**Sales Forecasting Using Time Series Analysis**

**1. Introduction**

Sales forecasting is a crucial tool for businesses to predict future sales trends and make informed decisions regarding inventory, staffing, and marketing strategies. This report presents the findings from a time series analysis using historical sales data.

**2. Data Analysis & Preprocessing**

* The dataset was analyzed to ensure data quality and completeness.
* The Augmented Dickey-Fuller (ADF) test was performed to check stationarity. The initial results indicated that the data was **not stationary** (p-value = 0.0897).
* First-order differencing was applied to achieve stationarity (p-value = 4.57e-21), making the data suitable for forecasting.

**3. Forecast Model Selection**

* An **ARIMA(1,1,1)** model was chosen and fitted to the data.
* The model parameters were evaluated, showing statistical significance (p-values < 0.05), confirming a well-fitted model.
* The model was then used to forecast sales for the next **30 days**.

**4. Forecast Results & Insights**

* The forecasted sales trends remain **consistent with past sales**, indicating stable demand.
* No significant spikes or drops were observed, suggesting no immediate disruptions in sales patterns.
* Small fluctuations may indicate **seasonal demand variations**, which can be leveraged for strategic planning.

**5. Business Recommendations**

* **Inventory Management:** Maintain stock levels based on forecasted demand to prevent overstocking or shortages.
* **Marketing Strategies:** Plan targeted promotions or discounts during high-demand periods to maximize revenue.
* **Resource Allocation:** Adjust workforce and logistics in line with projected sales trends to optimize operational efficiency.
* **Risk Mitigation:** Monitor sales fluctuations and update forecasting models periodically for accurate predictions.

**6. Conclusion** The time series analysis has provided valuable insights into future sales trends, helping the business make data-driven decisions. Regular updates to the model and integrating external factors (e.g., holidays, promotions) will further enhance forecasting accuracy.