MATLAB and Python Weather Plotting

Contents

MATLAB and Python Weather Plotting 1
Tutorial 1: MATLAB Plot Daily Weather in Scottsbluff 1
Assignment 1: Weather Plots with MATLAB 4
Tutorial 2: Python Plot Daily Weather in Scottsbluff 5
Tutorial 3: Line and Bar Plots with Python 8
Assignment 2: Weather Plots with Python 9
Assignment Submission 10

Time required: 120 minutes

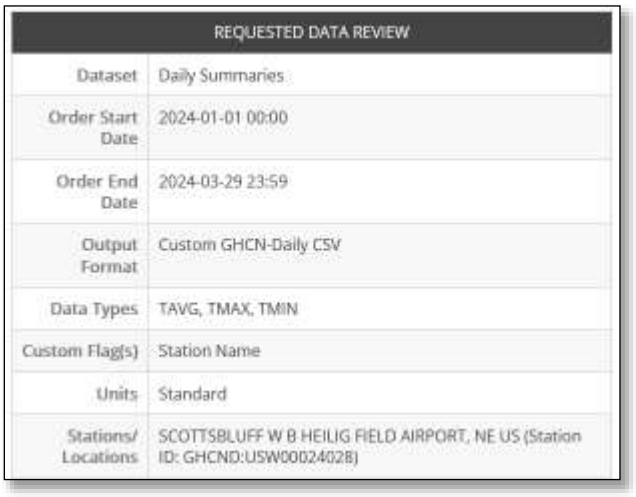
1. Save Python code in a Google Colab Notebook.
2. Save MATLAB code in a MATLAB file.

Tutorial 1: MATLAB Plot Daily Weather in Scottsbluff

We are going to work with some daily weather data from NOAA (National Oceanic and Atmospheric Administration.

1. Go to: https://www.ncdc.noaa.gov/cdo-web/search
2. Select **Weather Observation Type/Dataset**
3. **Select Dataset**: Daily Summaries.
4. **Select Date Range**: 2025, Jan to 2025, Mar 30 or the lates available date.
5. **Search For:** ZIP Codes
6. **Enter a Search Term:** 69361 (or a different Zip Code if you wish.)
7. Click **Search.**
8. You will go to a screen with a list of weather stations. **Scottsbluff, NE 69361 →** Click **Add To Cart.**
9. Click the **Cart (Free Data).**

10. **Select Cart Options → Custom GHCN-Daily CSV** (You can check and change the date range here if you wish.
11. Click **Continue.**
12. Custom Options: Daily Summaries → Select data types for customer output: **Air Temperature**. Click Continue.
13. You will get a page that says **Review Order**.

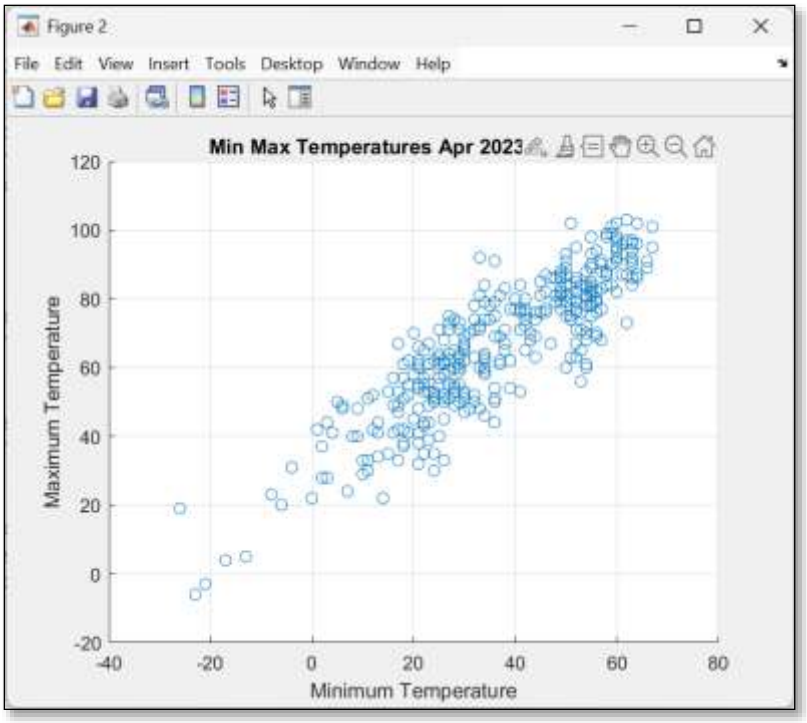


REQUESTED DATA REVIEW	
Dataset	Daily Summaries
Order Start Date	2024-01-01 00:00
Order End Date	2024-03-29 23:59
Output Format	Custom GHCN-Daily CSV
Data Types	TAVG, TMAX, TMIN
Custom Flag(s)	Station Name
Units	Standard
Stations/ Locations	SCOTTSBLUFF W B HEILIG FIELD AIRPORT, NE US (Station ID: GHCND:USW00024028)

