# Temperature Data Analysis Using MATLAB

 No AI use

Time required: 90 minutes

Topics covered in this assignment:

1. Vectors and Matrices
2. Vectors and Matrices as function arguments
3. Scalar and Array operations on Vectors and Matrices
4. Logical vectors
5. Matrix operations and Matrix properties

**Problem:** You are given a dataset representing the temperatures (in °F) recorded at different times of the day over a week in a matrix form. Each row represents a day, and each column represents a time slot (e.g., morning, afternoon, evening). Your task is to analyze this data using MATLAB to extract meaningful information.

When we extract information from data (original matrix), we are creating new vectors or matrices.

As you work through the problem, display and compare your results with the example run at the end of this assignment.

**Dataset:** A matrix of the morning, afternoon, and evening temperatures in Scottsbluff, NE for the first week in July 2024.

| Date | Morning Temp (°F) | Afternoon Temp (°F) | Evening Temp (°F) |
|---|---|---|---|
| **2024-07-01** | 61 | 90 | 64 |
| **2024-07-02** | 59 | 84 | 57 |
| **2024-07-03** | 57 | 93 | 55 |
| **2024-07-04** | 50 | 82 | 58 |

| | | | |
|---|---|---|---|
| **2024-07-05** | 58 | 85 | 55 |
| **2024-07-06** | 55 | 91 | 54 |
| **2024-07-07** | 54 | 83 | 56 |

Task 1. Create a matrix for the data given. Do not use the Date column, that is for your reference.

Task 2. Convert the matrix from Fahrenheit to Celsius. Use the round function to return whole numbers. ( round() )
We will do all calculations with the converted matrix that has the Celsius numbers.

Task 3. Extract the temperature data for the third day. (Colon operator)

Task 4. Extract the temperature data for the afternoon slot across all days. (Colon operator)

Task 5. Calculate the average temperature for each day.

Task 6. Increase all temperatures by 2°C to simulate a heatwave.

Task 7. Calculate the difference between the maximum and minimum temperatures for each day.

Task 8. Calculate the days with evening temperatures above 10°C.

```
% Task: Extract the evening temperatures above 10
% Extract the third column
evening_temps = temperatures(:, 3);

% Find indices of temperatures above 25
% The index is the numeric location in the vector
indices_above_10 = find(evening_temps > 10);

% Count the number of days in the vector
num_days_above_10 = length(indices_above_10);
```

Task 9. Calculate the transpose of the temperature matrix.

Task 10. Extract morning, afternoon and evening temperatures into 3 vectors.

Task 11. Plot the temperature trends.

```
% Create days of the week for any sized vector
% Create a vector 'days' that contains integers from 1 to the number of rows
% in the 'temperatures_C' matrix.
% 'size(temperatures_C, 1)' returns the number of rows in 'temperatures_C'.
% the colon operator : generates a vector with values from 1 to that number.
days = 1:size(temperatures_C, 1);

% Plot the temperature trends
figure;
plot(days, morning_temps, '-o', 'DisplayName', 'Morning');
hold on;
plot(days, afternoon_temps, '-x', 'DisplayName', 'Afternoon');
plot(days, evening_temps, '-s', 'DisplayName', 'Evening');
hold off;

% Add labels and title
xlabel('Day');
ylabel('Temperature (°C)');
title('Temperature Trends Over the Week');
legend;

% Show the plot
grid on;
```

Task 12. Use **disp()** to display the results for each task.

Example run:

```
Third day temperatures:
    14    34    13

Afternoon temperatures:
    32
    29
    34
    28
    29
    33
    28

Average temperatures:
   22.0000
   19.3333
   20.3333
   17.3333
   18.6667
   19.3333
   17.6667

Temperatures after heatwave:
    18    34    20
    17    31    16
    16    36    15
    12    30    16
    16    31    15
    15    35    14
    14    30    15

Temperature differences:
    16
    15
    21
    18
    16
    21
    16

Days with evening temperatures above 10°C:
     7

Transpose of temperature matrix:
    16    15    14    10    14    13    12
    32    29    34    28    29    33    28
    18    14    13    14    13    12    13
```

