# DATA SCIENCE INTERVIEW PREPARATION

# (30 Days of Interview Preparation)

# # DAY 07

## Q1. What is the process to make data stationery from non-stationary in time series?

## Ans:

The two most common ways to make a non-stationary time series stationary are:

- **Differencing**
- **Transforming**

Let us look at some details for each of them:

**Differencing:**

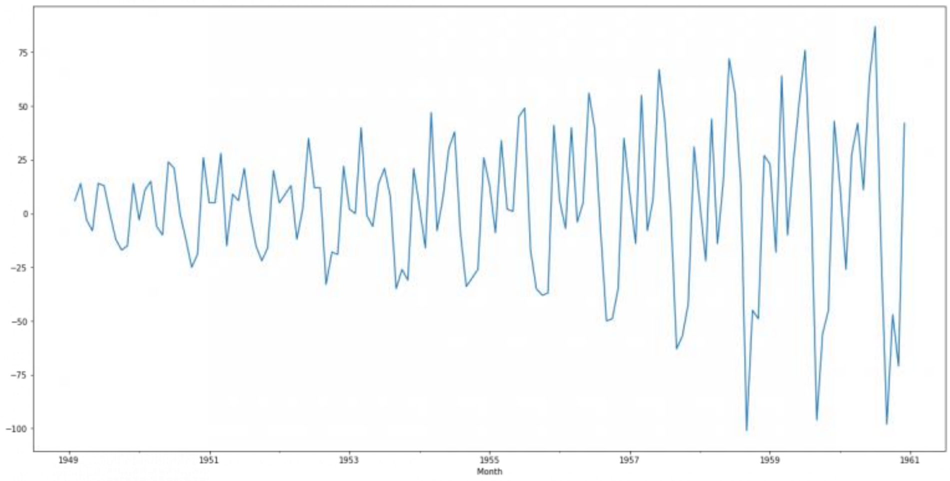
To make your series stationary, you take a difference between the data points. So let us say, your original time series was:

X1, X2, X3,...........Xn

Your series with a difference of degree 1 becomes:

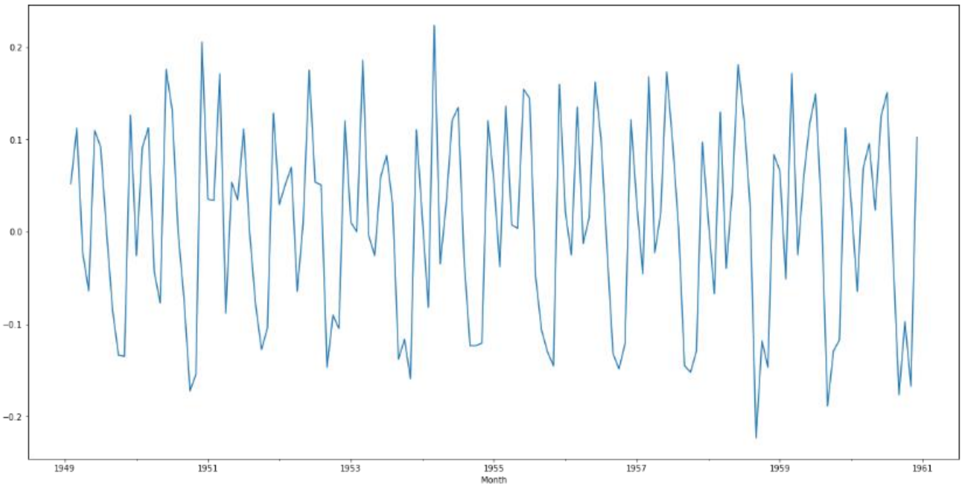
(X2 - X1, X3 - X2, X4 - X3,.......Xn - X(n-1)

Once, you make the difference, plot the series and see if there is any improvement in the ACF curve. If not, you can try a second or even a third-order differencing. Remember, the more you difference, the more complicated your analysis is becoming.