14. Enter your email address to receive the link to your data.
15. **Submit Order**.
16. You should get a confirmation email that your order is being processed.
17. In a couple of minutes: You should get an email with a Download link.
18. Into the same folder as your MATLAB program, Download the file as: **noaa_scottsbluff_2025.csv**
19. Create the following MATLAB program as **NOAAScottsbluffDaily.m**

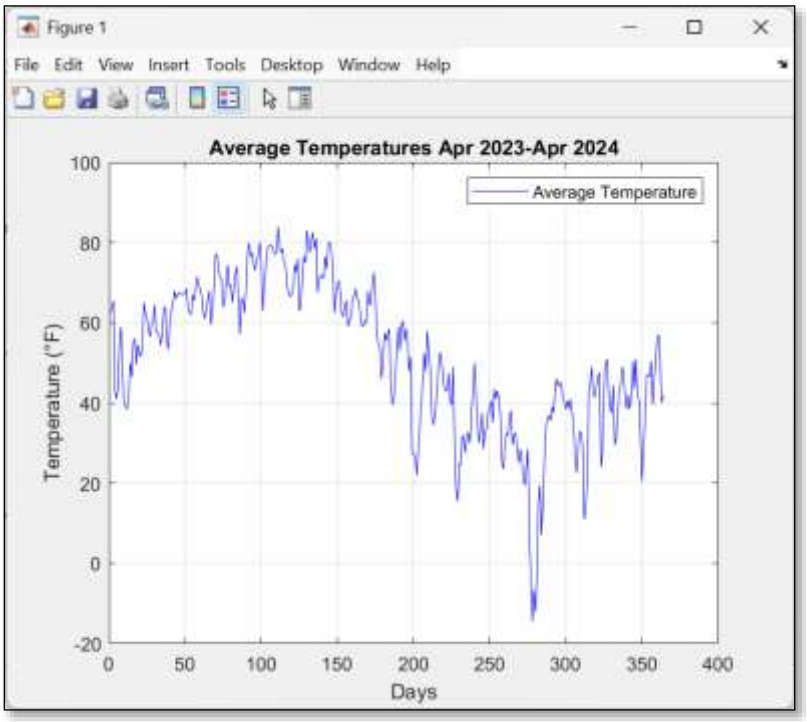
```
% Read the data from the CSV file "noaa_scottsbluff_2024.csv"
% into a table named "noaa", % interpreting text data as strings.
noaa = readtable("noaa_scottsbluff_2024.csv", "TextType", "string");

% Display the first few rows of the table "noaa".
head(noaa)

% Extract the 'TMAX' column from the table "noaa"
% and assign it to the variable "temp_max".
temp_max = noaa.TMAX;

% Extract the 'TMIN' column from the table "noaa"
% and assign it to the variable "temp_min".
temp_min = noaa.TMIN;

% Create a scatter plot with "temp_min" as the x-values,
% "temp_max" as the y-values, % marker size of 100,
% filled markers in blue color with transparency set to 50%.
scatter(temp_min, temp_max)

% Display the grid on the plot.
grid on

% Set the title of the plot to "Min Max Temperatures Jan-Mar 2024".
title("Min Max Temperatures Jan-Mar 2024")

% Set the label for the x-axis as "Minimum Temperature".
xlabel("Minimum Temperature")

% Set the label for the y-axis as "Maximum Temperature".
ylabel("Maximum Temperature")
```

Example run:

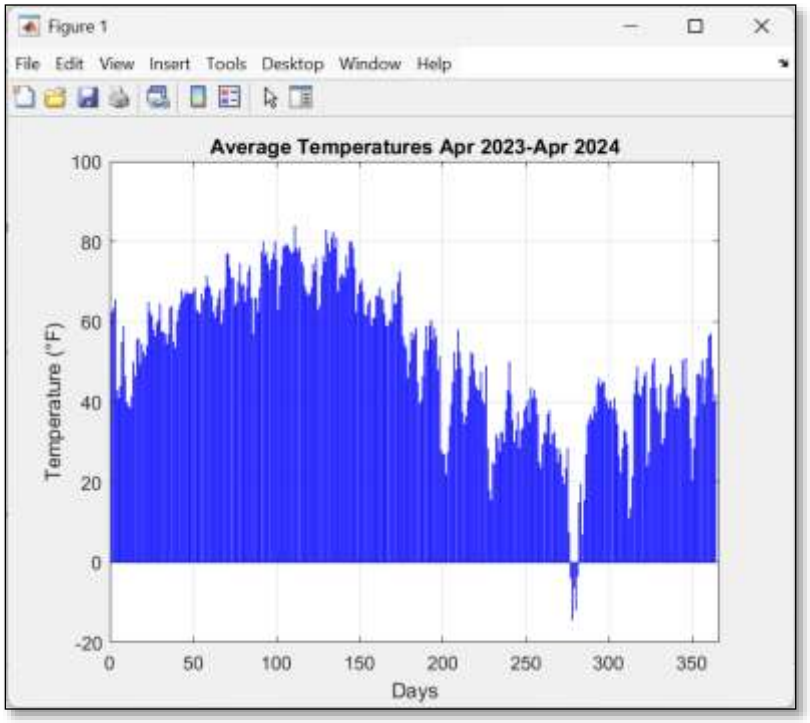


Assignment 1: Weather Plots with MATLAB

1. Create a line plot showing the average temperatures.



2. Create a bar plot showing the average temperatures.



Tutorial 2: Python Plot Daily Weather in Scottsbluff

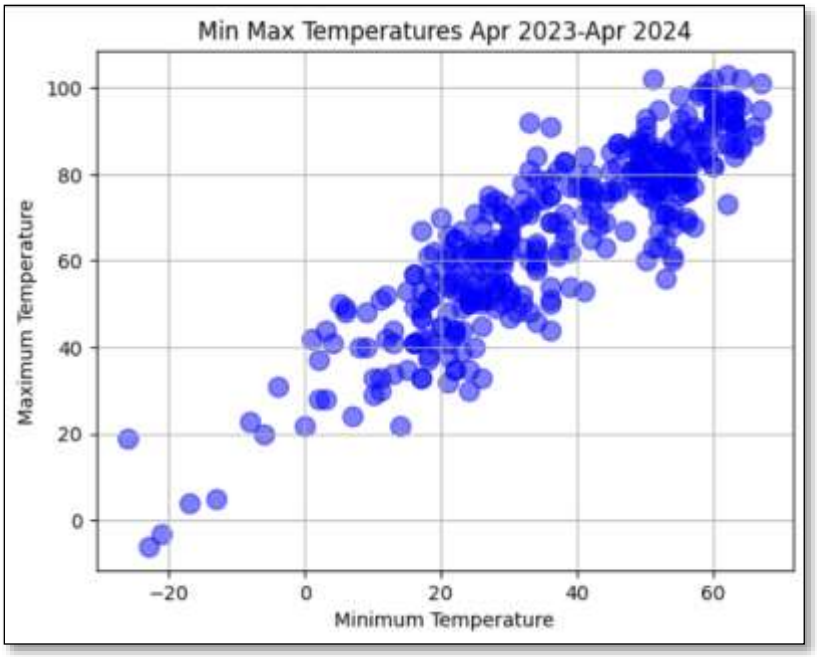
1. In Google Colab → Create a Notebook named: **Wk12PythonNOAAScottsbluffDaily**
2. Enter the following code. The link is available below for copying and pasting the URL.

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

# Read the data from the CSV file "noaa_scottsbluff_2024.csv" into a DataFrame named "noaa".
noaa = pd.read_csv(
    "https://raw.githubusercontent.com/itinstructor/JupyterNotebooks/main/Datasets/noaa_scottsbluff_2024.csv"
)
```

```
https://raw.githubusercontent.com/itinstructor/JupyterNotebooks/refs/heads/main/Datasets/Weather/noaa_scottsbluff_2024.csv
```

```python
# Display the first few rows of the DataFrame "noaa".
print(noaa.head())

# Extract the 'TMAX' column from the DataFrame "noaa"
# assign it to the variable "temp_max".
temp_max = noaa['TMAX']

# Extract the 'TMIN' column from the DataFrame "noaa"
# assign it to the variable "temp_min".
temp_min = noaa['TMIN']

# Create a scatter plot with "temp_min" as the x-values,
# "temp_max" as the y-values, marker size of 100,
# filled markers in blue color with transparency set to 0.5.
plt.scatter(temp_min, temp_max, s=100, c="blue", alpha=0.5)

