5.Program for Estimating and Eliminating trends in Trends Dataset - Aggregation and Smoothing

Aim:

To analyze and eliminate trends in ranking data using Moving Average and Exponential Smoothing methods for better visualization of underlying patterns.

Procedure and Code:

🔹 Step 1: Import Libraries

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

🔹 Step 2: Load Dataset (with Time Series)

We'll simulate a simple dataset with an upward trend.

```
# Create a sample dataset
date_range = pd.date_range(start='2022-01-01', periods=100, freq='D')
np.random.seed(0)
data = pd.Series(0.5 * np.arange(100) + np.random.normal(size=100), index=date_range)

df = pd.DataFrame({'Date': data.index, 'Value': data.values})
df.set_index('Date', inplace=True)

print(df.head())
```

🔹 Step 3: Aggregation (Optional)

Grouping data monthly to reduce short-term fluctuations

```
# Aggregate daily data to monthly mean
monthly_data = df['Value'].resample('M').mean()
print(monthly_data.head())
```

🔹 Step 4: Estimate Trend (Smoothing using Moving Average)

```
# Using a 7-day moving average to smooth the trend
df['Trend'] = df['Value'].rolling(window=7, center=True).mean()
```

🔹 Step 5: Eliminate Trend

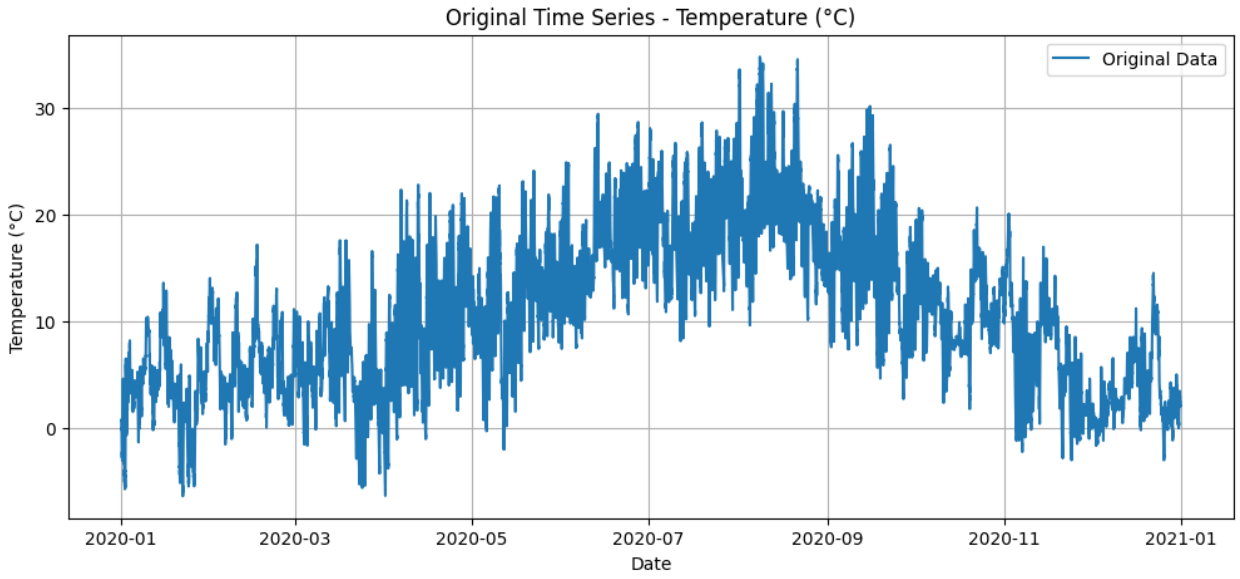
Detrending by subtracting the smoothed trend from original

