import numpy as np

import pandas as pd

import matplotlib.pyplot as plt

from datetime import datetime, timedelta

# Create sample time series data

np.random.seed(42)

dates = pd.date\_range(start='2024-01-01', periods=100, freq='D')

temperatures = np.random.normal(20, 5, 100) # Mean of 20°C, std dev of 5

humidity = temperatures \* 0.5 + np.random.normal(60, 10, 100) # Correlated with temperature

# Create a DataFrame

weather\_data = pd.DataFrame({

'date': dates,

'temperature': temperatures,

'humidity': humidity

})

# Basic pandas operations

print("\nFirst few rows of the dataset:")

print(weather\_data.head())

print("\nBasic statistics:")

print(weather\_data.describe())

# Calculate rolling averages

weather\_data['temp\_moving\_avg'] = weather\_data['temperature'].rolling(window=7).mean()

weather\_data['humidity\_moving\_avg'] = weather\_data['humidity'].rolling(window=7).mean()

# Create subplots for visualization

fig, (ax1, ax2) = plt.subplots(2, 1, figsize=(12, 8))

fig.suptitle('Weather Data Analysis')

# Temperature plot

ax1.plot(weather\_data['date'], weather\_data['temperature'],

label='Daily Temperature', alpha=0.5)

ax1.plot(weather\_data['date'], weather\_data['temp\_moving\_avg'],

label='7-day Moving Average', linewidth=2)

ax1.set\_ylabel('Temperature (°C)')

ax1.legend()

ax1.grid(True)

# Humidity plot

ax2.plot(weather\_data['date'], weather\_data['humidity'],

label='Daily Humidity', alpha=0.5, color='green')

ax2.plot(weather\_data['date'], weather\_data['humidity\_moving\_avg'],

label='7-day Moving Average', linewidth=2, color='darkgreen')

ax2.set\_ylabel('Humidity (%)')

ax2.legend()

ax2.grid(True)

# Adjust layout and display

plt.tight\_layout()

plt.show()

# Calculate correlations

correlation = weather\_data['temperature'].corr(weather\_data['humidity'])

print(f"\nCorrelation between temperature and humidity: {correlation:.2f}")

# Group by month and calculate statistics

monthly\_stats = weather\_data.set\_index('date').resample('M').agg({

'temperature': ['mean', 'min', 'max'],

'humidity': ['mean', 'min', 'max']

})

print("\nMonthly statistics:")

print(monthly\_stats)