4 \rightarrow D_5 | 43 \end{array}$$

$$V_0 = 0$$

$$V_0 = 25$$

$$V_1 = \beta \times V_0 + (1-\beta) \theta_1$$

$$V_1 = 0.9 \times 0 + (1-0.9) 13$$

$$V_1 = 0 + 0.1 \times 13 = 1.3$$

$$V_2 = \beta \times V_1 + (1-\beta) \theta_2$$

$$V_2 = 0.9 \times 1.3 + 0.1 \times 17$$

$$V_2 = 1.17 + 1.7$$

$$V_2 = 2.87$$

