**DATA ANALYTICS USING COGNOS – GROUP 3**

**Project 5: Product Sales Analysis**

**Project Description:**

The "Product Sales Analysis" project focuses on harnessing the power of IBM Cognos to analyze sales data, extract valuable insights, and drive informed business decisions. By exploring top-selling products, identifying peak sales periods, and understanding customer preferences, this initiative aims to enhance inventory management and refine marketing strategies. Key components of the project include defining analysis objectives, collecting relevant sales data, designing insightful visualizations within IBM Cognos, and translating findings into actionable insights.

**Algorithm Used -Time Series Forecasting**

Time Series Analysis is a statistical method used to analyze data collected over time, such as sales, temperature, or stock prices. It involves visualizing data to identify trends, decomposing data into trend, seasonality, and residual components, selecting an appropriate model (e.g., ARIMA or Exponential Smoothing), fitting the model to historical data, validating its performance, and using it to make forecasts. The insights gained from Time Series Analysis inform data-driven decision-making in inventory management, marketing, or other fields, ensuring businesses can adapt to changing patterns and optimize their strategies effectively.

The algorithm is chosen because it is useful in,

**1.** **Predicting Future Sales Trends and Peak Sales Periods**: Time Series Forecasting models like ARIMA and Exponential Smoothing are specifically designed to analyze historical sales data and predict future sales trends. This is critical for understanding when peak sales periods occur, which is essential for inventory management and marketing strategies.

**2.** **Handling Seasonality**: Seasonal sales trends are common in retail, and Time Series Forecasting models excel at capturing these patterns. They can help you identify when specific products are likely to sell well, such as during holidays or particular seasons.

**3. Ease of Interpretation**: Time series forecasts are relatively easy to interpret and communicate to stakeholders. Visualizations can show historical sales data and predict future trends clearly.

**4. Integration with IBM Cognos**: Time Series Forecasting can be seamlessly integrated with IBM Cognos to create visually appealing and interactive dashboards and reports, which is one of your project's key objectives.

**Methodology:**

1. **Data Collection and Preprocessing**

The step involves the following processes before proceeding with the next steps:

* Data Collection: To gather the historical sales data from various sources, such as point-of-sale systems, e-commerce platforms, or databases, and to ensure that the data includes relevant timestamps (e.g., daily or hourly sales records).
* Data Cleaning: To Clean the data to handle missing values, outliers, and inconsistencies. This step is crucial to ensure data quality.
* Data Transformation: Convert the data into a time series format with a timestamp index. Ensure that the timestamp column is in a datetime format.

1. **Exploratory Data Analysis (EDA)**

* Data Visualization: To Plot the time series data to gain insights into its characteristics, such as trends, seasonality, and noise. This step may involve time series decomposition to separate components.
* Stationarity Check: To Determine if the data is stationary (i.e., mean, variance, and autocorrelation are constant over time). Non-stationary data may require differencing to achieve stationarity.

1. **Model Selection**

* ACF and PACF Analysis: To use autocorrelation and partial autocorrelation plots to identify potential ARIMA model orders (p, d, q). The ACF plot helps determine the order of the moving average (q), while the PACF plot assists in selecting the order of differencing (d) and autoregressive (p) terms.
* Model Selection: Based on the ACF and PACF analysis, choose the appropriate ARIMA model. Also, seasonal decomposition and SARIMA models for data with seasonal patterns are chosen with consideration.

1. **Data Splitting**

Training and Testing Data: Splitting of the time series data into training and testing datasets. Typically, the training set contains historical data, while the testing set includes a period for model validation.

1. **Model Training and Validation**

* Model Fitting: Training of the selected ARIMA or SARIMA model using the training data. Fine-tuning of the model parameters based on the chosen order.
* Model Validation: To validate the model using the testing dataset. Calculate evaluation metrics, such as Mean Absolute Error (MAE), Mean Squared Error (MSE), or Root Mean Squared Error (RMSE), to assess the model's accuracy.

1. **Forecasting**

Future Sales Forecast: Use the trained ARIMA or SARIMA model to make future sales predictions. The forecast horizon may vary based on specific objectives.

1. **Visualization and Reporting**

* Visualize Forecast: To create visualizations that compare the actual sales data with the forecasted values. This can help stakeholders understand the model's performance.
* Generate Reports: Document the forecasting results, including model parameters, accuracy metrics, and future sales predictions. Present actionable insights and recommendations for inventory management and marketing strategies.

1. **Model Maintenance**

Continuous Monitoring: Continue to monitor the model's performance over time. Re-train the model periodically to adapt to changing sales patterns.

Parameter Optimization: Adjust model parameters if sales data characteristics change or the model's performance degrades.

**Expected Benefits**

* Enhanced Inventory Management
* Targeted Marketing Strategies
* Increased Revenue
* Competitive Advantage

**Conclusion**

This project leverages IBM Cognos and Machine Learning to unlock the potential of sales data analysis. By adhering to a structured methodology, businesses can gain valuable insights to improve decision-making, ultimately leading to increased efficiency and competitiveness. Further discussions are needed to initiate project planning and execution.