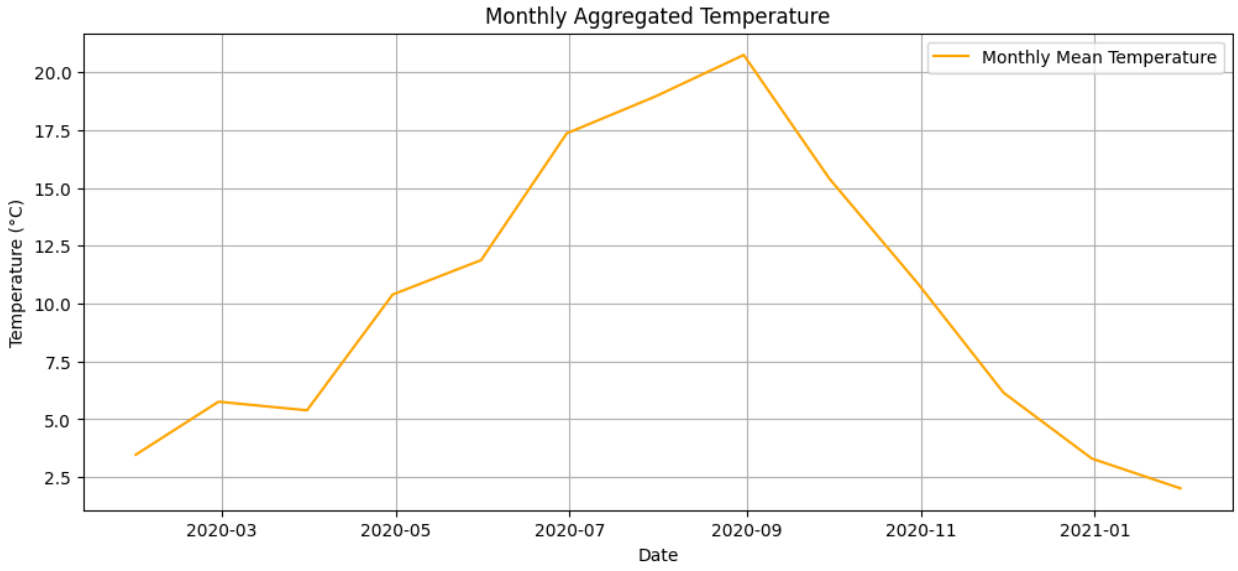
```
df['Detrended'] = df['Value'] - df['Trend']
```