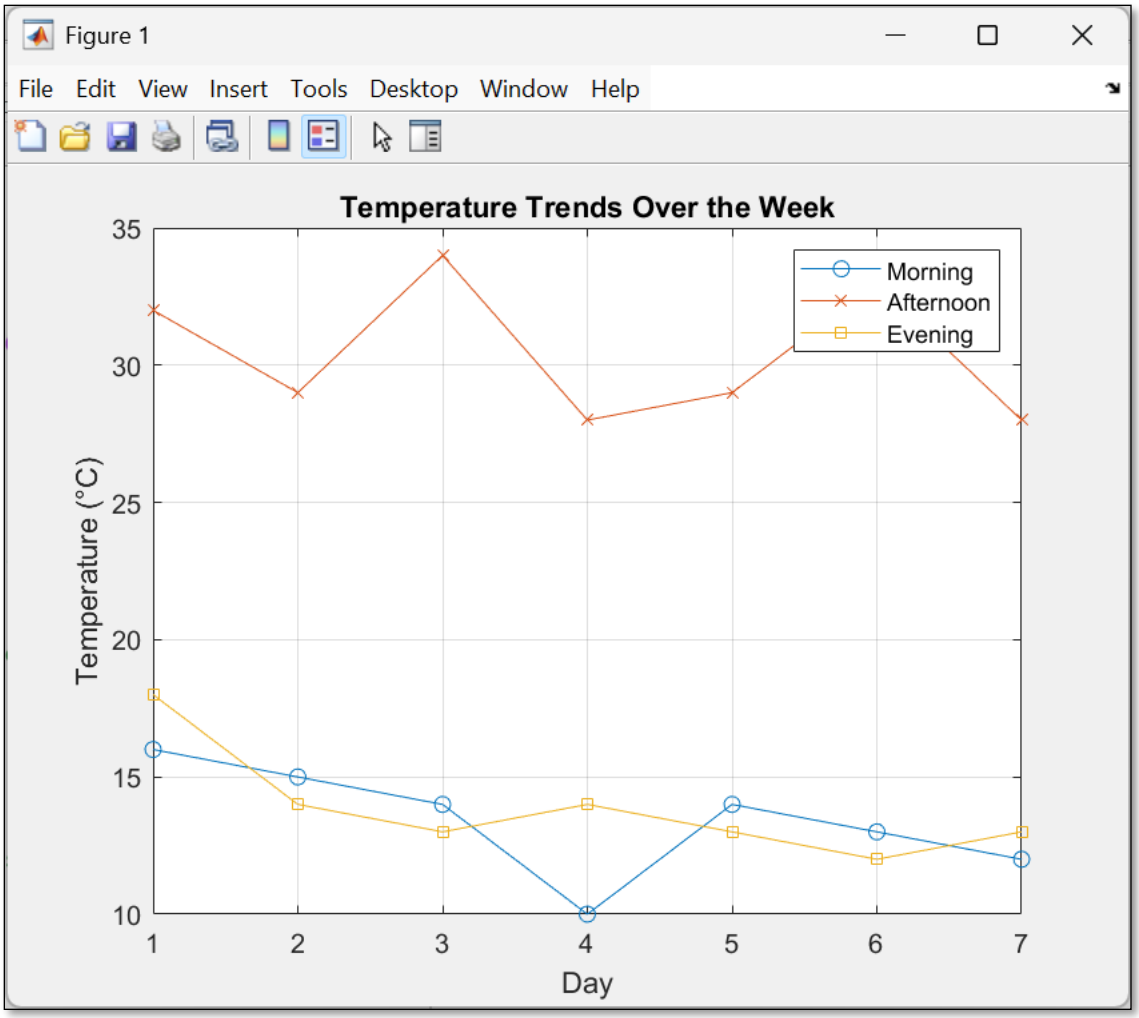
Figure 1
File Edit View Insert Tools Desktop Window Help
Temperature Trends Over the Week
Morning
Afternoon
Evening
Temperature (°C)
Day
35
30
25
20
15
10
1
2
3
4
5
6
7