

# Time Series Analysis:

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- **Time series:** when all other factors are constant prediction of future values.
- **Different Methods of doing Time series Analysis and Forecasting**
  - **ARIMA model.**
  - **Seasonal ARIMA.** Most used.
  - **Holt Winter Exponential Smoothing.** Easiest and effective model. [Link](#)
  - **Advanced Models** (..Coming soon! Start only after above 3 are done.)

## 1. **Important Concepts and terminology** in Time series Analysis.

- Stationarity. To know everything follow the [link](#).
  - A stationary time series is one whose properties (ie mean, variance, autocorrelation) does not depend on the time.
- Autoregression AR.
- Moving Average MA
- Integration & Difference
- ACF and PACF Plots
- **Time series components:**
  - Trend: long term smooth movement, upward or downward
  - Seasonal: periodic fluctuation, less than 1 year, most commonly found in industry.
  - Cyclical: periodic fluctuation, more than 1 year.
  - irregularity: random movement.

# ARIMA

- ARIMA is the Most common model used for time series forecasting. It has 3 components.
  1. Autoregression AR.
  2. Moving Average MA
  3. Integrated

## 1. Autoregression AR.

- Future values of Y is dependent of previous lagged values of Y.
- regression of  $y_t$  on  $y_{t-1}$ ,  $y_{t-2}$  .
- **P = ORDER OF AR**; current value of y is dependent on how many previous lagged value of current Y. if  $p=2$  that means  $y_t$  is dependent on  $y_{t-1}$  and  $y_{t-2}$ .
- **P** from **PACF**
- Interpretation of PACF:

## 2. Moving Average MA.

- Future values of Y is dependent of previous lagged values of **white noise** ie the irregular component. white noise is just the error. error is the difference between the actual value and predicted value. so we take into consideration the error also to predict the future value.
- autocorrelation between the errors.
- Trend, s, c components of TS is captured in AR where as the irregular comp is captured in MA.
- q is order of MA.
- **ACF** gives q.

## 3. Integrated

- Intergrated means no of times we difference the data then we have to integrated it back to get the original series back.
- We difference to remove trend and seasonality to it stationary series as only after making a series stationary we cam impliment AR and MA.