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

**EX:No.5**

**DATE:22/02/25**

# AIM:

To implement programs for estimating and eliminating trend in time series data using aggregation and smoothing techniques.

## OBJECTIVE:

To estimate and remove trends in time-series office supply sales 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 the office supplies sales data.
* Aggregate data to daily totals to observe granular trends.
* Estimate trends using moving average smoothing.
* Detrend the series by subtracting the estimated trend.
* Visualize the original, smoothed, and detrended time series.

## ALGORITHM:

* Import necessary libraries (pandas, matplotlib)
* Load the dataset and parse the date column
* Set the date column as the time index
* Aggregate the sales values on a daily basis
* Apply 30-day moving average to estimate the trend
* Subtract the moving average from original series to obtain the detrended data
* Visualize the original series with the trend and the detrended series separately

**CODE:**

import pandas as pd

import matplotlib.pyplot as plt

# Load the dataset

df = pd.read\_csv("cleaned\_sales\_data.csv")

# Convert 'Order Date' to datetime

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

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

# Daily aggregated sales

df\_daily = df['Sales'].resample('D').sum()

# Estimate trend using 30-day moving average

window\_size = 30

df\_trend = df\_daily.to\_frame(name='Sales')

df\_trend['Moving\_Avg'] = df\_trend['Sales'].rolling(window=window\_size).mean()

# Detrending: Remove the estimated trend

df\_trend['Detrended'] = df\_trend['Sales'] - df\_trend['Moving\_Avg']

# Plot original vs trend

plt.figure(figsize=(14, 5))

plt.plot(df\_trend['Sales'], label='Original Sales', alpha=0.4)

plt.plot(df\_trend['Moving\_Avg'], label='Estimated Trend (30-day MA)', color='red')

plt.title('Original Sales with Estimated Trend')

plt.xlabel('Date')

plt.ylabel('Sales')

plt.legend()

plt.tight\_layout()

plt.show()

# Plot detrended series

plt.figure(figsize=(14, 5))

plt.plot(df\_trend['Detrended'], label='Detrended Series', color='purple')

plt.title('Sales After Trend Elimination (Detrended Series)')

plt.xlabel('Date')

plt.ylabel('Detrended Sales')

plt.legend()

plt.tight\_layout()

plt.show()

# OUTPUT:

# Screenshot 2025-04-07 001755

**RESULT:**

Thus, the program for estimating and eliminating trend in time series data using aggregation and smoothing techniques has been done successfully