1. Classical time series analysis like ARIMA, SARIMA, assume the time series to be stationary.
2. What do you mean by a stationary time series?
   1. The statistical properties (mean, variance, and trend) of a time series do not change.
3. What is the variance in a time series data?
   1. At a high level the stochastic process at every time *t* has the same distribution. At every time interval a stochastic process is said to be identical, independently distributed (i.i.d). So the variance depends on the previous value of the timestamp.
   2. It is true that you have one observation at each time, but this is the realization of the stochastic process {yt:t∈1,2,…}{��:�∈1,2,…} behind the data you observe, where for stochastic process I mean a collection of univariate random variables defined on some probability space.
   3. Typically, time series are defined by specifying a model for the individual components of the process, for example an AR(1): yt=ϕyt−1+ϵt��=���−1+��, where ϵt∼WN(σ2)��∼��(�2), i.e. ϵt�� is a white noise with variance σ2�2.
   4. So, for a AR(1), assuming that the process is [weakly stationary](https://en.wikipedia.org/wiki/Stationary_process), the variance of each random variable yt�� does not depend on time t, and you can compute it as
   5. Var(yt)=ϕ2Var(yt−1)+σ2⟹Var(yt)=σ21−ϕ2
   6. https://stats.stackexchange.com/questions/336566/what-is-the-variance-for-time-series-data-how-can-it-be-computed
4. <https://www.kaggle.com/datasets/robikscube/hourly-energy-consumption>
5. The dataset or resources for the time series notebook is downloaded from the above link
6. The above dataset is a univariate time series data. Some of the steps that needs to be done when a time series data is given is as follows:
   1. Plot the Graph
   2. Look for missing values
   3. Stationarity Check (mean, variance, trend)
7. What are the different methods available for time series related problems?
8. Exponential Smoothing (ES): Exponential smoothing methods use weighted averages of past observations to forecast future values. Different variants of exponential smoothing exist, such as Simple Exponential Smoothing (SES), Holt's Linear Exponential Smoothing (Double Exponential Smoothing), and Holt-Winters' Exponential Smoothing (Triple Exponential Smoothing) for handling trends and seasonality.
9. State Space Models: State space models are flexible frameworks that can incorporate various components such as trends, seasonality, and exogenous variables. They provide a way to represent complex time series dynamics and are often estimated using techniques like Kalman filtering or maximum likelihood estimation.
10. Vector Autoregression (VAR): VAR models extend the concept of autoregression to multiple time series variables. It models the relationships between multiple variables by considering their past values as predictors.
11. Machine Learning Methods: Machine learning algorithms such as random forests, support vector machines, and neural networks can also be applied to time series data. These methods can capture complex patterns and non-linear relationships but may require more computational resources and larger datasets.
    1. The above answer is provided by ChatGPT
12. Also how do we apply Vector Autoregression modeling?
13. How do we set the run command properties of matplotlib?
14. What are the step by step by process of ARIMA model
    1. First make the data stationary
    2. Second find out the order of p, d, q
    3. Estimate the parameters using Maximum likelihood estimation.
15. In order to determine the correct order for our autoregressive and moving average model terms, we will need to review our ACF and PACF plots. In general, if the PACF shows a sharp cutoff after a certain point and the lag-1 autocorrelation is positive, the order of the AR term can be determined by looking at the lag value for which the PACF cuts off. The PACF is highly significant for the first 24-hour cycle then drops off. This suggests that an AR order of 24 may be appropriate. However, use of an order this large will dramatically slow down model training time.
16. Addition of a moving average term to our model can be evaluated by looking at the ACF plot. If the plot demonstrates a sharp cutoff point and the lag-1 autocorrelation is negative, this suggests that a MA term should be added to the model. We do not see either of these features in our ACF plot. This suggests that a MA term may not help our model.