**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 pollution data (2012-2021).
* 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

import matplotlib.pyplot as plt

# Load the dataset

df = pd.read\_csv("/content/us\_air\_pollution\_2012\_2021\_updated.csv")

# Convert 'Date' column to datetime format

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

# Select the pollution column (update the name if different)

pollution\_col = "PM2.5 (µg/m³)" # Update based on actual column name

# Filter data for 2012-2021

df = df[(df['Date'].dt.year >= 2012) & (df['Date'].dt.year <= 2021)]

# Set Date as index df.set\_index('Date', inplace=True)

# Aggregation - Monthly & Yearly Average df\_monthly = df[pollution\_col].resample('M').mean()

df\_yearly = df[pollution\_col].resample('Y').mean()

# Moving Average Smoothing (Rolling Mean)

df['Moving\_Avg'] = df[pollution\_col].rolling(window=12).mean()

# Exponential Smoothing

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

# Plot Original vs Aggregated & Smoothed Data plt.figure(figsize=(10, 5))

plt.plot(df[pollution\_col], 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("Pollution Level")

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.