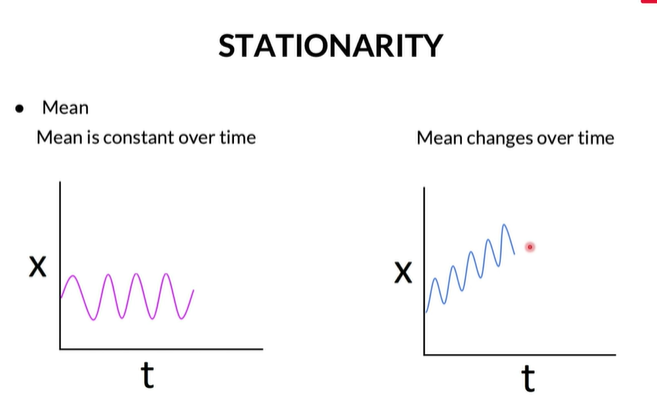
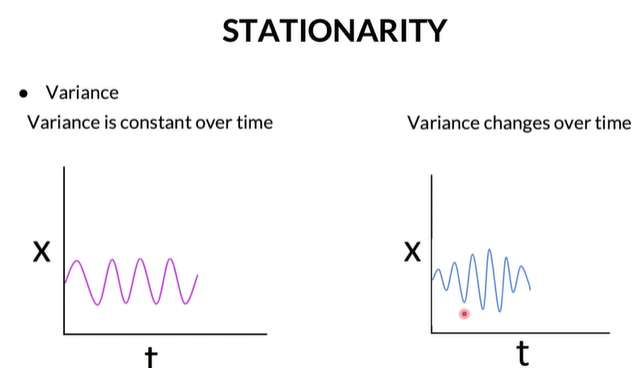
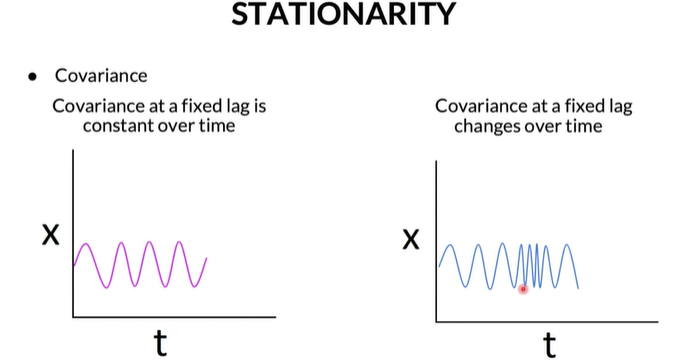
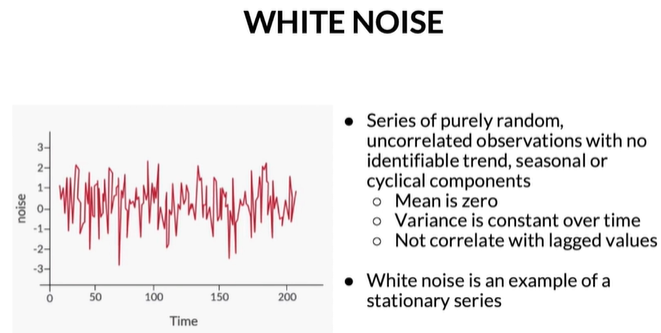
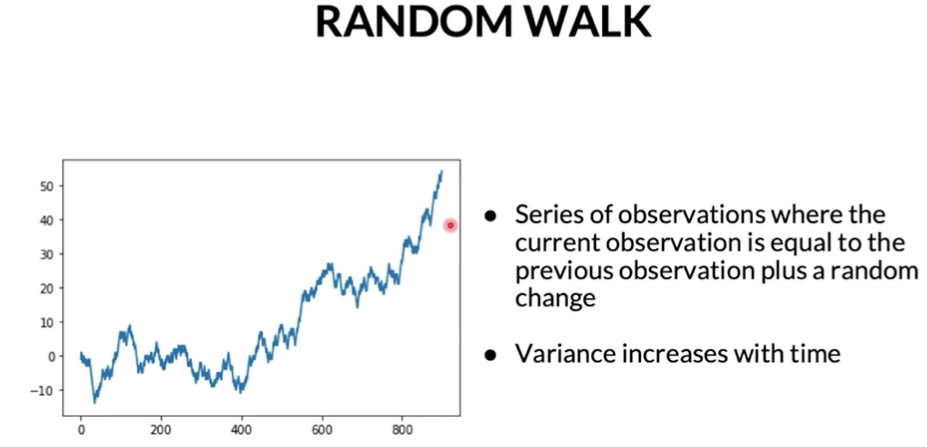
Time series forecasting 2

In this module, we shall talk about Timeseries forecasting and the requirements.