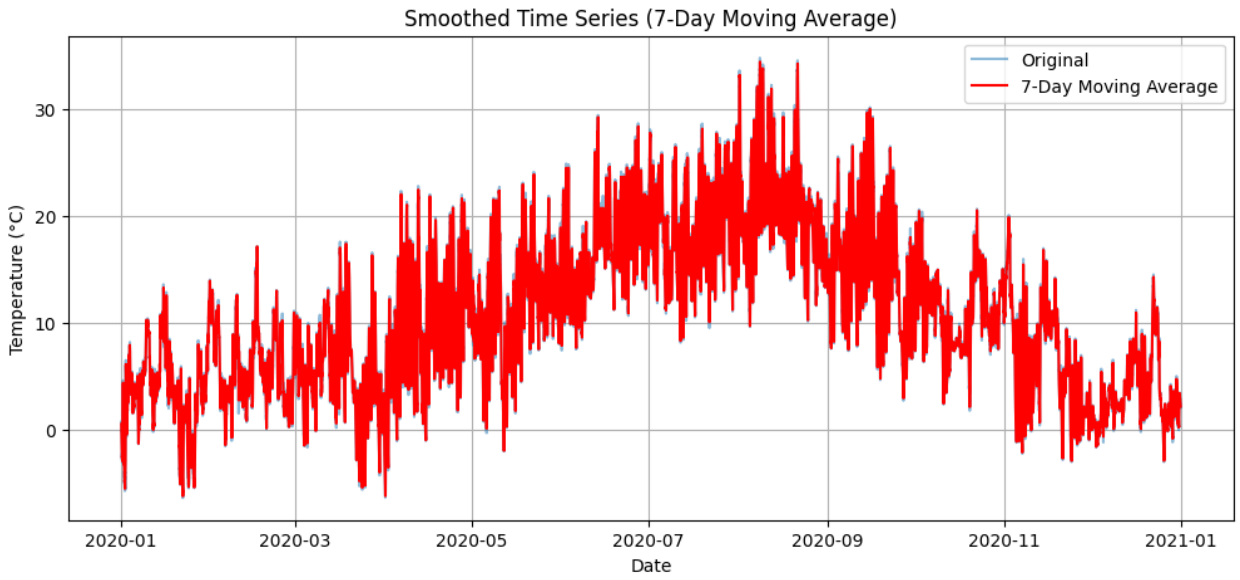
🔹 Step 6: Visualize the Results

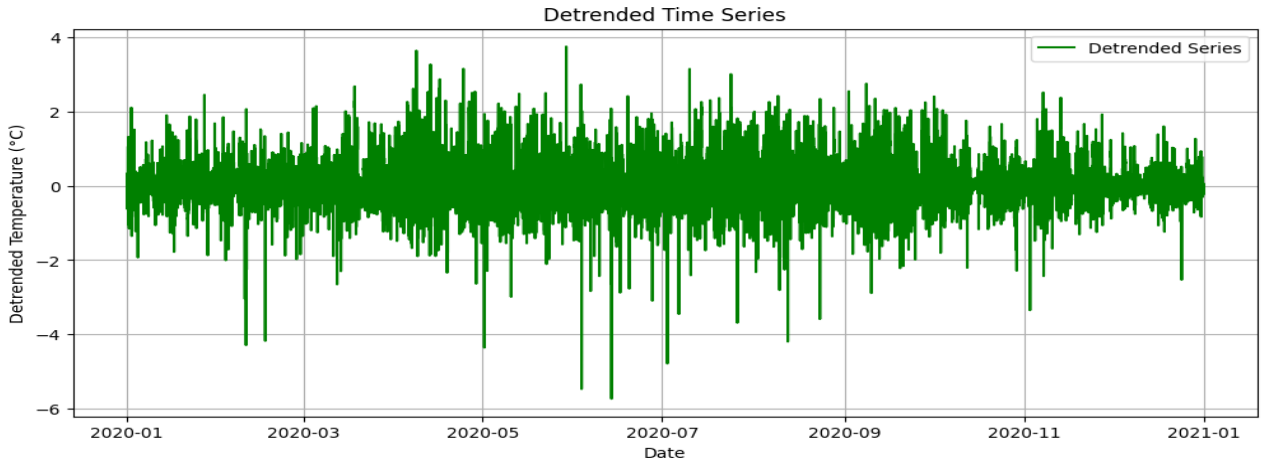
```
plt.figure(figsize=(12, 8))

plt.subplot(3, 1, 1)
plt.plot(df['Value'], label='Original Data')
plt.title('Original Time Series')
plt.legend()

plt.subplot(3, 1, 2)
plt.plot(df['Trend'], color='green', label='Estimated Trend (7-day MA)')
plt.title('Estimated Trend')
plt.legend()

plt.subplot(3, 1, 3)
plt.plot(df['Detrended'], color='orange', label='Detrended Series')
plt.title('Detrended Time Series')
plt.legend()

plt.tight_layout()
plt.show()
```

Output:



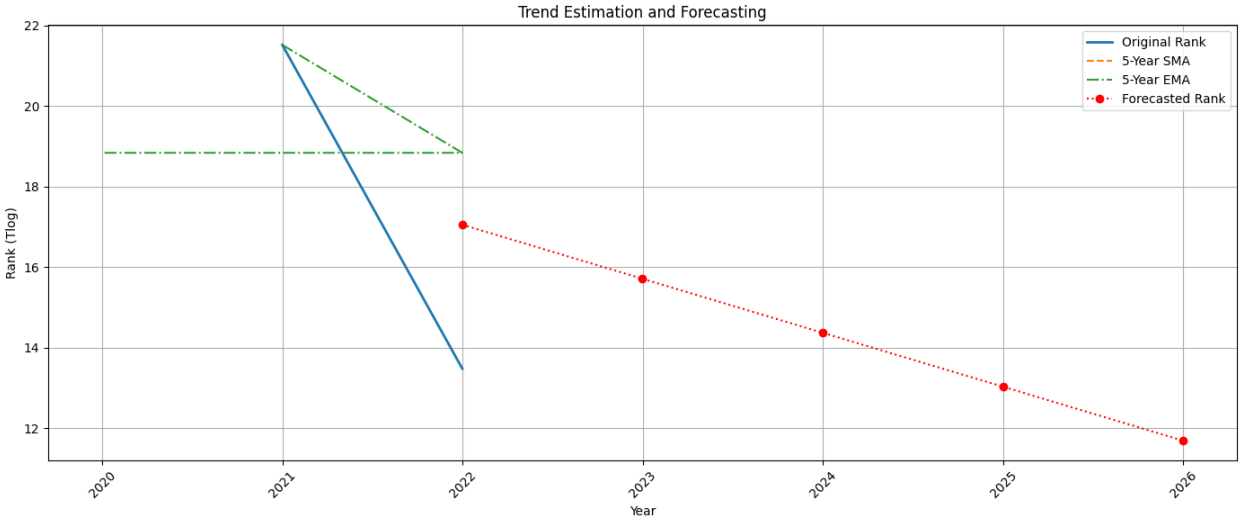

Monthly Aggregated Temperature
Monthly Mean Temperature
Temperature (°C)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
2020-03
2020-05
2020-07
2020-09
2020-11
2021-01
Date


Smoothed Time Series (7-Day Moving Average)
Original
7-Day Moving Average
Temperature (°C)
30
20
10
0
2020-01
2020-03
2020-05
2020-07
2020-09
2020-11
2021-01
Date



Result:

The program to estimate and eliminate the trends in the dataset is implemented and verified successfully


Trend Estimation and Forecasting
Original Rank
5-Year SMA
5-Year EMA
Forecasted Rank
Rank (Tlog)
Year
22
20
18
16
14
12
2020
2021
2022
2023
2024
2025
2026