Implement programs to check stationary of a time series data

Aim:

To Implement programs to check stationary of a time series data.

Procedure:

1. **Load the dataset**.
2. **Visualize the time series** to detect trends or seasonality.
3. **Perform the ADF test** to statistically assess stationarity.
4. **Check rolling statistics** (mean and std) for additional insights on stationarity.
5. If non-stationary, apply transformations (e.g., differencing or decomposition).
6. Use the transformed stationary data for modeling.

Code:

```
import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

from statsmodels.tsa.stattools import adfuller

# Load the dataset from a local path

# Replace 'path/to/your/beer_production.csv' with your actual dataset path

dataset_path = (r"C:\Users\Lenovo\Downloads\monthly-beer-production.csv")

data = pd.read_csv(dataset_path, header=0, parse_dates=[0], index_col=0,
date_parser=pd.to_datetime)
```

```
# Show the first few rows of the dataset
print(data.head())
# Step 1: Plot the time series data
def plot_time_series(data):
    plt.figure(figsize=(10, 6))
    plt.plot(data)
    plt.title("Monthly Beer Production in Australia")
    plt.xlabel('Date')
    plt.ylabel('Beer Production (in Mega Litres)')
    plt.show()
# Plot the time series
plot_time_series(data)
# Step 2: Perform Augmented Dickey-Fuller (ADF) Test
def adf_test(data):
    result = adfuller(data)
    print(f"ADF Statistic: {result[0]}")
    print(f"p-value: {result[1]}")
    print("Critical Values:")
    for key, value in result[4].items():
        print(f'    {key}: {value}')

    if result[1] < 0.05:
```

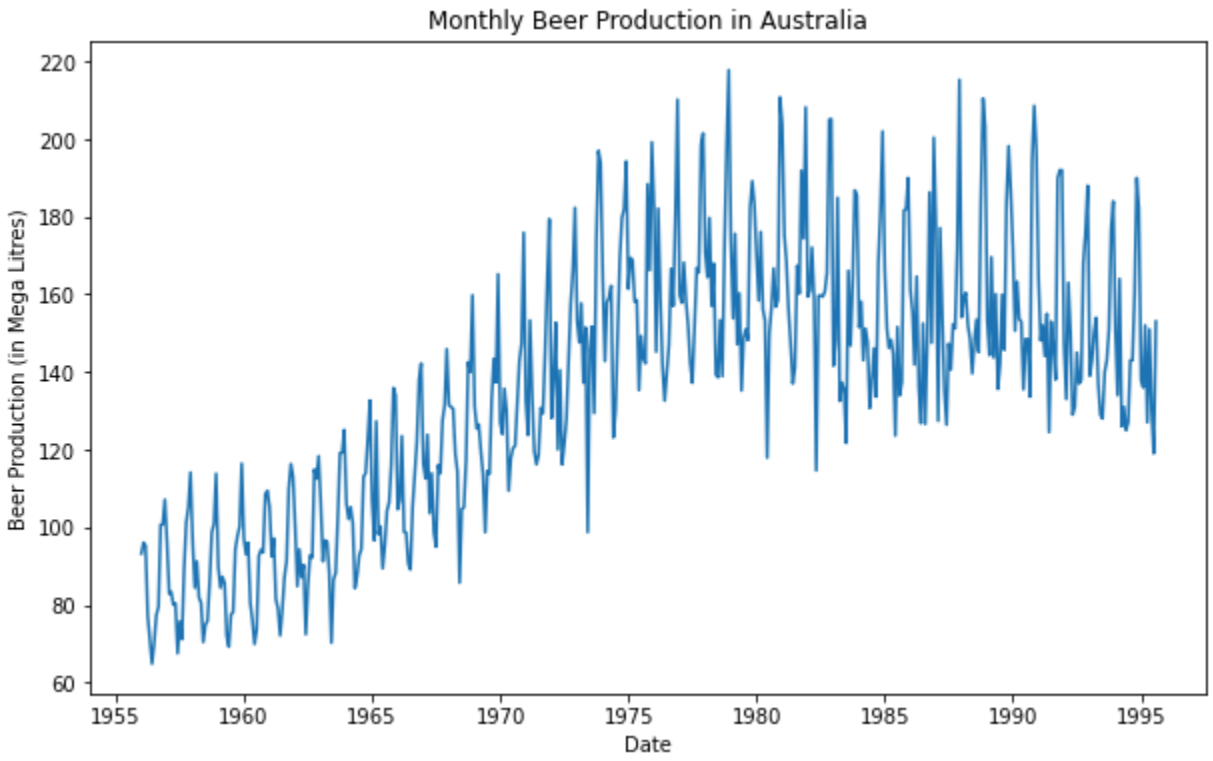
```
        print("The series is stationary (p-value < 0.05).")
    else:
        print("The series is not stationary (p-value > 0.05).")
# Perform the ADF Test
adf_test(data)
# Step 3: Rolling Statistics (Mean and Std)
def rolling_statistics(data):
    rolling_mean = data.rolling(window=12).mean()
    rolling_std = data.rolling(window=12).std()
    plt.figure(figsize=(10, 6))
    plt.plot(data, label="Original")
    plt.plot(rolling_mean, label="Rolling Mean", color='red')
    plt.plot(rolling_std, label="Rolling Std", color='green')
    plt.legend(loc="best")
    plt.title("Rolling Mean and Rolling Standard Deviation")
    plt.show()
# Visualize Rolling Statistics
rolling_statistics(data)
```

