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Course Name	Regression Analysis and Predictive Models Lab
Course Code	PMDS504P
Set	B
Assessment	Digital Assessment 5

2 QUESTION 2: Stationarity Check & Autocorrelation Analysis

2.1 AIM: To check Stationarity and perform Autocorrelation Analysis on the monthly sunspot activity dataset.

2.2 Stationarity Check

2.2.1 Apply the Augmented Dickey-Fuller (ADF) test

[100]:
```
from statsmodels.tsa.stattools import adfuller
from statsmodels.graphics.tsaplots import plot_acf
```

[101]:
```
# Applying (ADF) Test
adf_result = adfuller(df['Sunspots'])

# Printing the  results
print("\n--- ADF Test Results ---")
print(f"ADF Statistic        : {adf_result[0]:.4f}")
print(f"p-value              : {adf_result[1]:.4f}")
print(f"Number of lags used  : {adf_result[2]}")
print(f"Number of observations used: {adf_result[3]}")
print("Critical Values      :")
for key, value in adf_result[4].items():
    print(f"   {key}: {value:.4f}")

# Interpretation
if adf_result[1] < 0.05:
    print("\nConclusion: The series is stationary, so we reject the null␣
 ↪hypothesis.")
else:
    print("\nConclusion: The series is not stationary, so we fail to reject the␣
 ↪null hypothesis.")
```

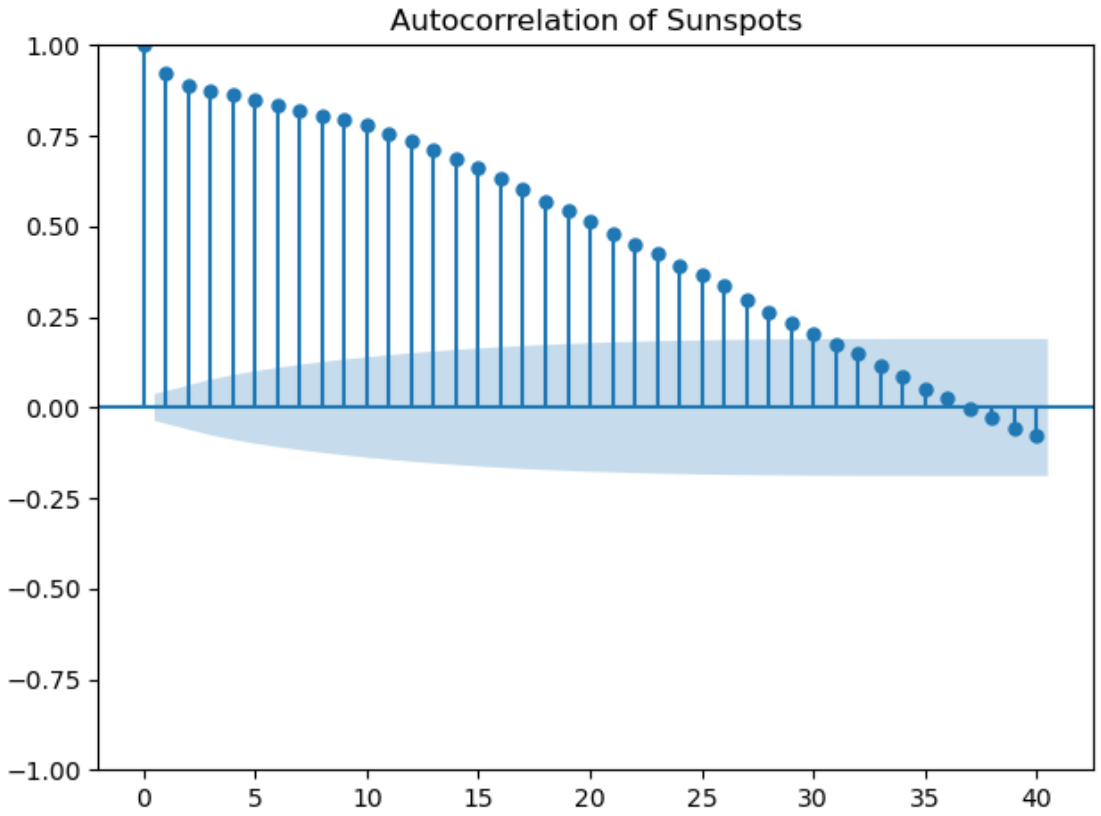
```
--- ADF Test Results ---
```

```
ADF Statistic        : -9.5677
p-value              : 0.0000
Number of lags used  : 27
Number of observations used: 2792
Critical Values      :
   1%: -3.4327
   5%: -2.8626
   10%: -2.5673

Conclusion: The series is stationary, so we reject the null hypothesis.
```

2.3 b) Autocorrelation Analysis

[103]:
```
### Plotting the autocorrelation function

plt.figure(figsize=(10, 4))
plot_acf(df['Sunspots'], lags=40)
plt.title('Autocorrelation of Sunspots')
plt.tight_layout()
plt.show()
```

```
<Figure size 1000x400 with 0 Axes>
```



2.4 Interpretation

- The first lag has a high autocorrelation, which is expected as a time series is always correlated with itself at lag 0.
- The autocorrelation slowly decreases and remains significantly positive for many lags.
- The autocorrelation slowly decreases and remains significantly positive for many lags