**Time Series Analysis and Forecasting**

**Instructions:**

In this assignment, you will demonstrate your understanding of time series analysis and forecasting techniques.

Dataset: Select a time series dataset suitable for analysis and forecasting. You can use publicly available datasets such as stock prices, weather data, or any other dataset that exhibits a time-dependent pattern.

**Steps to follow:**

a. Dataset exploration: Explore the time series dataset by analysing its properties, such as trend, seasonality, and noise. Visualize the data using line plots, histograms, or other appropriate techniques.

b. Preprocessing: Preprocess the time series data by managing missing values, smoothing noisy data, and addressing any anomalies or outliers. Apply techniques such as interpolation, filtering, or data transformation, as necessary.

c. Time series decomposition: Decompose the time series into its trend, seasonality, and residual components. Use decomposition techniques such as moving averages, seasonal decomposition of time series (STL), or other appropriate methods.

d. Model selection: Select an appropriate time series forecasting model based on the characteristics of the data. Consider models such as ARIMA (Autoregressive Integrated Moving Average), SARIMA (Seasonal ARIMA), Exponential Smoothing, or Prophet.

e. Model training and validation: Split the time series dataset into training and testing sets. Train the selected model on the training data and evaluate its performance using appropriate metrics such as mean absolute error (MAE) or root mean squared error (RMSE).

f. Forecasting: Use the trained model to make future predictions and generate forecasts for the time series. Visualize the forecasts along with the actual data to assess the model's accuracy and reliability.

g. Parameter tuning and optimization: Experiment with different model configurations and hyperparameter settings to optimize the forecasting performance. Explore techniques such as grid search, cross-validation, or model ensembles to enhance the accuracy of the forecasts.

h. Documentation: Provide a comprehensive report or document that includes the following sections:

Introduction: Submit your assignment as a pdf, and video file that includes the following sections

Dataset: Describe the time series dataset used, including its source, length, and any key features.

Methodology: Describe the steps followed, such as data preprocessing, time series decomposition, model selection, training, and validation.

Results: Present the evaluation metrics, including forecast accuracy measures and visualizations of the predictions. Discuss the strengths and limitations of the forecasting model.

Discussion: Analyse the results, highlight any challenges encountered during the assignment, and propose improvements or future directions.

i. Include any relevant code snippets, configuration files, and visualizations as appendices or provide links to a code repository if applicable.