Output:

Monthly beer production

Month

1956-01-01	93.2
1956-02-01	96.0
1956-03-01	95.2
1956-04-01	77.1
1956-05-01	70.9



ADF Statistic: -2.282661418787573

p-value: 0.17762099829132627

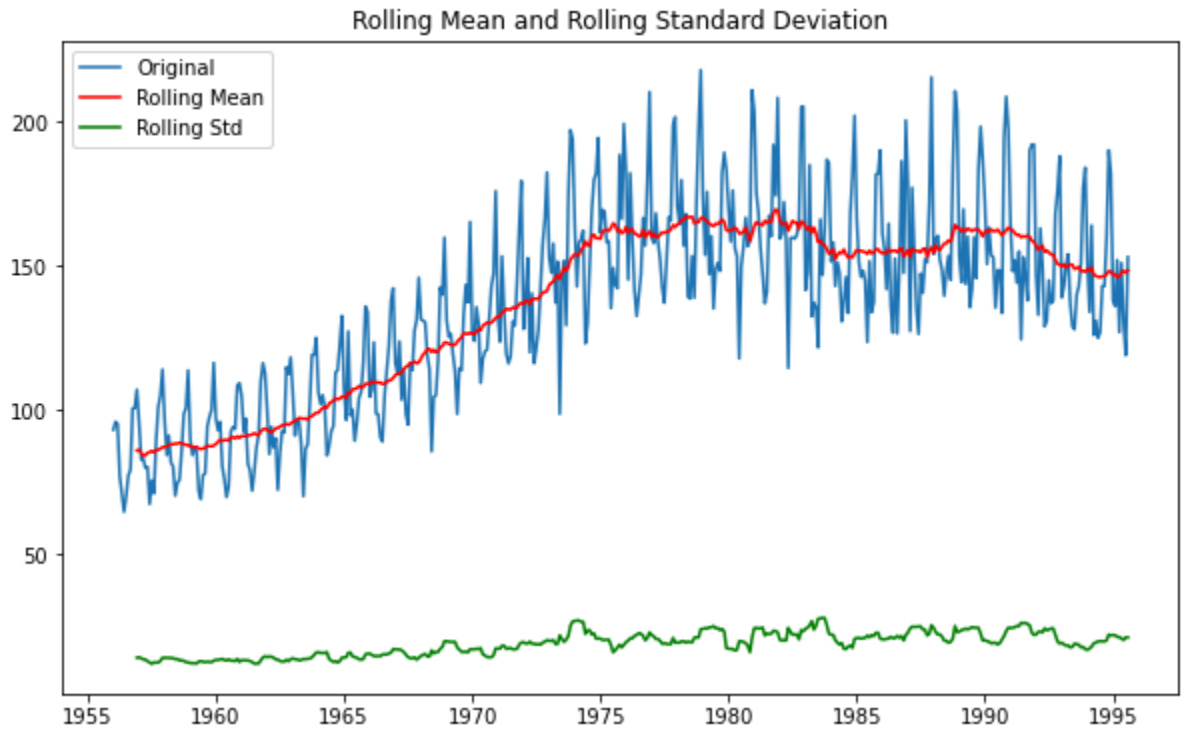
Critical Values:

1%: -3.4447087976702284

5%: -2.867871300049488

10%: -2.5701423432047443

The series is not stationary (p-value > 0.05).



Result:

The check stationary of a time series data program was executed successfully.