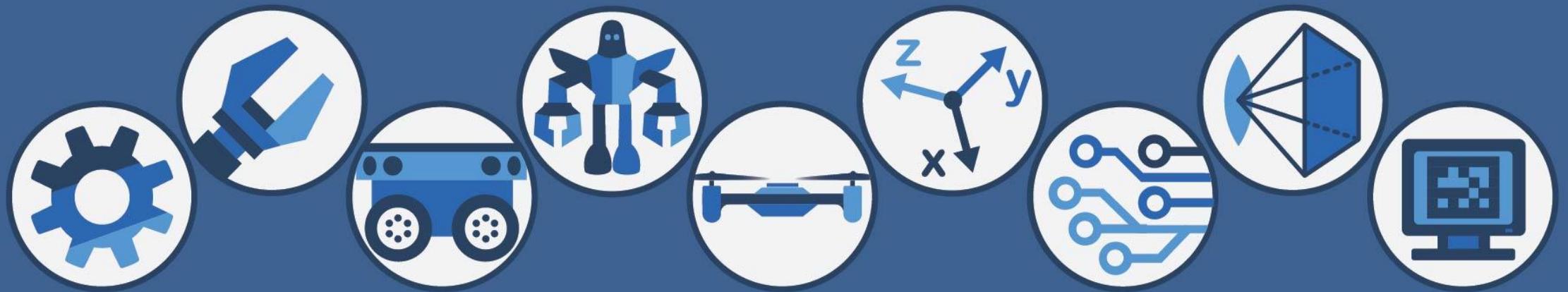


# MACHINE LEARNING LAB

## Introduction to Python



MARYAM RIAZ



School of Electrical Engineering and Computer Science (SEECS), NUST, Pakistan

# Code of Ethics

- All students must come to the lab on time
- Respect faculty and peers through speech and actions
- Students must remain attentive and should not be sleeping during the lab
- Students must be physically AND mentally present in the lab in order to be marked as present for attendance.
- Discussion unrelated to lab is **NOT** allowed
- Eating and Drinking are strictly prohibited in the lab
- Mobile phone use is **NOT** allowed. Students found to be using mobile phone in the lab will not be marked as present
- Do **NOT** tamper with the layout of the lab reports or change the front page of the lab report. Failing to do so will render the report invalid for checking
- Even in group submission of reports, students must work individually during the lab hours

# Code of Ethics

- Late submission of lab reports are **NOT** guaranteed to be checked
- “*If*” a late submitted report is checked, it will be subjected to severe penalty so that for every 1 day late, 1 mark will be deducted. Thus, there is no point in submitting lab reports after 10 days
- Sharing of code is **NOT** permitted
- After completing the lab, ensure that you have deleted the lab files from the lab computer. It is the student's responsibility to ensure that none of the files are copied by other students
- Copying of lab reports will get **zero tolerance**. Even if one instance, task, screenshot or piece of code is found to be copied then both the copying and the copied report will get zero marks
- Additional attempts on the same report or quiz are **NOT** allowed
- Before leaving the lab at the end, shut down the lab computer and place the seats back in their original position

# Code of Ethics

- ChatGPT (or other similar chatbots) are not allowed for any sort of assistance in the lab
- Remember that you are here to learn and obtain skills
- The results of your lab performance are important but only if you acquire them out of your thinking and effort. By employing tools like ChatGPT, you rob yourselves of the opportunity to train your skillset



# Lab Evaluation

Name	Reg. No	PLO4 - CLO4  Viva /Quiz / Lab Performance  5 Marks	PLO4 - CLO4  Analysis of data in Lab Report  5 Marks	PLO5 - CLO5  Modern Tool Usage  5 Marks	PLO8 - CLO6  Ethics  5 Marks	PLO9 - CLO7  Individual and Team Work  5 Marks

# Coding from Scratch

In this lab, many times you will be required to code algorithms from scratch. While coding from scratch does take a lot of time and effort, there are several reasons as why it should be done by students:

- Concepts learnt by coding from scratch are retained for much longer
- When you code from scratch, you develop understanding that greatly helps in narrowing down the right course of action from a large set of choices
- Coding from scratch provides much deeper insights into the underlying concepts which are very important for debugging, troubleshooting and error avoidance
- Coding from scratch is the only guarantee that you possess a solid understanding of the algorithms, concepts, principles and mathematics
- For research purposes, new ideas need to be explored. This is only possible if you fully understand the core principles

# Python Language

- Python is an interpreted, open-source language with an emphasis on code readability and has a very large community support
- Consider the following comparison between C++ and Python codes:

Python	C++
a = 10 b = "M" c = 7.6 print(a,b,c)	int a = 10; char b = "M"; float c = 7.6; cout << a << " " << b << " " << c << endl;

- The output of both programs is the same:  
`>> 10 M 7.6`
- No semicolons are needed to end each line in Python
- It is not necessary to declare the data type of variable in Python
- The `print()` statement creates spaces and new line automatically

# Python Scripts

- Python scripts are files that end in **.py** format and contain the code
- Let's write a simple python script and execute it via the terminal:

```
a = 10  
b = "M"  
c = 7.6  
print(a,b,c)
```

- Once you have typed the above code, save the script as **test.py**
- Now open the terminal, go the directory (with cd) where you saved the script and execute it with the following command:

```
python test.py
```

# Variables in Python

- To add a comment in code, use # in Python
- The data type of a variable can change in Python:

```
a = 10          # this will work  
a = 5.5        # this will work  
a = "house"    # this will work
```

- The equivalent code in C++ will give an error:

```
int a = 10;      // this will work  
a = 5.5;        // error  
a = "house";    // error
```

