**Time Series Forecasting**

**NMIMS Solved Assignments for December 2024**

**1. How would you use ARIMA to forecast airline passenger numbers over the next year? What steps would you follow to ensure accurate predictions?**

**Answer:**

**Introduction:**

The ARIMA (AutoRegressive Integrated Moving Average) model is a powerful statistical tool used for time series forecasting, making it particularly useful for predicting airline passenger numbers, which often exhibit trends and seasonality. To effectively forecast passenger numbers over the next year using ARIMA, a systematic approach is necessary. This includes data collection and preprocessing to handle any missing values or outliers, followed by exploratory data analysis to understand trends and seasonality patterns. Identification of the appropriate ARIMA parameters (p, d, q) is crucial, which can be achieved using techniques such as the ACF (AutoCorrelation Function) and PACF (Partial AutoCorrelation Function) plots. The model is then fitted to the data, validated, and tested for accuracy using metrics like AIC (Akaike Information Criterion) and RMSE (Root Mean Square Error). Finally, predictions are made, accompanied by confidence intervals to quantify uncertainty.

**This is partially solved sample answer**

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**2. How would you forecast patient admissions for a hospital over the next quarter? How would you handle sudden changes, like during a pandemic?**

**Ms Swaralatha Venkataraman, popularly known as Swara Tai, has been running a small neighborhood grocery store in a western suburb of Mumbai for the past five years. She has been recording daily sales for various products and now wants to forecast future sales to better manage inventory and staff schedules. She is particularly concerned about seasonal products like fresh fruits and vegetables, which exhibit noticeable sales patterns during different seasons. Recently she got to know that you have been pursuing studies in Management. As you are one of her frequent customers, she has asked for your help in forecasting sales for the next quarter.**

**Answer:**

**Introduction:**

Forecasting patient admissions for a hospital and sales for a grocery store involves analyzing historical data, identifying trends, and considering external factors. In healthcare, this process ensures efficient resource allocation, staffing, and budgeting, especially in the face of sudden changes like pandemics, which can drastically alter admission patterns. For Ms. Swaralatha Venkataraman, who operates a grocery store in Mumbai, accurate sales forecasting is crucial for managing inventory and staff effectively. By examining daily sales records, particularly for seasonal items like fresh fruits and vegetables, she can uncover sales patterns that inform her inventory decisions. This is vital for maximizing profitability while minimizing waste. Combining quantitative methods, such as time series analysis, with qualitative insights about seasonal demand can provide a comprehensive approach to forecasting her sales for the upcoming quarter.

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**3a. Explain the steps involved in building a basic time series forecasting model for daily sales of the grocery store. How would you preprocess the data before modeling?**

**Answer:**

**Introduction:**

Time series forecasting is essential for understanding and predicting trends in daily sales for grocery stores. By analyzing historical sales data, businesses can make informed decisions regarding inventory management, staffing, and marketing strategies. This process involves several steps, including data collection, preprocessing, model selection, training, and evaluation. Proper data preprocessing ensures the model’s accuracy and effectiveness, addressing issues like missing values, seasonality, and trends. In this context, we will explore the specific steps involved in building a basic time series forecasting model for daily grocery sales.

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**3b. How would you account for seasonal variations in sales, especially for products like fresh fruits and vegetables, in your forecasting model?**

**Answer:**

**Introduction:**

Seasonal variations significantly impact sales, particularly for perishable goods like fresh fruits and vegetables. These products experience fluctuating demand based on factors such as harvest cycles, consumer preferences, and climate changes. Accurately forecasting sales requires integrating seasonal trends into the forecasting model to ensure that inventory levels align with expected demand. Understanding these seasonal patterns not only aids in effective inventory management but also enhances strategic planning and maximizes revenue potential throughout the year.

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