



**National University**  
Of Computer and Emerging Sciences

## **Artificial Intelligence**

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**Semester:** <7th>

## **CS477 Computer Vision**

### **Lab 1: Programming in Python Language**

#### **Introduction**

This laboratory exercise will introduce the fundamental aspects of the Python programming language which is a very popular language and used extensively in the area of Computer Vision

#### **Objectives**

The following are the main objectives of this lab:

- Write and execute code with python syntax
- Create and use variables of different data types in python
- Use arithmetic and logical operations in python
- Implement conditional (selection) statements in python
- Implement repetition statements (WHILE and FOR loops) in python
- Define and call functions in python

#### **Lab Conduct**

- Respect faculty and peers through speech and actions
- The lab faculty will be available to assist the students. In case some aspect of the lab experiment is not understood, the students are advised to seek help from the faculty.

Computer Vision



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- In the tasks, there are commented lines such as `#YOUR CODE STARTS HERE#` where you have to provide the code. You must put the code/screenshot/plot between the `#START` and `#END` parts of these commented lines. Do NOT remove the commented lines.
- Use the tab key to provide the indentation in python.
- When you provide the code in the report, keep the font size at 12

### Theory

Python is an open-source, interpreted language which is widely used for computer vision tasks in research, academia and industry. It has an easy-to-learn syntax and is ideal for writing programs in a short duration. The python interpreter can be downloaded from the website and installed on the system. By default, the IDLE program is installed. For machine learning, it is recommended to switch to a more powerful IDE such as PyCharm, Spyder and Jupyter etc. For this lab, we will use Google Colab for writing python code. Google Colab is a cloud-based platform that allows you to write python code in your web browser and provides free access to computing resources such as GPUs.

A brief summary of the relevant keywords and functions in python is provided below:

|                |  |
|----------------|--|
| <b>print()</b> | output text on console                                       |
| <b>input()</b> | get input from user on console                               |
| <b>range()</b> | create a sequence of numbers                                 |
| <b>len()</b>   | gives the number of characters in a string                   |
| <b>if</b>      | contains code that executes depending on a logical condition |



|                 |  |
|-----------------|--|
| <b>else</b>     | connects with <b>if</b> and <b>elif</b> , executes when conditions are not met |
| <b>elif</b>     | equivalent to <b>else if</b>   |
| <b>while</b>    | loops code as long as a condition is true                                      |
| <b>for</b>      | loops code through a sequence of items in an iterable object                   |
| <b>break</b>    | exit loop immediately  |
| <b>continue</b> | jump to the next iteration of the loop   |
| <b>def</b>      | used to define a function  |

## Lab Task 1

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Write a program which evaluates the following expressions for when  $x = 1, 2, 3, 4$  and  $5$ .

$$5x^4 + 4x^3 + 3x^2 + 2$$
$$\frac{3x^2 + 7x}{4} - \frac{2x}{5}$$

(a) Fill the following table with the answers:

|              | $x = 1$ | $x = 2$ | $x = 3$ | $x = 4$ | $x = 5$ |
|--------------|---------|---------|---------|---------|---------|
| Expression 1 |         |         |         |         |         |
| Expression 2 |         |         |         |         |         |



(b) Provide the code for both expressions in the indicated regions:

## Lab Task 2

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Write a program that reads in two integer inputs, then determines and prints if the first is a multiple of the second. To input a variable, use the following syntax:

***variable = input("prompt\_message")***

Remember that the above function returns a string which is stored in the variable. You need to explicitly convert the string variable to an integer type using the `int()` casting. Provide the code and screenshot of the results.

## Lab Task 3

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Write a program that prints the names and registration numbers of your group members. Your code must also add the registration numbers together and display the result. Provide the code and screenshots of the resulting output.



## Lab Task 4

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Write a program that takes two numbers as inputs. Then, the program must compare the two numbers and print appropriately from among the following lines:

- Both numbers are positive
- Both numbers are negative
- Both numbers are zero
- At least one number is zero
- One number is positive and the other number is negative
- Both numbers are equal

**### TASK 4 CODE STARTS HERE ###**

## Lab Task 5

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Write a program that calculates the factorial of a number. To calculate the factorial, you will need to make use of a *while* loop. The syntax of the while loop is given as follows:

***while condition:***



*statement\_1*

*statement\_2*

**### TASK 5 CODE STARTS HERE ###**

**### TASK 5 CODE ENDS HERE ###**

**### TASK 5 SCREENSHOT STARTS HERE ###**

**### TASK 5 SCREENSHOT ENDS HERE ###**

## Lab Task 6

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Write a function that takes 2 integer arguments and returns their product but you must **NOT** use the product operator (\*). You will need to provide the function definition and the function call. The function definition syntax is given below:

```
def function_name:  
    statement_1  
    statement_2  
    ...  
    return output
```