# Data Types in Python

- Python contains several data types, some of which are given below:

```
x_string = "Hello World"  
x_integer = 25  
x_float = 25.1  
x_boolean = True  
x_complex = 2j  
x_list = [1, 2, 3, 4, 5]  
x_tuple = (1, 2, 3, 4, 5)  
x_set = {1, 2, 3, 4, 5}  
x_dictionary = {"name": "Ali", "age": 31}
```

# Arithmetic Operators

- The following code shows the arithmetic operators in Python:

```
a = 10  
b = 3
```

```
add = a + b  
sub = a - b  
mul = a*b  
div = a/b  
quotient = a//b  
remainder = a%b  
power = a**b
```

```
print(add, sub, mul, div, quotient, remainder, power)  
>> 13 7 30 3.333333333333335 3 1 1000
```

# Logical Operators

- The following code shows the logical operators in Python:

```
a = True
```

```
b = False
```

```
print(a and b)
```

```
>> False
```

```
print(a or b)
```

```
>> True
```

```
print(not a)
```

```
>> False
```

```
print(not(a and b))
```

```
>> True
```

```
print(not(a or b))
```

```
>> False
```

```
print(not b)
```

```
>> True
```

# Strings

- Python supports the string data type which is an array of characters

```
h = "Manipulator"  
print(h)
```

Output:

```
Manipulator
```

- You can get individual characters with square brackets

```
print(h[0])  
print(h[1])  
print(h[8])
```

Output:

```
M  
a  
p
```

- You can get the number of characters with the **len()** function

```
g = len(h)  
print(g)
```

Output:

```
11
```

# Strings

- You can concatenate strings easily in python

```
c = "Computer"  
d = "Vision"  
e = c + d  
print(e)
```

Output:

ComputerVision

```
f = c + " " + d  
print(f)
```

Output:

Computer Vision

- You can check if a character is present in the string with the “in” keyword

```
print("t" in c)  
print("s" in c)
```

Output:

True  
False

# User Input

- To get input from user, we use the `input()` function

```
v1 = input("Enter the first number: ")  
print(v1)
```

```
v2 = input("Enter the second number: ")  
print(v2)
```

Output:

```
Enter the first number: 200  
200  
Enter the second number: 100  
100
```

# User Input

- The **input()** function returns a string data which is stored in the variable
- If we add the previous two numbers, they will concatenate because they are strings, not numbers

```
print(v1 + v2)
```

Output:

```
200100
```

- To compute the numeric sum, we need to convert the string data type to an int or float data type

```
v1 = int(v1)  
v2 = int(v2)  
print(v1 + v2)
```

Output:

```
300
```

# If...Else

- Python supports the IF...ELSE conditional statements which choose to execute statements depending if a condition is true or false
- The syntax for a IF statement is given as:

```
if <condition>:  
    <statement_1>  
    <statement_2>
```

- An example is given below:

```
a = 4  
b = 3  
if a > b:  
    print("a is greater than b")
```

- The <condition> can be any of the following:

a==b      a!=b      a < b      a > b      a <= b      a >= b

# If...Else

- The **else** keyword contains statements that execute when the condition is not met

```
a = 4  
b = 3  
if a > b:  
    print("a is greater than b")  
else:  
    print("b is greater than a")
```

- Note that the colon symbol is part of the syntax
- To contain statements, they are indented with spaces
- The indents are mandatory in Python to define the block of statements

# If...Else

- The **elif** keyword nests an if command inside an else statement
- It is the equivalent of **else if**

```
a = 4
b = 3
if a > b:
    print("a is greater than b")
elif (a < b):
    print("a is less than b")
else
    print("a is equal to b")
```

- Only one of the three print statements will be executed

# Loops

- Python has two types of loops: WHILE and FOR
- The **while** loop has the following syntax:

```
while <condition>:  
    <statement_1>  
    <statement_2>
```

- The while loop checks the condition. If the condition is true, the statements are executed. After executing, the condition is rechecked. If it is true, it is executed again. This continues until the condition becomes false at which point the loop ends
- An example is given below

```
a = 0  
while a < 5:  
    print(a)  
    a = a + 1
```

Output:

0
1
2
3
4

# Loops

- The **break** keyword terminates the loop in which it is placed:

```
a = 0  
b = 3  
while a < 5:  
    print(a)  
    a = a + 1  
    if a == b:  
        break
```

Output:

```
0  
1  
2
```

# Loops

- The **continue** keyword skips the current iteration of the loop:

```
a = 0  
b = 3  
while a < 5:  
    a = a + 1  
    if a == b:  
        continue  
    print(a)
```

Output:

```
1  
2  
4  
5
```

# Loops

- The **for** loop goes through a sequence of items (iterable object)
- We use the **range()** to create a sequence of numbers

```
for i in range(0,5):  
    print(i)
```

Output:

```
0  
1  
2  
3  
4
```

```
for items in range(0,10,2):  
    print(items)
```

Output:

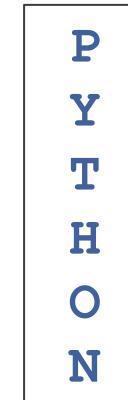
```
0  
2  
4  
6  
8
```

# Loops

- The **for** loop can also go through a sequence of characters
- The iterable object is a string variable in this case

```
for i in "PYTHON":  
    print(i)
```

Output:



P  
Y  
T  
H  
O  
N

# Functions

- We can define and call functions in python

```
def my_function(a, b):          # Function Definition  
    out = a + b  
    print(a, "+", b, "=", out)  
    return out
```

```
value = my_function(3,4)        # Function Call  
print("value =", value)
```

Output:

```
3 + 4 = 7  
value = 7
```

# Lab Tasks

- Download the Lab Material
- Perform the Lab Tasks given in the manual
- Submit the saved manual in PDF form
- Remember to delete your manual after completing the lab session