Introduction to Time series assignment

Use Jupyter Notebooks, provide explanations in your markdowns and comments

Assignment 1: Analyzing Cryptocurrency Price Fluctuations

- **Dataset:** Bitcoin Historical Data (https://www.kaggle.com/mczielinski/bitcoin-historical-data)
- **Description:** This dataset provides historical data for Bitcoin prices, trading volume, and market capitalization. It covers a period from 2013 to the present day.
- **Key Columns:**
  - `Date`: The date of the observation.
  - `Open`: The opening price of Bitcoin on that day.
  - `High`: The highest price of Bitcoin on that day.
  - `Low`: The lowest price of Bitcoin on that day.
  - `Close`: The closing price of Bitcoin on that day.
  - `Volume`: The trading volume of Bitcoin on that day.
  - `Market Cap`: The market capitalization of Bitcoin on that day.
- **Task:**
  1. Load the dataset into a pandas DataFrame.
  2. Convert the `Date` column to datetime format and set it as the index.
  3. Create a line plot of the closing price (`Close`) of Bitcoin over time.
  4. Identify any significant trends, patterns, or anomalies in the price fluctuations.
  5. Annotate the plot to highlight these observations.
  6. Write a short paragraph summarizing your findings.

Assignment 2: Exploring Global Temperature Trends

- **Dataset:** Climate Change: Earth Surface Temperature Data (https://www.kaggle.com/berkeleyearth/climate-change-earth-surface-temperature-data)
- **Description:** This dataset provides monthly average temperatures for various land areas around the world from 1750 to the present day.
- **Key Columns:**
  - `dt`: The date of the observation (YYYY-MM-DD).
  - `LandAverageTemperature`: The global average land temperature in Celsius.
  - `LandAverageTemperatureUncertainty`: The 95% confidence interval around the average land temperature.
- **Task:**
  1. Load the dataset into a pandas DataFrame.
  2. Convert the `dt` column to datetime format and set it as the index.

3. Create a line plot of LandAverageTemperature over time.
4. Identify any long-term trends or cyclical patterns in the temperature data.
5. Annotate the plot to highlight these observations.
6. Write a short paragraph summarizing your findings.

Assignment 3: Visualizing Airline Passenger Traffic

- **Dataset:** Air Passengers (https://www.kaggle.com/rakannimer/air-passengers)
- **Description:** This dataset contains monthly totals of international airline passengers from 1949 to 1960.
- **Key Columns:**
  - Month: The date of the observation (YYYY-MM).
  - #Passengers: The number of passengers.
- **Task:**
  1. Load the dataset into a pandas DataFrame.
  2. Convert the Month column to datetime format and set it as the index.
  3. Create a line plot of #Passengers over time.
  4. Identify any seasonal patterns or trends in the passenger traffic data.
  5. Annotate the plot to highlight these observations.
  6. Write a short paragraph summarizing your findings.

Assignment 4: Analyzing Stock Market Performance

- **Dataset:** S&P 500 stock data (https://www.kaggle.com/camnugent/sandp500)
- **Description:** This dataset contains daily stock prices for all companies currently in the S&P 500 index.
- **Key Columns:**
  - Date: The date of the observation.
  - Open: The opening price of the stock on that day.
  - High: The highest price of the stock on that day.
  - Low: The lowest price of the stock on that day.
  - Close: The closing price of the stock on that day.
  - Volume: The trading volume of the stock on that day.
  - Name: The name of the company.
- **Task:**
  1. Choose a specific company from the dataset.
  2. Filter the dataset to include only the data for that company.
  3. Convert the Date column to datetime format and set it as the index.
  4. Create a line plot of the closing price (Close) of the chosen stock over time.
  5. Identify any significant trends, patterns, or anomalies in the price fluctuations.
  6. Annotate the plot to highlight these observations.

7. Write a short paragraph summarizing your findings.