Stationarity: Where the mean does not change over time.  
 

Variance: The variance should be constant over time.   


Covariance: The covariance at a fixed lag is constant over time  
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
White noise is an example of stationary series  with purely random, uncorrelated observations with no identifiable trend, seasonal or cyclical components.  
  
Random walk is an example of stationary series.   


**White Noise**

Which of the following is FALSE for white noise?

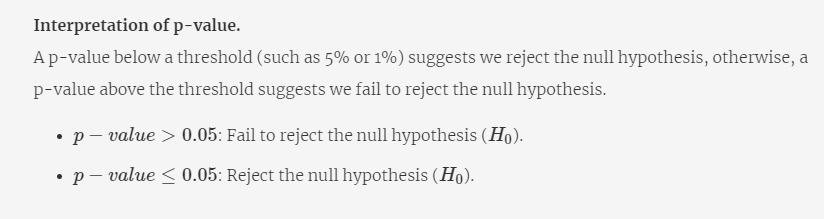
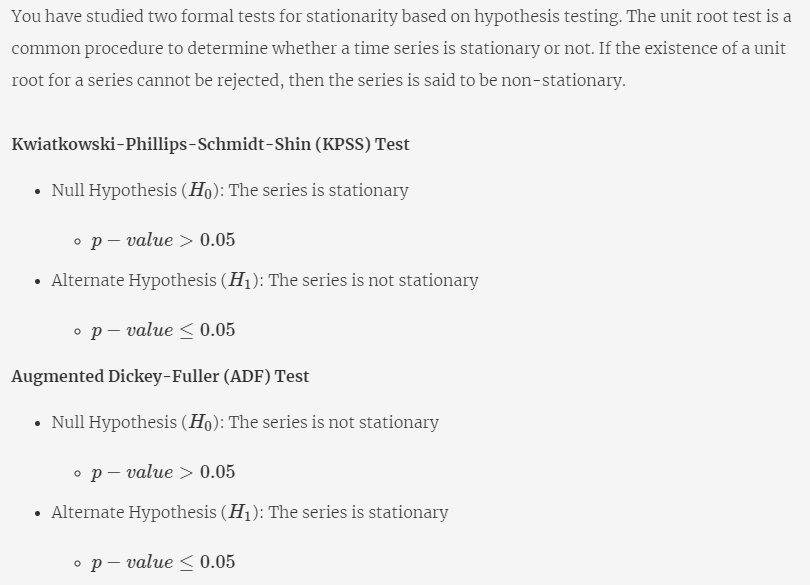
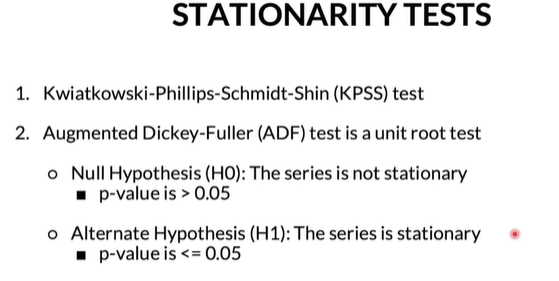
**Covariance can be non-zero but should be constant.**

