# Lab Task # 02

Instructor: Muhammad Ismail                                      Marks: 12 marks

**Instructions:**
   1. Deadline **2:20 pm, 30-01-2025**.
   2. No task will be accepted after deadline.
   3. Plagiarism will result in zero marks.
   4. Task submission and demo are compulsory, otherwise zero marks will be given.

# Task 1:

Write a function calculator(operation) that performs basic operations(add, subtract, multiply, and divide). The function takes one argument, operation, and returns a lambda function. Inside calculator, use a nested function that accepts two integers, x and y, and computes the result based on the specified operation.

## Requirements:

- If operation is invalid, the lambda should raise a ValueError with "Invalid operation".
- Handle division by zero in the nested function by returning "Division by zero is not allowed".

## Expected Output:

add_fn = calculator("add")

print(add_fn(5, 3))

**Output:** 8

# Task 2:

Given the dataset students_score_data.csv you have to perform:

- **Load the Data:**
  - Create a Pandas DataFrame with the above data.
  - Display the first few rows.
- **Fill the missing values:**
  - Fill the missing values with the average value of each column
  - Remove the row where all three subjects' marks are missing
  - If the score in any subject is less than zero replace it with zero.

- **Calculate the Average Score:**
  - Create a new column Average_Score that contains the average score of Math, Science, and English for each student.

- **Determine Pass/Fail Status:**
  - Add another column Pass_Status. A student is considered "Pass" if their Average_Score is 75 or above, otherwise "Fail".
  - Encode the Pass_Status column, 0 for Pass and 1 for Fail.
  - Count the total number of students pass and calculate the percentage of pass students.

- **Determine top 3 students:**
  - Determine the top 3 based on total marks

- **Display the Updated Data:**
  - Show the DataFrame with the new columns.

# Task 3:

Plot a scatter plot comparing Math vs. Science scores,

- where:

  - Excellent: english >= 90
  - Good: 75 <= english < 90
  - Needs Improvement: english < 75

- The size of the points is proportional to the English scores.
- Color the points based on their performance category ("Excellent," "Good," or "Needs Improvement").

# Task 4:

You are given two arrays of random integers. Your task is to:

- Create two numpy arrays of size 10 with random integers between 1 and 100.

- Perform element-wise addition, subtraction, multiplication, and division on the two arrays.

- Find the dot product of both arrays.

# Task 5:

You are given two 4x4 NumPy arrays filled with random integers between 1 and 100. Your task is to:

- Add the two arrays element-wise.
- Subtract the second array from the first array element-wise.
- Multiply both arrays element-wise.
- Find the row-wise sum of both arrays.
- Compute the overall sum, mean, and standard deviation of the combined arrays.

# Task 6:

Perform the following operations:

- **Create the Array:**
  - Generate a 6x6 matrix of random integers between 0 and 100.
- **Row/Column Calculations:**
  - Compute the mean, median, and standard deviation for each student (row).
  - Compute the mean, max, and min for each subject (column).
- **Identify Outliers:**
  - Replace outlier scores (those beyond 2 standard deviations from the mean of each subject) with -1.
- **Masked Array:**
  - Select students who scored above 90 in at least one subject and calculate their average score.
- **Top n Students:**
  - Implement a function to return the indices of the top n students based on their total score across all subjects.