**EXP: 5 Estimating and Eliminating Trend in Time Series Data**

**AIM:** The objective of this experiment is to estimate and remove trends in time series data using aggregation and smoothing techniques. This will help in analyzing the stationary components of the time series and improving forecasting accuracy.

**PROCEDURE:**

**Step 1: Load Required Libraries**

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

from statsmodels.tsa.stattools import adfuller

from statsmodels.nonparametric.smoothers\_lowess import lowess

**Step 2: Load the Dataset**

# Load time series dataset (Replace with actual dataset path)

df = pd.read\_csv("/path/to/dataset.csv")

# Convert date column to datetime format

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

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

# Display the first few rows

df.head()

**Step 3: Visualizing the Time Series**

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

plt.plot(df['Value'], label='Original Time Series', color='blue')

plt.xlabel('Date')

plt.ylabel('Value')

plt.title('Original Time Series Plot')

plt.legend()

plt.show()

**Step 4: Apply Rolling Mean (Moving Average) for Smoothing**

window = 7 # 7-day moving average

rolling\_mean = df['Value'].rolling(window=window).mean()

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

plt.plot(df['Value'], label='Original', alpha=0.5)

plt.plot(rolling\_mean, label=f'{window}-Day Moving Average', color='red')

plt.xlabel('Date')

plt.ylabel('Value')

plt.title('Moving Average Smoothing')

plt.legend()

plt.show()

**Step 5: Apply LOWESS (Locally Weighted Scatterplot Smoothing)**

lowess\_smoothed = lowess(df['Value'], df.index, frac=0.1)

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

plt.plot(df.index, df['Value'], label='Original', alpha=0.5)

plt.plot(df.index, lowess\_smoothed[:, 1], label='LOWESS Smoothing', color='green')

plt.xlabel('Date')

plt.ylabel('Value')

plt.title('LOWESS Smoothing')

plt.legend()

plt.show()

**Step 6: Estimating and Removing the Trend**

# Subtracting rolling mean to remove trend

df['Detrended'] = df['Value'] - rolling\_mean

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

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

plt.xlabel('Date')

plt.ylabel('Value')

plt.title('Detrended Time Series')

plt.legend()

plt.show()