**Transforming:**

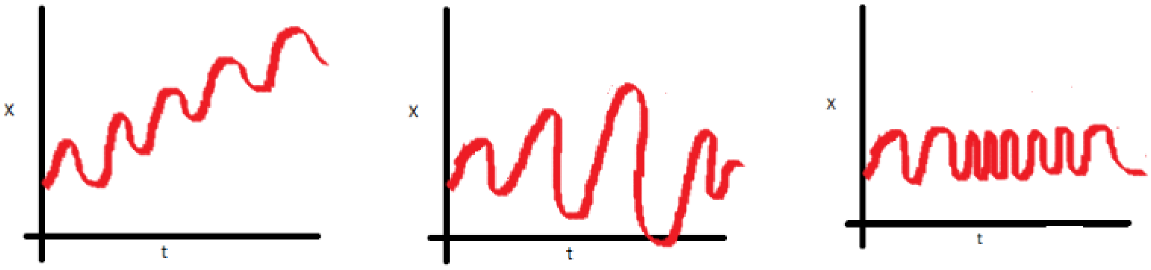
If we cannot make a time series stationary, you can try out transforming the variables. Log transform is probably the most commonly used transformation if we see the diverging time series. However, it is suggested that you use transformation only in case differencing is not working.



## Q2. What is the process to check stationary data ?

## Ans:

**Stationary series**: It is one in which the properties – mean, variance and covariance, do not vary with time.

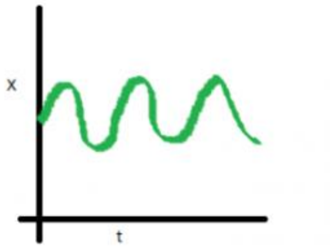


Let us get an idea with these three plots:

- In the first plot, we can see that the mean varies (increases) with time, which results in an upward trend. This is the non-stationary series.
  For the series classification as stationary, it should not exhibit the trend.
- Moving on to the second plot, we do not see a trend in the series, but the variance of the series is a function of time. As mentioned previously, a stationary series must have a constant variance.

- If we look at the third plot, the spread becomes closer, as the time increases, which implies that covariance is a function of time.

These three plots refer to the non-stationary time series. Now give your attention to fourth:



In this case, Mean, Variance and Covariance are constant with time. This is how a stationary time series looks like.

Most of the statistical models require the series to be stationary to make an effective and precise prediction.

The various process you can use to find out your data is stationary or not by the following terms:

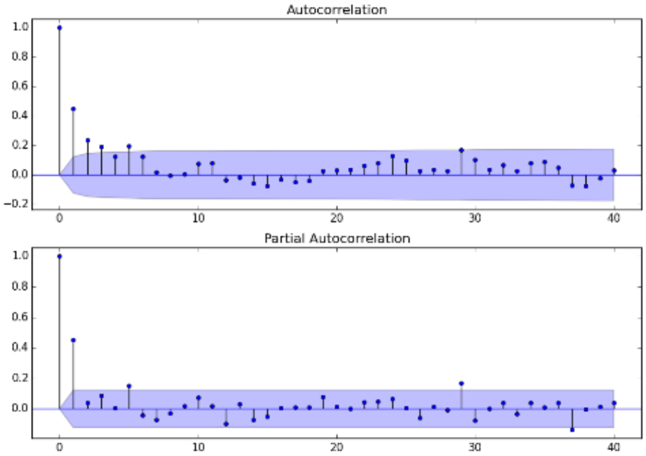
1. Visual Test
2. Statistical Test
3. ADF(Augmented Dickey-Fuller) Test
4. KPSS(Kwiatkowski-Phillips-Schmidt-Shin) Test

## Q3. What are ACF and PACF?.

## Ans:

**ACF** is a (complete) auto-correlation function which gives us the values of the auto-correlation of any series with lagged values. We plot these values along with a confidence band.We have an ACF plot. In simple terms, it describes how well the present value of the series is related to its past values. A time series can have components like the trend, seasonality, cyclic and residual. ACF considers all the components while finding correlations; hence, it's a 'complete auto-correlation plot'.

