**Department of Electrical Engineering**

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| **Faculty Member:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **Dated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
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| **Course/Section:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **Semester: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
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**CS-477 Computer Vision**

**Lab#2: Data Structures and NumPy**

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|  |  | **PLO4-CLO4** | **PLO5-CLO5** | **PLO8-CLO6** | **PLO9-CLO7** |
| **Name** | **Reg No.** | **Investigation**  **(5 marks)** | **Modern Tool Usage**  **(5 marks)** | **Ethics**  **(5 marks)** | **Individual and Team Work**  **(5 marks)** |
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**Lab#2: Data structures and NumPy**

**Objectives:** The following are the main objectives of this lab:

* Implement data structures such as lists and dictionaries in python
* Create, alter and loop through lists
* Use slicing to access range of items in a list
* Utilize various list methods such as append, insert, extend, remove, pop etc
* Implement 2-D lists.
* Create and implement a dictionary.
* Introduction to numpy

**Lab Instructions**

* This lab activity comprises of following parts: Lab Exercises, and Post-Lab Viva/Quiz session.
* The lab report shall be uploaded on LMS.
* Only those tasks that are completed during the allocated lab time will be credited to the students. Students are however encouraged to practice on their own in spare time for enhancing their skills.

**Lab Report Instructions**

All questions should be answered precisely to get maximum credit. Lab report must ensure following items:

* Lab objectives
* Python codes
* Results (graphs/tables) duly commented and discussed
* Conclusion

**Theory**

Data structures are an important part of python. The 4 main data structures are lists, tuples, sets and dictionaries. Lists are most commonly used so they will be the major part of the lab tasks. Dictionaries are also used at times. Tuples and sets are very similar to lists and are not very commonly used in robotics. In this lab, mainly lists will be considered. To write python scripts (.py files), the SublimeText application will be used which is a text editor with syntax highlighting. Once the code is written, the script is saved and then executed by using the Linux terminal.

The terminal commands are given as:

**cd <directory>** change directory

**cd..** go back to previous directory

**pwd**  print the current directory

**ls**  list the contents of the current directory

**python <script.py>** execute python script

A brief summary of the list functions in python is provided below. (For more details, check the slides for this lab)

**append(I)** append item I to the end of the list

**insert(i, I)** insert item I at i position of the list

**extend(L)** extend/concatenate a second list L

**remove(I)** remove a specified item I from a list

**pop(i)** remove item at specific index i in the list

**count(I)** return total number of a specific item I from a list

**index(I)** return index of first occurrence of a specific item I

**reverse** reverse the items of the list

**Lab Task 1 [1]**

**Create a simple list containing the characters of the word: MANIPULATOR. Loop through the list and display each character on a new line.**

*### TASK 1 CODE STARTS HERE ###*

*### TASK 1 CODE ENDS HERE ###*

**Lab Task 2 [1]**

**Write a program which first prompts the user for an integer which will be the size of a list. Then, the program must repeatedly prompt the user to input the items of the list. Each item is to be added with the append function. The inputs continue until the number of items reach the size of the list. The final list is then printed. The syntax for making an empty list and appending function are given below:**

my\_list = [ ]

my\_list.append(item)

*### TASK 2 CODE STARTS HERE ###*

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

**Lab Task 3 [1]**

**Write a function that takes in a list input and returns true if the items of the list make a palindrome. A palindrome is a word/number that is written the same way forward and backward. Examples of palindromes include “radar”, “level”, “5445”, “8395938”, “racecar”. To use a list in a function, use the following syntax:**

def my\_function(my\_list):

statement1

statement2

*### TASK 3 CODE STARTS HERE ###*

*### TASK 3 CODE ENDS HERE ###*

**Lab Task 4 [1]**

**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 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 4 CODE STARTS HERE ###*

*### TASK 4 CODE ENDS HERE ###*

**Lab Task 5 [1]**

**In this task, you will implement the Selection Sort algorithm using lists. A selection sort searches a list looking for the smallest element. Then, the smallest element is swapped with the first element of the list. The process is repeated for the sub-list beginning with the second element of the list. Each pass of the list results in one element being placed in its proper location. When the sub-list being processed contains one element, the list is sorted. Create a function which takes a list as input and then implements the selection sort on it. You need to print the list each time a swap is made.**

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

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

**Lab Task 6 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Use the np.array function to define two matrices of size 3x3. Place numerical elements of your choice in the matrices. Write code to perform the following:

* Print the arrays
* Compute the sum of the matrices
* Compute the difference of the matrices
* Compute the element-wise product of the matrices
* Compute the element-wise division of the matrices
* Compute the matrix multiplication of the matrices

*### TASK 6 CODE STARTS HERE ###*

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