# Display the grid on the plot
plt.grid(True)

# Set the title of the plot to "Min Max Temperatures Jan-Mar 2024".
plt.title("Min Max Temperatures Jan-Mar 2024")

# Set the label for the x-axis as "Minimum Temperature".
plt.xlabel("Minimum Temperature")

# Set the label for the y-axis as "Maximum Temperature".
plt.ylabel("Maximum Temperature")

# Display the plot.
plt.show()
```

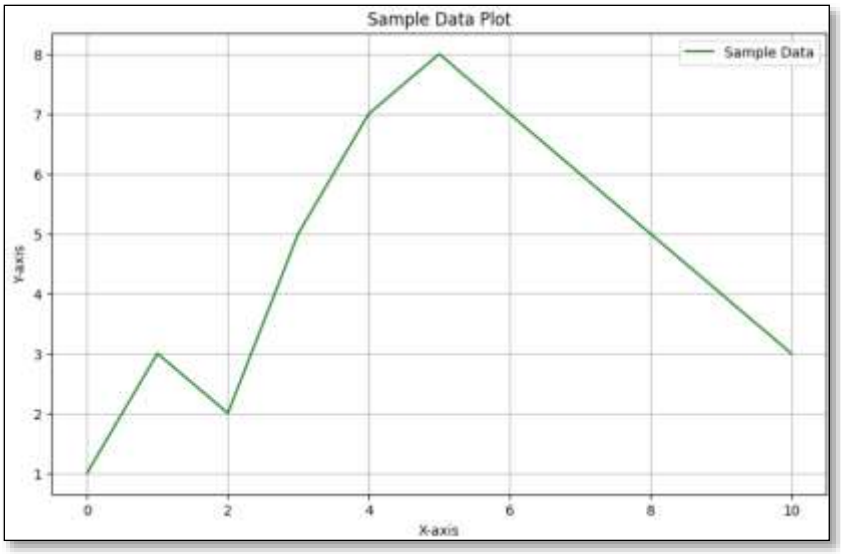
Example run:


Min Max Temperatures Apr 2023-Apr 2024
Maximum Temperature
Minimum Temperature
100
80
60
40
20
0
−20
0
20
40
60

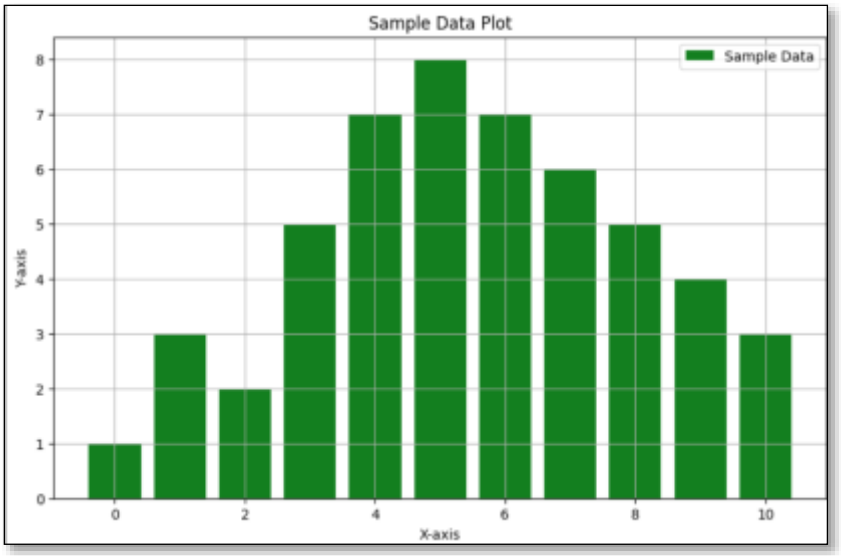
Tutorial 3: Line and Bar Plots with Python

```python
import matplotlib.pyplot as plt

# Hard-coded sample data vector for y-values
y = [1, 3, 2, 5, 7, 8, 7, 6, 5, 4, 3]

# Generate x-values automatically based on the length of y
x = range(len(y))

# Create a new figure with a specified size
plt.figure(figsize=(10, 6))

# Create a line plot using the provided x and y data
plt.plot(
    x,  # x-coordinates for the plot (generated range based on the length of y)
    y,  # y-coordinates for the plot (hard-coded sample data)
    label="Sample Data",  # Add a label for the line to be used in the legend
    color="g",  # Set the line color to green
    linewidth=1.5,  # Set the width of the line to 1.5
)

plt.xlabel("X-axis")  # Label the x-axis
plt.ylabel("Y-axis")  # Label the y-axis
plt.title("Sample Data Plot")  # Add a title to the plot
plt.legend()  # Add a legend
plt.grid(True)  # Add a grid to the plot

plt.show()  # Display the plot
```

Example run:



To change this plot to a bar plot, change **plt.plot** to **plt.bar**



Assignment 2: Weather Plots with Python

Use the previous Python assignment and add this to it.

1. Calculate the average temperatures using TMIN and TMAX.
2. Create a line plot showing the average temperatures.
3. Create a bar plot showing the average temperatures.

Assignment Submission

1. In Google Colab → Click the Share button in the upper right hand side.
    a. Change General Access → Anyone with the link → Click Copy link.
2. Attach a screenshot of the MATLAB Command Window showing the successful execution of each script.
3. Attach all to the assignment in Blackboard.