**Implement programs for estimating & eliminating trend in time series data – aggregation, smoothing.**

**EX:No.4 DATE:1/02/25**

# AIM:

To Implement programs for estimating & eliminating trend in time series data – aggregation, smoothing..

## OBJECTIVE:

To estimate and remove trends in time-series air pollution data using aggregation and smoothing techniques.

## BACKGROUND:

* Time series data often has trends that affect analysis.
* **Aggregation** (e.g., monthly/yearly averaging) helps identify patterns.
* **Smoothing** (e.g., moving average, exponential smoothing) removes fluctuations.
* Trend elimination improves forecasting and stationarity.

## SCOPE OF THE PROGRAM:

* Load and clean air passengers data
* Apply **aggregation** (monthly/yearly averages) to estimate trends.
* Use **moving average smoothing** to reduce noise.
* Apply **exponential smoothing** to highlight trends

**CODE:**

import pandas as pd

df = pd.read\_csv(r"/content/AirPassengers (1).csv")

# Convert 'Month' column to datetime format

df['Month'] = pd.to\_datetime(df['Month'], errors='coerce')

# Set 'Month' as index

df.set\_index('Month', inplace=True)

# Aggregation - Monthly & Yearly Average

df\_monthly = df['#Passengers'].resample('M').mean()

df\_yearly = df['#Passengers'].resample('Y').mean()

# Moving Average Smoothing (Rolling Mean)

df['Moving\_Avg'] = df['#Passengers'].rolling(window=12).mean()

# Exponential Smoothing

df['Exp\_Smooth'] = df['#Passengers'].ewm(span=12, adjust=False).mean()

# Plot Original vs Aggregated & Smoothed Data

plt.figure(figsize=(12, 6))

plt.plot(df['#Passengers'], label="Original Data", alpha=0.5)

plt.plot(df['Moving\_Avg'], label="Moving Avg (12-month)", color='red')

plt.plot(df['Exp\_Smooth'], label="Exponential Smoothing", color='green')

plt.xlabel("Date")

plt.ylabel("Number of Passengers")

plt.title("Trend Estimation & Elimination using Smoothing")

plt.legend()

plt.show()

# OUTPUT:

# 

**RESULT:**

Thus, the program using the time series data implementation has been done successfully.