Forecasting Exchange Rates using Time Series Analysis

**Objective**:

Leverage ARIMA and Exponential Smoothing techniques to forecast future exchange rates based on historical data provided in the **exchange\_rate.csv** dataset.

**Dataset**:

The dataset contains historical exchange rate with each column representing a different currency rate over time. The first column indicates the date, and the second column represents exchange rates USD to Australian Dollar.

**Part 1: Data Preparation and Exploration**

1. **Data Loading**: Load the **exchange\_rate.csv** dataset and parse the date column appropriately.
2. **Initial Exploration**: Plot the time series for currency to understand their trends, seasonality, and any anomalies.
3. **Data Preprocessing**: Handle any missing values or anomalies identified during the exploration phase.

**Part 2: Model Building - ARIMA**

1. **Parameter Selection for ARIMA**: Utilize ACF and PACF plots to estimate initial parameters (p, d, q) for the ARIMA model for one or more currency time series.
2. **Model Fitting**: Fit the ARIMA model with the selected parameters to the preprocessed time series.
3. **Diagnostics**: Analyze the residuals to ensure there are no patterns that might indicate model inadequacies.
4. **Forecasting**: Perform out-of-sample forecasting and visualize the predicted values against the actual values.

**Part 3: Model Building - Exponential Smoothing**

1. **Model Selection**: Depending on the time series characteristics, choose an appropriate Exponential Smoothing model (Simple, Holt’s Linear, or Holt-Winters).
2. **Parameter Optimization**: Use techniques such as grid search or AIC to find the optimal parameters for the smoothing levels and components.
3. **Model Fitting and Forecasting**: Fit the chosen Exponential Smoothing model and forecast future values. Compare these forecasts visually with the actual data.

**Part 4: Evaluation and Comparison**

1. **Compute Error Metrics**: Use metrics such as MAE, RMSE, and MAPE to evaluate the forecasts from both models.
2. **Model Comparison**: Discuss the performance, advantages, and limitations of each model based on the observed results and error metrics.
3. **Conclusion**: Summarize the findings and provide insights on which model(s) yielded the best performance for forecasting exchange rates in this dataset.

Deliverables:

* Include visualizations and explanations for the choices and findings at each step.
* Well-commented Python code that used to conduct the analysis and build the models.

Assessment Criteria:

* Accuracy and completeness of the data preparation and exploration steps.
* Justification for model selection and parameter tuning decisions.
* Clarity and depth of the analysis in the diagnostics and model evaluation stages.

This assignment offers hands-on experience with real-world data, applying sophisticated time series forecasting methods to predict future currency exchange rates.