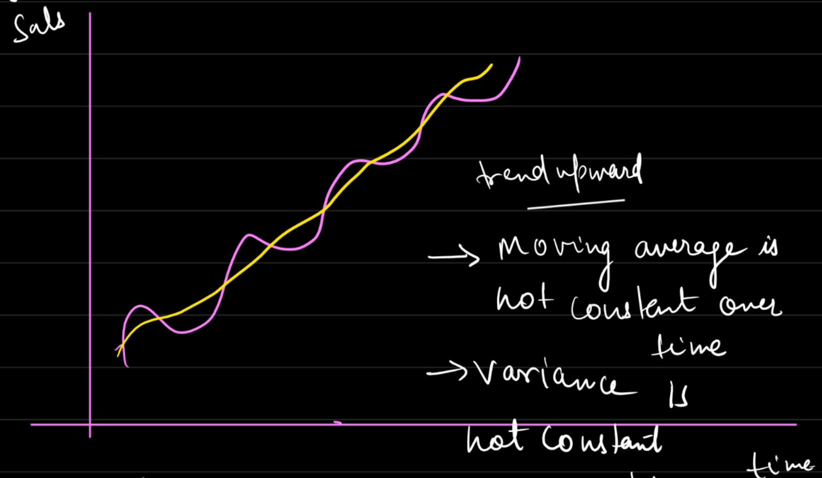
Stationary and Non stationary time series

Month	sales
Jan	40
feb	50
Mar	60
	70
	80
	90



trend upward

→ Moving average is not constant over time

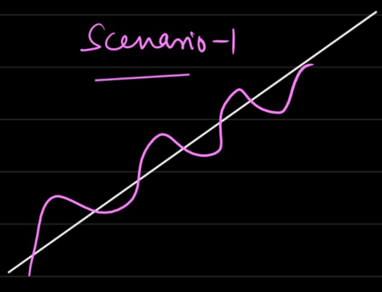
→ Variance is not constant over time.

* You can build a smoothening time series on any time series data.

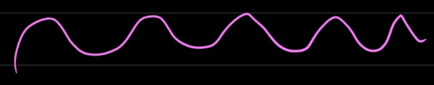
Time series forecasting
- Smoothing models
- Autoregressive model

* To build autoregressive models, statistical properties of a time series like mean | variance should be constant (not change over time).

Scenario-1



Scenario-2

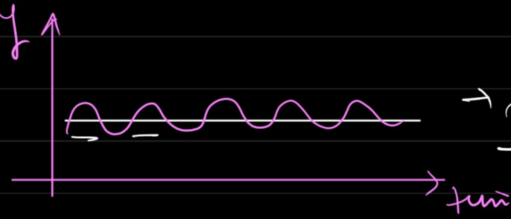


→ It will be easy to build a Autoregressive forecasting model in Scenario 2

Non stationary → Mean - variance will not be constant

Stationary → Mean - variance will be constant

Constant → Over time, value is not varying (changing)



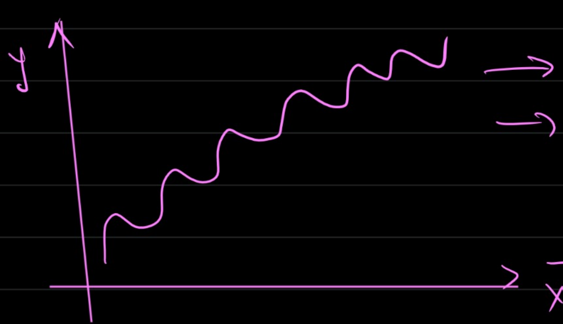
→ trend is flat | Horizonal
→ variance is constant.

ML → Data ingestion → Analysis → Preprocessing | transformation → Model building

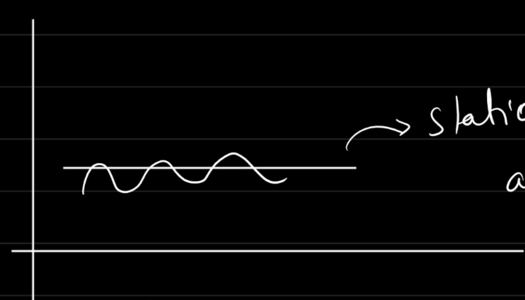
Time series → Time series is
Stationary (mean | variance constant) $\xrightarrow{\text{yes}}$ Model
or
(ARIMA, SARIMA)
Non-stationary
Check.
if non stationary → convert to stationary time series

* To check if a time series data is stationary or Non-St

① Visualization



→ trend ⇒ upward
→ Moving average is increase over time
→ variance is not constant
⇓
TS is non stationary



→ stationary
as moving avg is constant.

② statistical based test

ⓐ ADF (Augmented dickey fuller test)

H_0 : TS data is non stationary
H_A : TS data is stationary

Pvalue ≤ 0.05 → reject the H_0

conclusion → TS data is stationary

② KPSS test
(Kwiatkowski - Philips - schmidt - Shin test)
H_0 → my data is stationary.

* How to Conver non-stationary time series data to stationary time series data.

1. Differencing.
2. log transformation → take the log of value
3. root → take the sq root of value.
4. Seasonal adjustment.

ARIMA

I → Integrated stands for differencing.

Differenting = $y_t - y_{t-1}$ (current) (previous)

Month	Price (y)	1st differencing	2nd order differencing	3rd order differencing
Jan	5	NA	NA	
Feb	10	10-5 = 5	NA	
Mar	6	6-10 = -4	-4-5 = 9	
Apr	8	8-6 = 2	2-(-4) = 6	
May	15	7	7-2 = 5	
June	7	-8	-15	

→ check stationary

→ After differencing check if TS is stationary < stats test (ADF) / visualisation.

→ if stationary build the model else do differencing again and keep doing so untill you get a stationary TS.