7. Implement program for decomposing time series data into trend and seasonality

AIM:

To decompose a time series dataset into its three main components: **Trend**, **Seasonality**, and **Residual** using Python, to better understand the underlying patterns in the data

PROCEDURE:

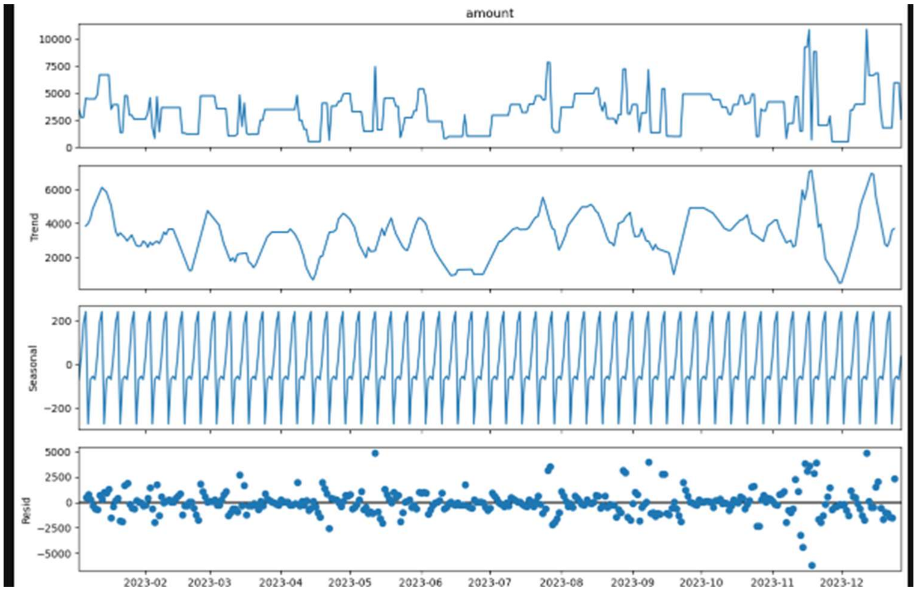
1) Import the necessary libraries (pandas, matplotlib, seasonal_decompose from statsmodels).
2) Load the time series data (daily expenses in this case).
3) Group the data by date and sum the daily expenses.
4) Ensure the date is in proper daily frequency and fill any missing values.
5) Apply time series decomposition using the seasonal_decompose() function with the additive model.
6) Plot the components: original data, trend, seasonal pattern, and residuals.

CODE:

```
import pandas as pd
import matplotlib.pyplot as plt
from statsmodels.tsa.seasonal import seasonal_decompose

# Step 1: Load the dataset
data = pd.read_csv('/mnt/data/expenses.csv')
data['date'] = pd.to_datetime(data['date'])

# Step 2: Group by date and sum daily expenses
daily_expenses = data.groupby('date')['amount'].sum().reset_index()
daily_expenses.sort_values('date', inplace=True)
daily_expenses.set_index('date', inplace=True)
```

```
# Step 3: Set frequency and fill missing dates
daily_expenses = daily_expenses.asfreq('D')  # Daily frequency
daily_expenses['amount'] = daily_expenses['amount'].fillna(method='ffill')  # Fill missing values

# Step 4: Decompose the time series
decomposition = seasonal_decompose(daily_expenses['amount'], model='additive')

# Step 5: Plot the components
fig = decomposition.plot()
fig.set_size_inches(12, 8)
plt.tight_layout()
plt.show()
```

OUTPUT:



RESULT:

The program to decompose time series to trends and seasonality is implemented successfully.