**### TASK 6 CODE ENDS HERE ###**

**### TASK 6 SCREENSHOT STARTS HERE ###**



```
PS C:\Users\RA\Desktop>
50
```

### TASK 6 SCREENSHOT ENDS HERE ###

## Lab Task 7

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Write a program that prompts the user for some strings variables. The user will input the group member names (strings) separately at the prompt. The strings will then be passed to a function as arguments. The function must use a *for* loop to iterate through the characters and print each character on a new line. The function must also print the total number of characters in the final string. For this, you can use the `len()` function. You also need to take screenshot of this task showing the entire output. The *for* loop syntax is given as follows:

```
for index in iterable:
    statement_1
    statement_2
```

### TASK 7 SCREENSHOT ENDS HERE ###



## Lab Task 8

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Write a program that generates the following number sequences and print the output. You can use the range() function for this task. Use a loop to invoke the range function only once at each iteration.

1, 2, 3... 10  
2, 4, 6... 20  
3, 6, 9... 30  
4, 8, 12 ... 40  
...  
10, 20, 30... 100





## Lab Task 9

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Create a 1-D list containing the characters of the name of any one person in your group. Loop through the list and display each character on a new line.

**### TASK 9 CODE STARTS HERE ###**

**### TASK 2 CODE ENDS HERE ###**

**### TASK 2 OUTPUT SCREENSHOT STARTS HERE ###**

**### TASK 2 OUTPUT SCREENSHOT ENDS HERE ###**

## Lab Task 10

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Write a program that repeatedly prompts the user for input. The user will keep entering numbers which are added to a list. Each time a number is added to the list, it must be placed in such a way that the list items are always in ascending order. Each time a number is given as input, the list is to be printed showing the newly added number. This continues until the word “done” is input



at which point the prompts will stop. The final list is then displayed. Do NOT use any inbuilt sorting function for this task.

**### TASK 10 CODE STARTS HERE ###**

**### TASK 10 OUTPUT SCREENSHOT ENDS HERE ###**

## Lab Task

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Create a list with the sequence 1, 2, 3... 20. Then using the slice operation (:) on this list, print the following sub-lists:

5, 6, 7... 20

1, 2, 3... 12

7, 8, 9 ... 16

4, 5

11, 12, 13, 14

**### TASK 11 CODE STARTS HERE ###**

**## TASK 11 CODE ENDS HERE ###**

**### TASK 11 OUTPUT SCREENSHOT STARTS HERE ###**

**### TASK 11 OUTPUT SCREENSHOT ENDS HERE ###**



## Lab Task 12

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In this task, you will make use of dictionaries. Write a program that first prompts the user to input five strings which will be the keys of the dictionary. Then, the program must prompt the user to input the values of the respective keys. When entering the values, the user must be shown the key whose value is being input. Once all values are entered, display the dictionary.

**### TASK 12 CODE STARTS HERE ###**

**### TASK 12 CODE ENDS HERE ###**

**### TASK 12 OUTPUT SCREENSHOT STARTS HERE ###**

**### TASK 12 OUTPUT SCREENSHOT ENDS HERE ###**

## Lab Task 13

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In this task, you will need to import two modules: **random** and **math**. Write a function that takes two arguments. These two arguments will mark the start and end of a range of integer values from which a random number is to be generated. Use your function to return random numbers which are then fed into a sine function. Show at least 5 random numbers and their sine function results. Provide the code and all relevant screenshots.

**### TASK 13 CODE STARTS HERE ###**

**### TASK 13 CODE ENDS HERE ###**

**### TASK 5 SCREENSHOT STARTS HERE ###**

**### TASK 5 SCREENSHOT ENDS HERE ###**

## Lab Task 14

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Import the NumPy Library. Use the np.array function to define a 7x7 array with random integer elements. Ensure that the elements are numbers (not strings). Then, perform the following:

- Print the array



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- Print element(3,3)
- Print rows 2 and 3 via slicing
- Print the central 3x3 elements as a matrix
- Compute the sum of all the matrix elements
- Compute the sum of the matrix elements along axis 0
- Compute the sum of the matrix elements along axis 1
- Compute the mean of all the matrix elements
- Compute the standard deviation of the matrix elements

**### TASK 14 CODE STARTS HERE ###**

**### TASK 14 CODE ENDS HERE ###**

**### TASK 14 SCREENSHOTS START HERE ###**

**### TASK 14 SCREENSHOTS END HERE ###**