# Artificial Intelligence

BS (CS) \_SPRING\_2025

Lab\_02 Tasks



# Learning Objectives:

1. Lambda Functions and Regular Expressions
2. Introduction to Numpy
3. Introduction to Pandas
4. Matplotlib

# **Lab Task (B):**

**Task 1:**

A drone moves in a **2D grid** starting from the origin (0, 0). The drone moves based on a sequence of commands (UP, DOWN, LEFT, RIGHT) and a specified number of steps. Your task is to calculate the **manhattan distance** (sum of absolute differences in x and y coordinates) between the drone's final position and the origin.

**Input Example:**

UP 10

DOWN 5

LEFT 6

RIGHT 3

**Output:**

**6**

**Task 2:**

Write a program using NumPy to create a random 5x5 matrix with integer values between 1 and 30. Replace all even elements with their negative values, and then calculate the product of the remaining (odd) elements.

**Example Input Matrix:**

**[[17, 14, 12, 7, 5],**

**[13, 29, 28, 19, 10],**

**[ 8, 25, 2, 27, 30],**

**[15, 20, 6, 11, 24],**

**[ 4, 9, 18, 3, 26]]**

**Task 3:**

Write a Python function to process strings that:

1. Read input strings from a text file (input\_data.txt), with each line containing one string.
2. Use a **regular expression** to filter out strings that do not contain at least one alphabetic character (skip numbers or special character-only strings).
3. Use a **lambda function** to calculate the number of vowels in each valid string.
4. Write a separate function (no built-in functions like filter) to remove strings with fewer than 3 vowels.
5. Return a dictionary where:
   * Keys are the original strings (filtered by regex).
   * Values are the number of vowels in each string.

**Example**

**input\_data.txt:**

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**Example Output:  
{'apple': 2, 'banana': 3, 'grape': 2}**

**Task 4:**

You have a DataFrame ***df*** that consists of 8 columns of integers, where some values are negative. For each row of the DataFrame, determine the **column label** (a, b, c, ...) that contains the **second negative value** in that row.

The DataFrame looks like this:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| a | b | c | d | e | f | g | h |
| 4 | -3 | -1 | 5 | 2 | 6 | -2 | -5 |
| -1 | -2 | 3 | -4 | 7 | 8 | 9 | -3 |
| 6 | 8 | -5 | -1 | 3 | 4 | 2 | -6 |
| 1 | -9 | 5 | 7 | -3 | 8 | 6 | 0 |
| -2 | 3 | 4 | -5 | 6 | -1 | 7 | -4 |

Your task is to write a Python function to:

1. Identify the column containing the second negative value in each row.
2. Return the result as a Pandas Series with the column labels for each row.

**Task 5:**

Create two 5x5 NumPy arrays filled with random integers between 0 and 15. Perform the following operations:

1. Print the type and shape of one array.
2. Replace all 0 values with NaN, and then replace NaN with a random integer between 1 and 15.
3. Find and display the unique values and their counts in the first array.
4. Sort the first array by its first column.
5. Replace all values outside the range [5, 10] with NaN, then replace NaN with 0, and calculate the sum of all elements.

**Task 6:**

Given the CSV file "**real\_estate.csv**" perform the following operations using Pandas:

1. Load the dataset and read it into a Pandas DataFrame.
2. Check for any missing values in the dataset and handle them appropriately (e.g., replace missing values with the column mean or mode).
3. Calculate the total number of properties grouped by data.type and data.status (grouped by both columns).
4. Identify the city that has the highest number of properties listed and list the total number of properties in that city.
5. Find the top 5 zip codes with the highest average number of parking spaces.
6. Determine how many properties are "OWNED" and were listed after the year 2000.
7. Create a bar plot showing the average number of parking spaces for each data.type.