**Feedback :**

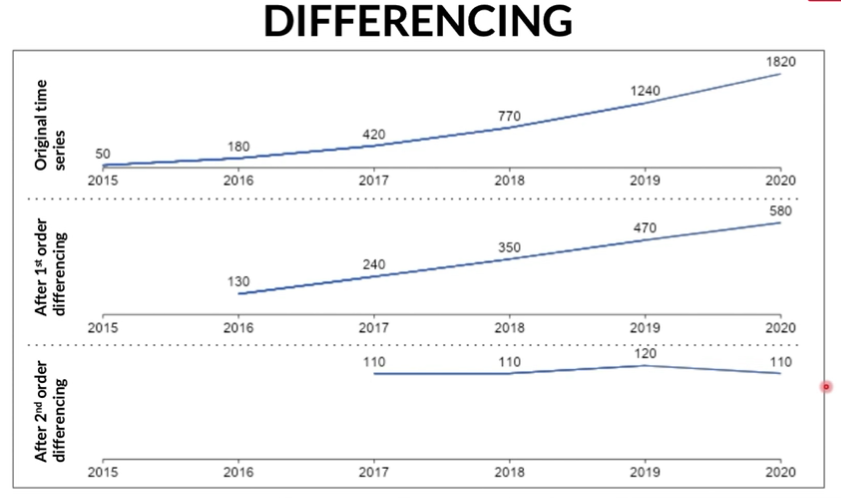
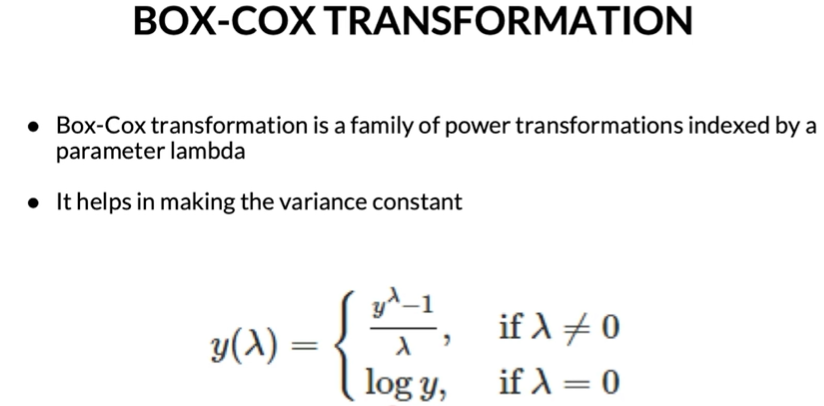
*Correct. Covariance must be constant over a given lag.*

Why is stationarity required for Timeseries models?

1. Stationary process are easier to analyse and model because its statistical properties remain constant over time
2. Like Linear regression, autoregression is built on the same assumptions of independent and identically distributed (IID) random variables

Stationarity tests  


If we get a value less than the critical value, then we can REJECT the NULL hypothesis

How to make a timeseries stationary?  
Ans – Differencing and Box-Cox transformation  
  


**Non-stationary to stationary**

Which of the following is true?

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**Box-Cox Transformation makes the variance constant in a Time series.**

**Feedback :**

Box-Cox Transformation makes the variance constant in a Time series

**Correct**

Differencing is performed by subtracting the previous observation from the current observation.

**Feedback :**

Differencing as the name suggests is subtracting the previous observation from the current observation.

**Correct**You missed this!

**Differencing can remove both Trend and seasonality in a Time series.**

**Feedback :**

Differencing removes trend and seasonality in a Time series. When an entire cycle is used for differencing the other cycle, then the seasonality is removed.

**Correct**

**Differencing makes the variance constant in a Time-series**

**Feedback :**

Box-Cox Transformation makes the variance constant in a time series.

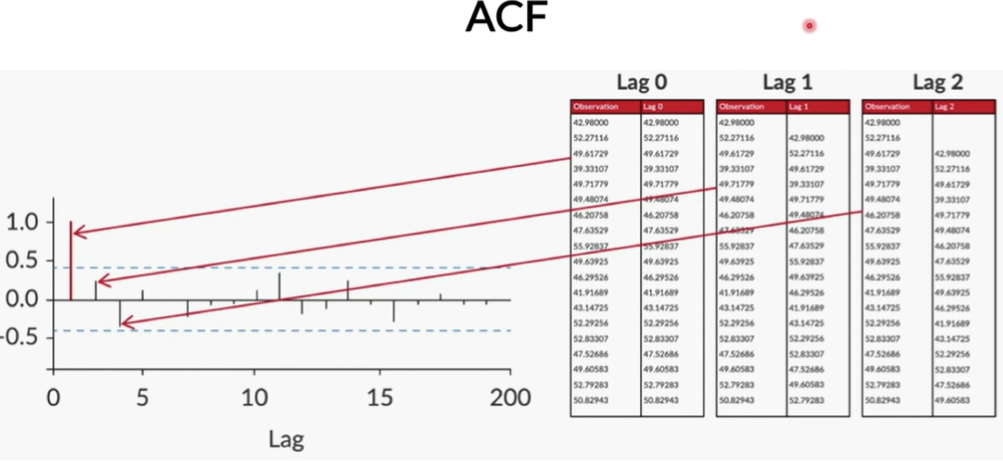
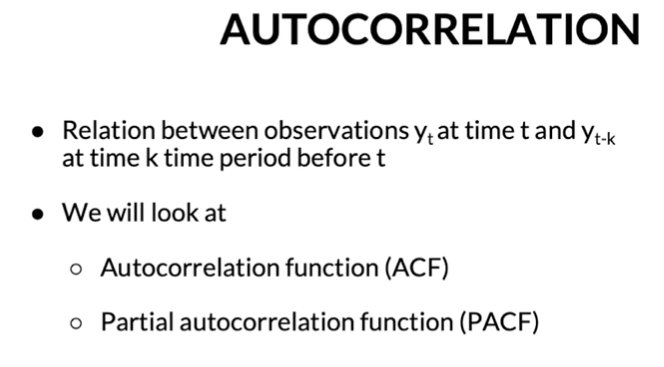
**Incorrect**