**PACF** is a partial autocorrelation function. Instead of finding correlations of present with lags like ACF, it finds the correlations of the residuals with the next lag value thus 'partial' and not 'complete' as we remove already found variations before we find next correlation. So if there are any hidden pieces of information in the residual which can be modelled by next lag, we might get a good correlation, and we'll keep that next lag as a feature while modelling. Remember, while modelling we don’t want to keep too many correlated features, as that it can create multicollinearity issues. Hence we need to retain only relevant features.

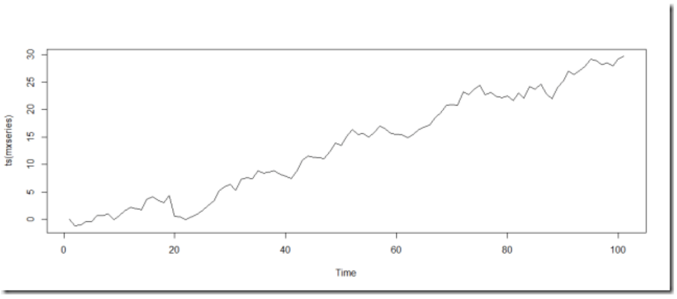


## Q4. What do you understand by the trend of data?

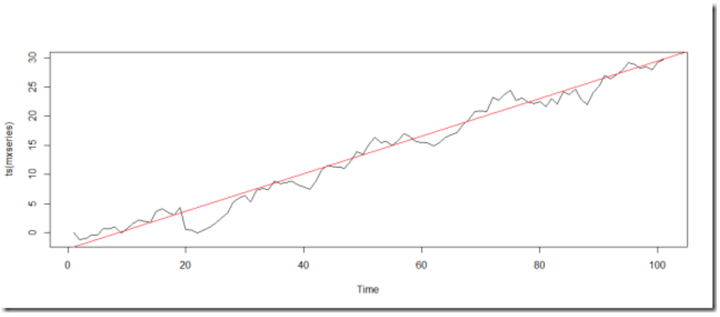
## Ans:

A general systematic linear or (most often) nonlinear component that changes over time and does not repeat.

There are different approaches to understanding trend. A positive trend means it is likely that growth continues. Let's illustrate this with a simple example:



Hmm, this looks like there is a trend. To build up confidence, let's add a linear regression for this graph:



Great, now it’s clear theirs a trend in the graph by adding Linear Regression.

## Q5. What is the Augmented Dickey-Fuller Test?

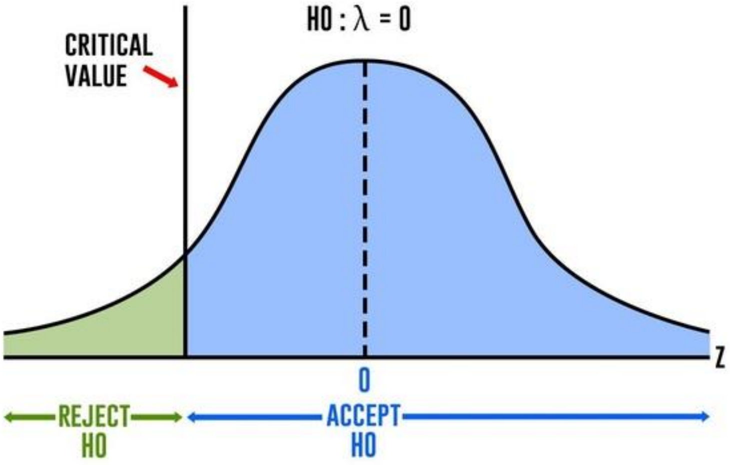
### Ans:

**The Dickey-Fuller test**: It is one of the most popular statistical tests. It is used to determine the presence of unit root in a series, and hence help us to understand if the series is stationary or not. The null and alternate hypothesis for this test is:

**Null Hypothesis**: The series has a unit root (value of a =1)

**Alternate Hypothesis**: The series has no unit root.

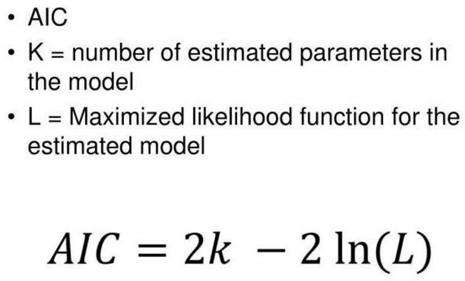
If we fail to reject the null hypothesis, we can say that the series is non-stationary. This means that the series can be linear or difference stationary.



