**QUAID E AWAM UNIVERSITY OF ENGINEERING SCIENCE AND TECHNOLOGY**

DEPARTMENT OF ARTIFICIAL INTELLIGENCE

**DATA STRUCTURES**

Dated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Roll No(s): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Lab 01 – Introduction to Python for Data Structures

## Lab Objectives

* Understand the basic syntax of Python (variables, loops, and conditionals).
* Use built-in Python data types such as lists, tuples, and dictionaries.
* Perform simple data manipulation tasks (insertion, retrieval, and iteration).
* Solve a real-world problem: storing and retrieving student records.

## Background

In Artificial Intelligence and Computer Science, data structures form the foundation of how information is stored, processed, and retrieved. Python is widely used in AI due to its simplicity and rich libraries. Before moving into advanced data structures (stacks, queues, trees, graphs), it is essential to understand basic data types and flow control.

**Variables**: Used to store data in memory.  
**Loops**: Allow repetition of tasks (for, while).  
**Conditionals**: Used for decision-making (if-else).  
**Lists**: Ordered, mutable collections of data.  
**Tuples**: Ordered, immutable collections of data.  
**Dictionaries**: Key-value pair mappings, useful for fast lookups.

## Lab Tasks

### Task 1: Variables & Input/Output

Write a Python program that:  
- Stores your name, age, and department in variables.  
- Prints them in a formatted sentence.

name = "Ali"  
age = 20  
department = "Artificial Intelligence"  
  
print(f"My name is {name}, I am {age} years old, and I study in {department}.")

### Task 2: Loops & Conditionals

Write a Python program to:  
- Print all numbers from 1 to 20.  
- For each number:  
 - Print "Even" if it is divisible by 2.  
 - Print "Odd" otherwise.

### Task 3: Lists & Tuples

1. Create a list of 5 course names.  
2. Add one new course to the list.  
3. Print all courses using a loop.  
4. Create a tuple of 3 cities and print them.

### Task 4: Dictionaries (Storing Student Records)

Create a dictionary to store student data (roll number, name, and GPA).  
- Insert at least 3 students.  
- Retrieve and print the GPA of one student using their roll number.

students = {  
 101: {"name": "Ali", "GPA": 3.4},  
 102: {"name": "Sara", "GPA": 3.7},  
 103: {"name": "Bilal", "GPA": 3.1}  
}  
  
roll = 102  
print(f"Student: {students[roll]['name']}, GPA: {students[roll]['GPA']}")

## Questions:

1. What is the difference between a list and a tuple in Python?
2. Why are dictionaries more suitable for storing student records compared to lists?
3. Modify Task 4 so that the program asks the user to input a roll number and then retrieves the corresponding student’s details.
4. Write a program that counts the number of vowels in a given string using a loop.
5. Predict the output of the following code snippet:  
   x = [1, 2, 3]  
   y = x  
   y.append(4)  
   print(x)  
   print(y)