1. **What do you mean by Time Series Analysis ?**

* Time series analysis is a statistical technique that deals with **time series data**, or trend analysis. In Time series,data is in a series of particular time periods or intervals.
* [**Time series analysis**](https://en.wikipedia.org/wiki/Time_series) is used for various applications such as stock market analysis, pattern recognition, earthquake prediction, economic forecasting, census analysis and so on.

A time series consists of the following components:

* [**Trend**](https://en.wikipedia.org/wiki/Trend)**:** The trend shows the general tendency of the data to increase or decrease during a long period of time. A trend is a smooth, general, long-term, average tendency. It is not always necessary that the increase or decrease is in the same direction throughout the given period of time.
* [**Seasonality**](https://en.wikipedia.org/wiki/Seasonality)**:** Patterns that repeats frequently at regular intervals. For example: high sales every weekend.
* [**Cyclicality**](https://en.wikipedia.org/wiki/Cyclical_history)**:** Cyclicality is where there is a repeating pattern but no fixed period.

2**. Why do we use Time Series Analysis?**

* TSA is the backbone for prediction and forecasting analysis, specific to the time-based problem statements.
* Analyzing the historical dataset and its patterns
* Understanding and matching the current situation with patterns derived from the previous stage.
* Understanding the factor or factors influencing certain variable(s) in different periods.

With help of “Time Series” we can prepare numerous time-based analyses and results.

* Forecasting
* Segmentation
* Classification
* Descriptive and Intervention analysis.

**3. What are the steps involved in Time Series Analysis?**

* building a model that represents a time series
* validating the model proposed
* using the model to predict (forecast) future values and/or impute missing values.

Forecasting

Forecasting is the process of making predictions from the historical data so that they can predict the future from the past and present data.

Types of forecasting:

1) Quantitative forecasting

2) Qualitative forecasting

1) Quantitative forecasting

* Quantitative forecasting is done based on the historical data (i,e) Past and present data mostly numerical data. Through this historical data, we use statistical methods and so we can predict with lesser bias.

2) Qualitative forecasting

* Qualitative forecasting is done based on the opinion and judgment of the subject matter experts and the customers. Why we rely upon judgment instead of data? Because in some cases, the past data are not available or unclear. so here we are depend on judgment and opinions.
* You may have some doubts about regression and time series. Both have some similarities and differences.

**4. What kind of problems can be solved using Time Series Analysis?**

Time series analysis is used to determine the best model that can be used to forecast business metrics. For instance, stock market price fluctuations, sales, turnover, and any other process that can use time series data to make predictions about the future. It enables management to understand time-dependent patterns in data and analyze trends in business metrics.

From a practical standpoint, time series analysis in organizations are mostly used for:

* Economic forecasting
* Sales forecasting
* Utility studies
* Budgetary analysis
* Stock market analysis
* Yield projections
* Census analysis
* Process and quality control
* Inventory studies
* Workload projections

**5. What are the components of Time Series Analysis?**

The various reasons or the forces which affect the values of an observation in a time series are the components of a time series. The four categories of the components of time series are

* Trend
* Seasonal Variations
* Cyclic Variations
* Random or Irregular movements

Seasonal and Cyclic Variations are the periodic changes or short-term fluctuations.

## **Trend**

* The trend shows the general tendency of the data to increase or decrease during a long period of time. A trend is a smooth, general, long-term, average tendency. It is not always necessary that the increase or decrease is in the same direction throughout the given period of time.
* It is observable that the tendencies may increase, decrease or are stable in different sections of time.  But the overall trend must be upward, downward or stable. The population, agricultural production, items manufactured, number of births and deaths, number of industry or any factory, number of schools or colleges are some of its example showing some kind of tendencies of movement.

### ****Linear and Non-Linear Trend****

* If we plot the time series values on a graph in accordance with time t. The pattern of the data clustering shows the type of trend. If the set of data cluster more or less round a straight line, then the trend is linear otherwise it is non-linear (Curvilinear).

## **Periodic Fluctuations**

* There are some components in a time series which tend to repeat themselves over a certain period of time. They act in a regular spasmodic manner.

### ****Seasonal Variations****

* These are the rhythmic forces which operate in a regular and periodic manner over a span of less than a year. They have the same or almost the same pattern during a period of 12 months. This variation will be present in a time series if the data are recorded hourly, daily, weekly, quarterly, or monthly.
* These variations come into play either because of the natural forces or man-made conventions. The various seasons or climatic conditions play an important role in seasonal variations. Such as production of crops depends on seasons, the sale of umbrella and raincoats in the rainy season, and the sale of electric fans and A.C. shoots up in summer seasons.
* The effect of man-made conventions such as some festivals, customs, habits, fashions, and some occasions like marriage is easily noticeable.  They recur themselves year after year. An upswing in a season should not be taken as an indicator of better business conditions.

### ****Cyclic Variations****

* The variations in a time series which operate themselves over a span of more than one year are the cyclic variations. This oscillatory movement has a period of oscillation of more than a year. One complete period is a cycle. This cyclic movement is sometimes called the ‘Business Cycle’.
* It is a four-phase cycle comprising of the phases of prosperity, recession, depression, and recovery. The cyclic variation may be regular are not periodic. The upswings and the downswings in business depend upon the joint nature of the economic forces and the interaction between them.

## **Random or Irregular Movements**

* There is another factor which causes the variation in the variable under study. They are not regular variations and are purely random or irregular. These fluctuations are unforeseen, uncontrollable, unpredictable, and are erratic. These forces are earthquakes, wars, flood, famines, and any other disasters.