**Patient Admission Trends**

**Identifying Seasonal Peaks**

Submitted By:

ASHWIN KUMAR KB (AF0477619)

DHANUSH KODI AJJ (AF0478133)

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**Abstract:**

Hospital admissions fluctuate due to seasonal variations, disease outbreaks, and demographic factors, impacting resource planning and patient care. This project leverages **Python-based data analysis and machine learning techniques** to analyze historical hospital admission data, detect seasonal trends, and provide actionable insights for healthcare management.

The project begins with **data preprocessing**, where missing values in critical fields like age and admission date are handled using **Pandas and NumPy**. A synthetic dataset is generated, incorporating disease types, seasonal peaks, and patient age groups. Using **time-based analysis**, trends in hospital admissions are examined to identify peak periods, leveraging **Pandas' time series functions** for statistical summarization and anomaly detection.

For a deeper understanding of admission patterns, **statistical summarization** is performed using **NumPy and SciPy**, calculating department-wise admission rates and disease-wise trends. **Data visualization** using **Matplotlib, Seaborn, and Plotly** helps in interpreting seasonal variations, disease-based admissions, and demographic distributions through interactive charts.

Further, **pattern detection** is applied using clustering techniques such as **K-Means and DBSCAN** from **Scikit-learn**, grouping similar disease patterns and identifying high-risk periods. Predictive analytics with **time series forecasting models (ARIMA, Prophet)** helps in estimating future admission trends, assisting hospitals in proactive decision-making.

By integrating **Python’s data science and machine learning capabilities**, this project provides **valuable insights into hospital admission trends**, enabling healthcare institutions to optimize **staff allocation, resource management, and preparedness for peak admission periods**, ultimately improving patient care and operational efficiency.