## Q6. What is AIC and BIC into time series?

### Ans:

**Akaike's information criterion** (AIC) compares the quality of a set of statistical models to each other. For example, you might be interested in what variables contribute to low socioeconomic status and how the variables contribute to that status. Let's say you create several regression models for various factors like education, family size, or disability status; The AIC will take each model and rank them from best to worst. The "best" model will be the one that neither under-fits nor over-fits.



- AIC
- K = number of estimated parameters in the model
- L = Maximized likelihood function for the estimated model

$$AIC = 2k \; - 2\ln(L)$$

The Bayesian Information Criterion (BIC) can be defined as:

*$k \log(n)- 2\log(L(\hat{\vartheta}))$.*

Here n is the sample size.

K is the number of parameters which your model estimates.

$\theta$ is the set of all parameter.

L ($\hat{\theta}$) represents the likelihood of the model tested, when evaluated at maximum likelihood values of $\theta$.

## Q7. What are the components of the Time -Series?

## Ans:

**Time series analysis**: It provides a body of techniques to understand a dataset better. The most useful one is the decomposition of the time series into four constituent parts-

1. Level- The baseline value for the series if it were a straight line.
2. Trend - The optional and linear, increasing or decreasing behaviour of series over time.
3. Seasonality - Optional repeated patterns /cycles of behaviour over time.
4. Noise - The optional variability in the observations that cannot be explained by the model.

## Q8. What is Time Series Analysis?

## Ans:

**Time series analysis**: It involves developing models that best capture or describe an observed time series to understand the underlying cause. This study seeks the “why” behind the time-series datasets. This involves making assumptions about the form of data and decomposing time-series into the constitution component.

Quality of descriptive model is determined by how well it describes all available data and the interpretation it provides to inform the problem domain better.

## Q9. Give some examples of the Time-Series forecast?

## Ans:

There is almost an endless supply of the time series forecasting problems. Below are ten examples from a range of industries to make the notions of time series analysis and forecasting more concrete.

1. Forecasting the corn yield in tons by the state each year.
2. Forecasting whether an EEG trace in seconds indicates a patient is having a seizure or not.
3. Forecasting the closing price of stocks every day.
4. Forecasting the birth rates at all hospitals in the city every year.
5. Forecasting product sales in the units sold each day for the store.
6. Forecasting the number of passengers through the train station each day.
7. Forecasting unemployment for a state each quarter.
8. Forecasting the utilisation demand on the server every hour.
9. Forecasting the size of the rabbit populations in the state each breeding season.
10. Forecasting the average price of gasoline in a city each day.

## Q10. What are the techniques of Forecasting?

## Ans:

There are so many statistical techniques available for time series forecast however we have found a few effective ones which are listed below:

- Simple Moving Average (SMA)
- Exponential Smoothing (SES)
- Autoregressive Integration Moving Average (ARIMA)

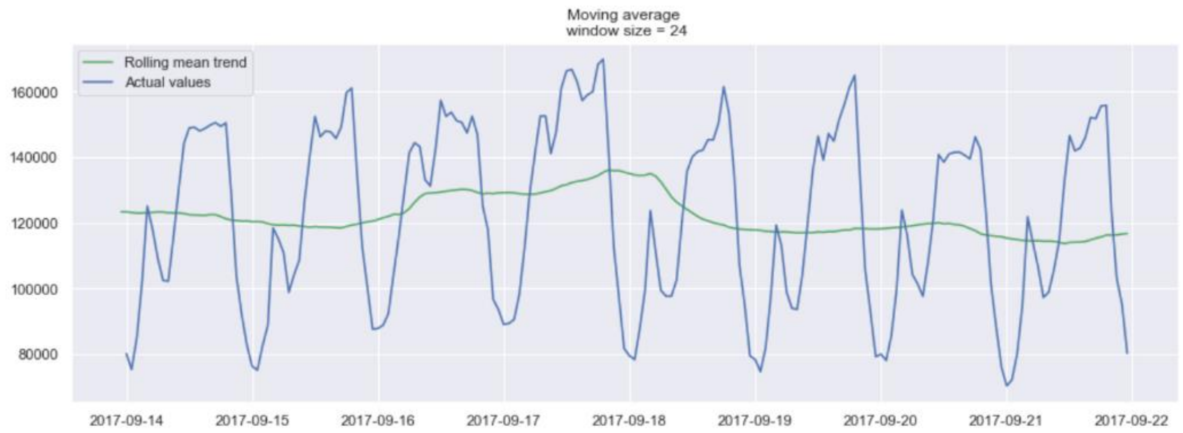
## Q11. What is the Moving Average?