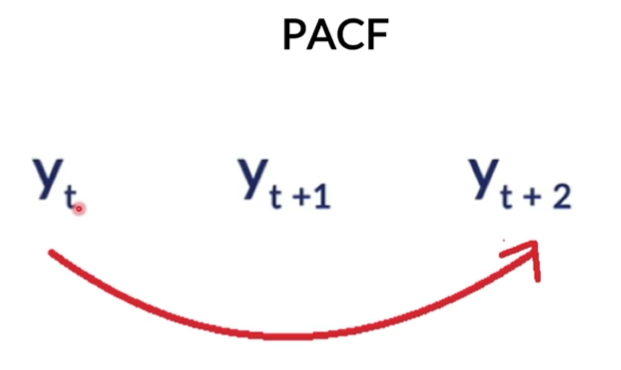
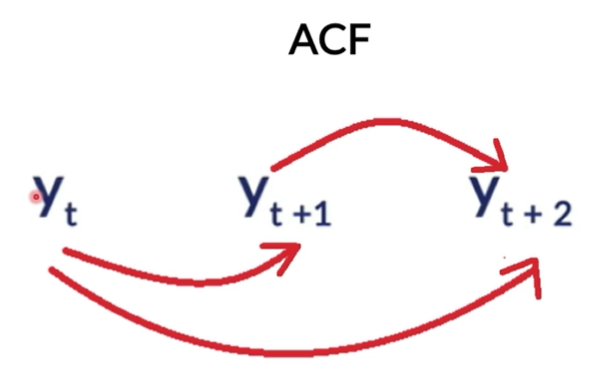
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**ACF and PACF**:

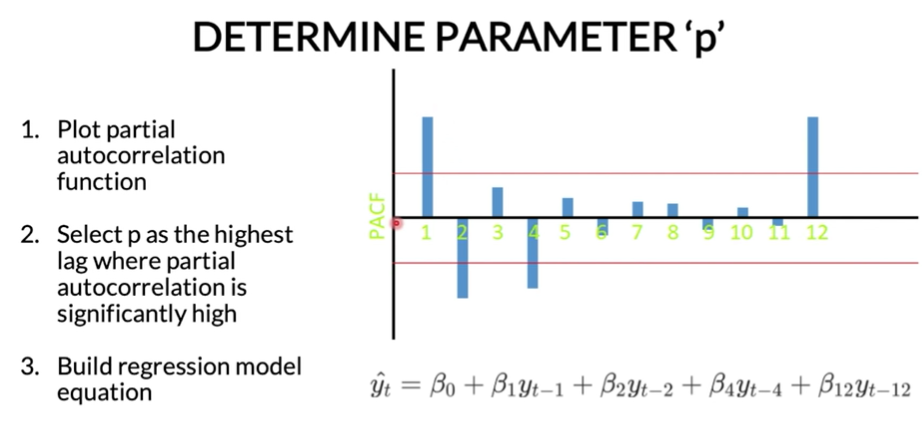
Autocorrelation is capturing the relationship between observations yt at time t and  yt−k at time k time period before t. In simpler words, Autocorrelation helps us to know how a variable is influenced by its own lagged values. We will look at two Autocorrelation measures here:

1. Autocorrelation function (ACF)
2. Partial autocorrelation function (PACF)



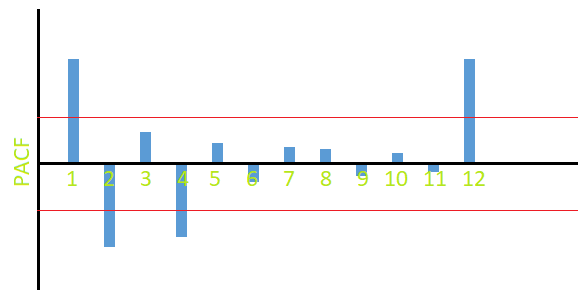


**The Simple Auto Regressive Model (AR)**

  
The Simple Auto Regressive model predicts the future observation as linear regression of one or more past observations. In simpler terms, the simple autoregressive model forecasts the dependent variable (future observation) when one or more independent variables are known (past observations). This model has a parameter **‘p’** called **lag order**. Lag order is the maximum number of lags used to build ‘p’ number of past data points to predict future data points.