## Ans:

The moving average model is probably the most naive approach to time series modelling. This model states that the next observation is the mean of all past observations.

Although simple, this model might be surprisingly good, and it represents a good starting point.

Otherwise, the moving average can be used to identify interesting trends in the data. We can define a window to apply the moving average model to smooth the time series and highlight different trends.

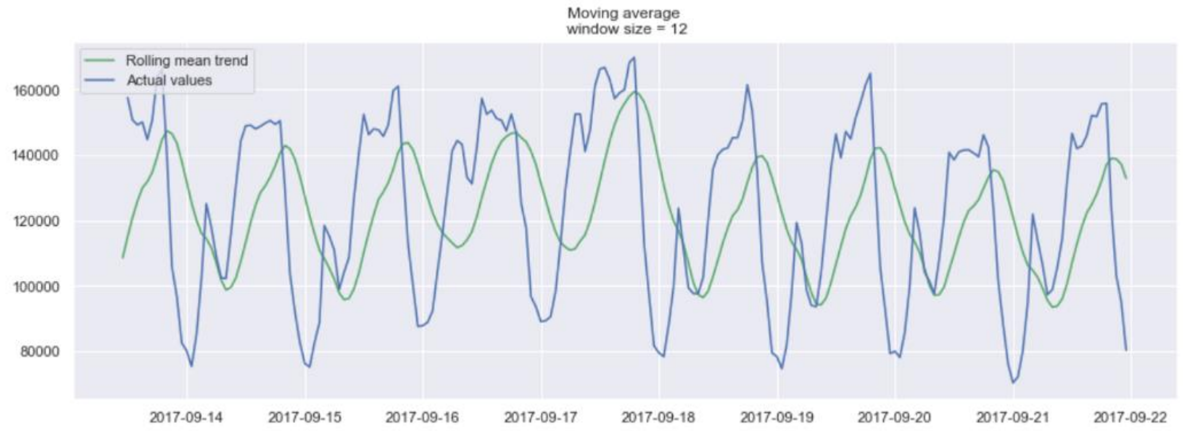


**Example of a moving average on a 24h window**

In the plot above, we applied the moving average model to a 24h window. The green line smoothed the time series, and we can see that there are two peaks in the 24h period.

The longer the window, the smoother the trend will be.

Below is an example of moving average on a smaller window.



**Example of a moving average on a 12h window**

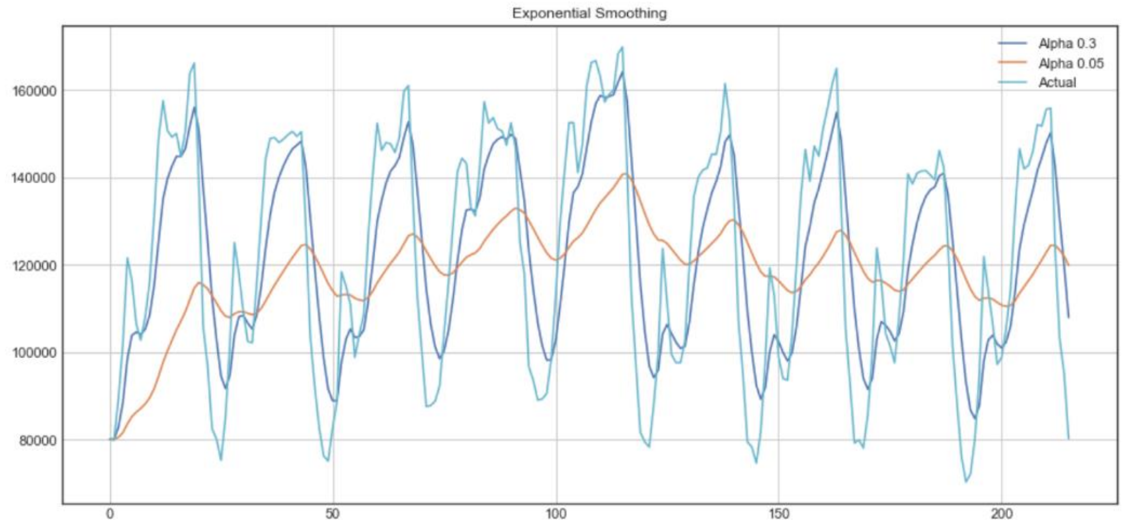
## Q12. What is  Exponential smoothing?
## Ans:

**Exponential smoothing** uses similar logic to moving average, but this time, different decreasing weight is assigned to each observation. We can also say, less importance is given to the observations as we move further from the present.

Mathematically, exponential smoothing is expressed as:

$$y = \alpha x_t + (1 - \alpha) y_{t-1}, t > 0$$

Here, alpha is the smoothing factor which takes values between 0 to 1. It determines how fast the weight will decrease for the previous observations.



From the above plot, the dark blue line represents the exponential smoothing of the time series using a smoothing factor of 0.3, and the orange line uses a smoothing factor of 0.05. As we can see, the smaller the smoothing factor, the smoother the time series will be. Because as smoothing factor approaches 0, we approach to the moving average model

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# DATA SCIENCE INTERVIEW PREPARATION

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# # DAY 08

## Q1. What is Tensorflow?

## Ans:

**TensorFlow:** TensorFlow is an open-source software library released in 2015 by Google to make it easier for the developers to design, build, and train deep learning models. TensorFlow is originated as an internal library that the Google developers used to build the models in house, and we expect additional functionality to be added in the open-source version as they are tested and vetted in internal flavour. Although TensorFlow is the only one of several options available to the developers and we choose to use it here because of thoughtful design and ease of use.

At a high level, TensorFlow is a Python library that allows users to express arbitrary computation as a graph of *data flows*. Nodes in this graph represent mathematical operations, whereas edges represent data that is communicated from one node to another. Data in TensorFlow are represented as tensors, which are multidimensional arrays. Although this framework for thinking about computation is valuable in many different fields, TensorFlow is primarily used for deep learning in practice and research.

TensorFlow 2.0

Easy

Simplified APIs. Focused on Keras and eager execution

Powerful

Flexibility and performance. Power to do cutting edge research and scale to > 1 exaflops

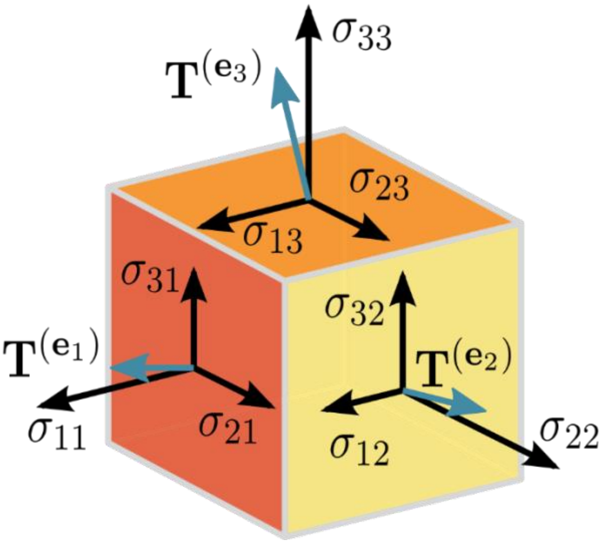
Scalable

Tested at Google-scale. Deploy everywhere

## Q2. What are Tensors?

## Ans:

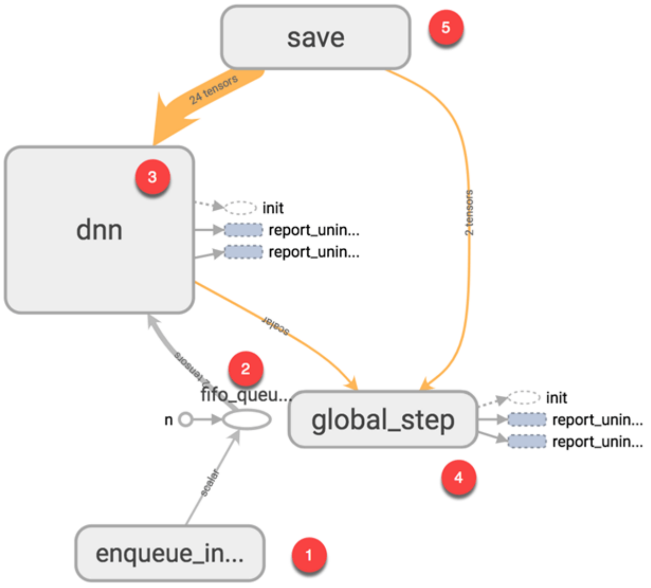
**Tensor:** In mathematics, it is an algebraic object that describes the linear mapping from one set of algebraic objects to the another. Objects that the tensors may map between include, but are not limited to the vectors, scalars and recursively, even other tensors (for example, a matrix is the map between vectors and thus a tensor. Therefore the linear map between matrices is also the tensor). Tensors are inherently related to the vector spaces and their dual spaces and can take several different forms. For example, a scalar, a vector, a dual_vector at a point, or a multi-linear map between vector spaces. Euclidean vectors and scalars are simple tensors. While tensors are defined as independent of any basis. The literature on physics, often referred by their components on a basis related to a particular coordinate system.



## Q3. What is TensorBoard?

## Ans:

**TensorBoard,** a suit of visualising tools, is an easy solution to Tensorflow offered by the creators that lets you visualise the graphs, plot quantitative metrics about the graph with additional data like images to pass through it.



This one is some example of how the TensorBoard is working.

## Q4. What are the features of TensorFlow?

### Ans:

- One of the main features of TensorFlow is its ability to build neural networks.
- By using these neural networks, machines can perform logical thinking and learn similar to humans.
- There are the other tensors for processing, such as data loading, preprocessing, calculation, state and outputs.
- It considered not only as deep learning but also as the library for performing the tensor calculations, and it is the most excellent library when considered as the deep learning framework that can also describe basic calculation processing.
- TensorFlow describes all calculation processes by calculation graph, no matter how simple the calculation is.

## Q5. What are the advantages of TensorFlow?

### Ans:

- It allows Deep Learning.
- It is open-source and free.
- It is reliable (and without major bugs)
- It is backed by Google and a good community.
- It is a skill recognised by many employers.
- It is easy to implement.

## Q6. List a few limitations of Tensorflow.

### Ans:

- Has the GPU memory conflicts with Theano if imported in the same scope.
- It has dependencies with other libraries.
- Requires prior knowledge of the advanced calculus and linear algebra along with the pretty good understanding of machine learning.

## Q7. What are the use cases of Tensor flow?

## Ans:

Tensorflow is an important tool of deep learning, it has mainly five use cases, and they are:

- Time Series
- Image recognition
- Sound Recognition
- Video detection
- Text-based Applications

## Q8. What are the very important steps of Tensorflow architecture?

## Ans:

There are three main steps in the Tensorflow architecture are:

- Pre-process the Data
- Build a Model
- Train and estimate the model

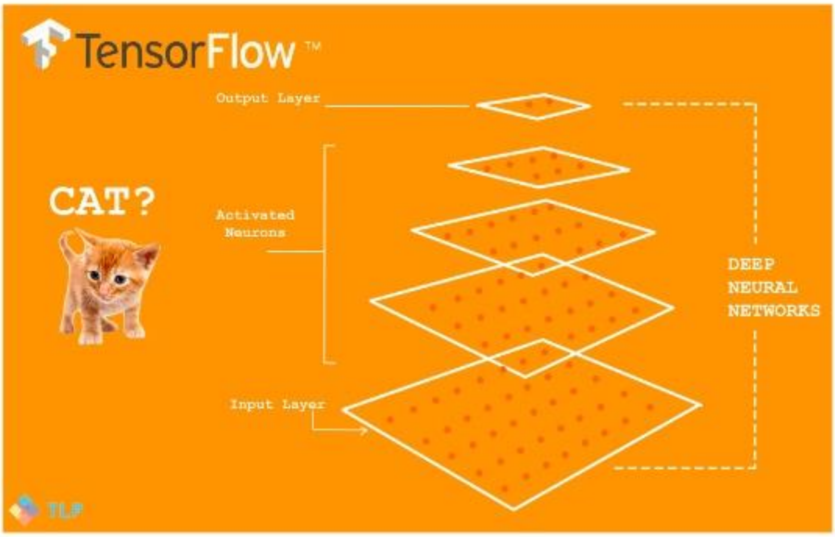
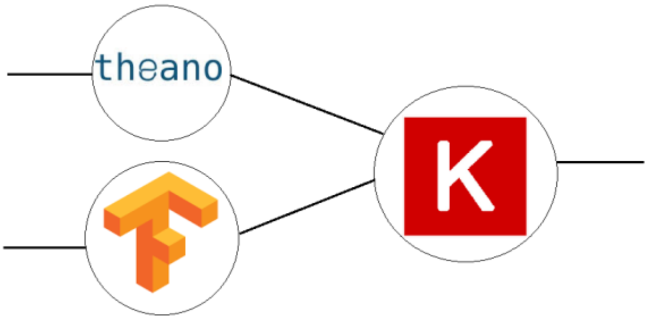


***Image Recognition***
***Classification using Softmax Regressions and Convolutional Neural Networks***

## Q9. What is Keras?

## Ans:

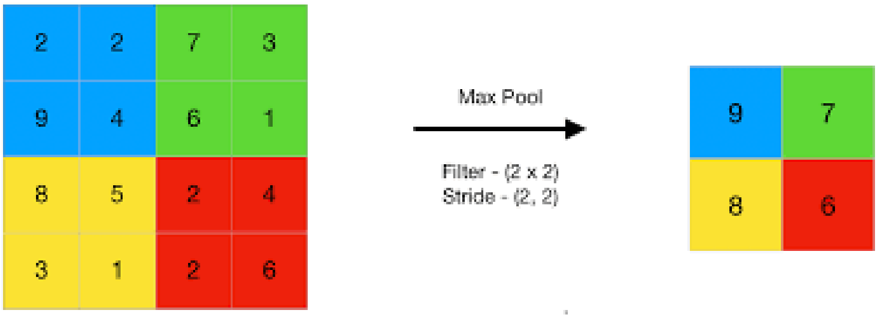
**Keras:** It is an Open Source Neural Network library written in Python that runs on the top of Theano or Tensorflow. It is designed to be the modular, fast and easy to use. It was developed by François Chollet, a Google engineer.



## Q10. What is a pooling layer?

## Ans:

**Pooling layer:** It is generally used in reducing the spatial dimensions and not depth, on a convolutional neural network model.



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|---|---|---|---|
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| 9 | 4 | 6 | 1 |
| 8 | 5 | 2 | 4 |
| 3 | 1 | 2 | 6 |

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|---|---|
| 9 | 7 |
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## Q11. What is the difference between CNN and RNN?

## Ans:

**CNN (Convolutional Neural Network)**

- Best suited for spatial data like images
- CNN is powerful compared to RNN
- This network takes a fixed type of inputs and outputs
- These are the  ideal for video and image processing

**RNN (Recurrent Neural Network)**

- Best suited for sequential data
- RNN supports less feature set than CNN.
- This network can manage the arbitrary input and output lengths.
- It is ideal for text and speech analysis.

## Q12. What are the benefits of Tensorflow over other libraries?

## Ans:

The following benefits are:

- Scalability
- Visualisation of Data
- Debugging facility
- Pipelining

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