**To determine the value of parameter ‘p’.**

* Plot partial autocorrelation function

****

* **Select p as the highest lag where partial autocorrelation is significantly high**

Here, the lag value of 1, 2, 4 and 12 has a significant level of confidence. i.e., significant level of influence on future observation (refer the red line). Hence, the value of 'p' will be set to 12 since that is the highest lag where partial autocorrelation is significantly high.

* Build autoregression model equation:

https://images.upgrad.com/716c0ecb-082f-42d3-96e2-89a63e3431a7-3.3.png

**3.3**

The past values which have a significant value are 1, 2, 4 and 12. Therefore, in the regression model the independent variables yt−1, yt−2, yt−4 and yt−12  which are the observations from the past has been taken to predict the dependent variable ^yt.

**AR model**

Which of the following is true for Auto Regressive (AR) models?

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**It models the future observation as a linear regression of one or more past observations.**

**Feedback :**

 Auto Regression as the name suggests models the future observation with the lag of one or more past observation.

**Correct**



This model uses past forecast errors.



**The parameter of the autoregressive model 'p' is calculated from the Partial Autocorrelation Function plot.**

**Feedback :**

p is calculated from the PACF plot.

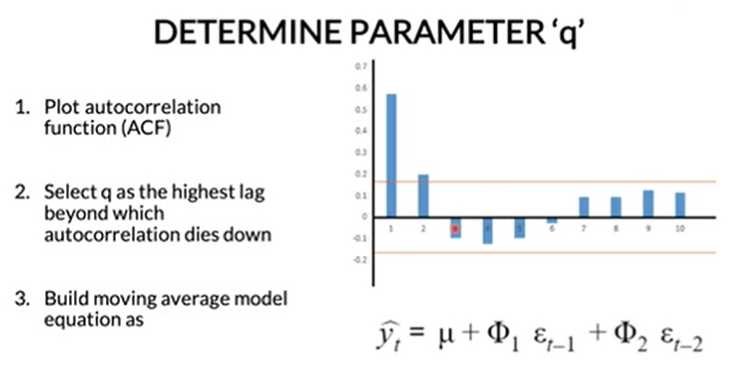
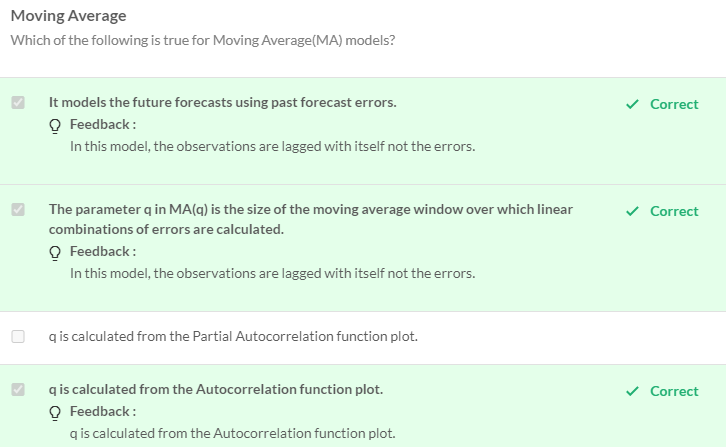
**Correct**

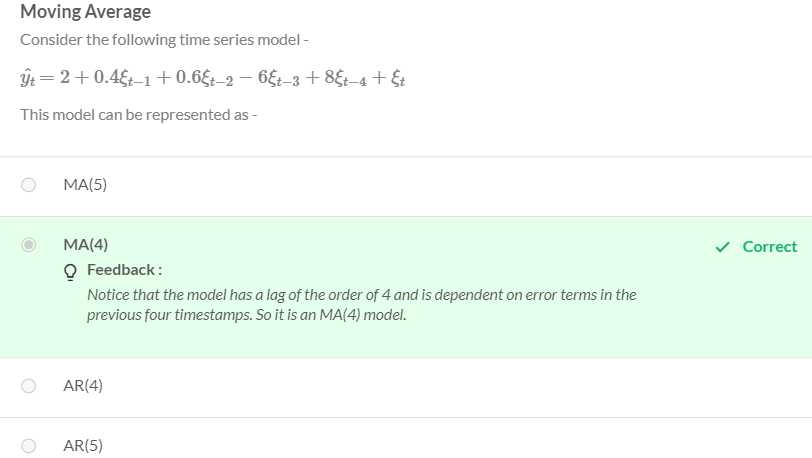


p is calculated from the Autocorrelation Function plot.

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**MOVING AVERAGE MODEL - Q**

**Auto Regressive Moving Average (ARMA) Model**:

