5 Years Integrated M.Sc. (IT) – Semester 3
Practical List
060010308 – Data Structures

<table>
<tr><td>Practical No: 1</td><td>Enrollment No:</td></tr>
<tr><td>Practical Problem</td><td>
<table>
<tr><td>1</td><td>Declare 6 arrays as required to store the students records with Roll no, Mark1, Mark2, Mark3, Total and grade fields. Array size must be 10 and initialize first four arrays with appropriate values. Perform following operations on that:

1. Calculate total marks for each students
2. Assign grade to all the students according to following rule
a. If student scores more than 90 percent then grade is ‘O’
b. If student scores more than 80 percent then grade is ‘A’
c. If student scores more than 70 percent then grade is ‘B’
d. If student scores more than 60 percent then grade is ‘C’
e. If student scores more than 50 percent then grade is ‘D’
f. If student scores less than 50 percent then grade is ‘F’
3. List all the records on the screen
4. Search for the record whose roll no is 9
5. Delete a record whose roll no is 5
6. Insert a record just after the record, whose roll no is 7
7. Sort all the records according to the descending order of total</td></tr>
<tr><td>2</td><td>A multiplication table is a matrix of order m x n where an entry in the ith row and the jth column is the product I*j, where i and j are the values of i and j. show a multiple table respectively.

3 4 5 6 7

3 9 12 15 18 21

4 12 16 20 24 28

5 15 20 25 30 35

6 18 24 30 36 42

7 21 28 35 42 49</td></tr>
<tr><td>3</td><td>A magic square is a square matrix of integers such that the sum of every row, the sum of every column and the sum of each of the diagonals are equal. Such a magic square is shown in example.

4 15 14 1
9 6 7 12
5 10 11 8
16 3 2 13</td></tr>
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	4	Write a program to find out total number of odd elements in 2-dimensaional array. Where row, column and value of elements are given by user. Display Like: 1st row has <n1> odd elements. 2nd row has <n2> odd elements. . . Nth row has <nn> odd elements. Total number of odd elements:<n1+n2+….+nn> [NOTE: The value for Row and Column are given by user]
	5	Write a program to create Matrix class and perform following operations on it. A. Input 3x3 matrix B. Transpose of matrix C. Addition of two matrices D. Subtraction of two matrices E. Multiplication of two matrices
	6	Write a program to insert string and display in following pattern. Input String is: HELLO H H E H E L H E L L H E L L O
	7	Write a program to insert string and display in following pattern. Input String is: HELLO H HE HEL HELL HELLO
	8	Write a program to insert string and display in following pattern. Input String is: HELLO H H E H E L H E L L H E L L O

	9	Write a program to input n number and print following pattern. i.e n=5 * * * * * * * * * * * * * * * * * *
	10	Write a program to implement below diamond. 1 1 2 1 1 2 3 2 1 1 2 1 1

Objective(s)	Student can get the knowledge about the use of Array
Pre-requisite	Basics of C++
Duration for completion	3hours
PEO(s) to be achieved	PEO2: To provide quality practical skill of tools and technologies to solve industry problems.
PO(s) to be achieved	PO6: Ability to use the techniques, skills and modern tools as necessary for software development.
CO(s) to be achieved	CO1: Identify essential Data Structures and analyze the complexity of algorithms and identify the optimized algorithm. CO2: Recognize problem properties where Arrays, stacks, queues, and deques are appropriate data structures.
Solution must contain	Source Code, Sample Calculation and Implementation must be using Class
Nature of submission	Handwritten
Post Laboratory questions	1. Is it possible to write i[a] instead of a[i]? Why? 2. Which formula is used to calculate address in one-dimensional array? *3.* What are the limitations of an array? *4.* What is ADT?

Assessment

Objective	Achieved or Not	Signature
• **Array Concepts** • **Pointer Concepts**		

Practical No: 2	**Enrollment No:**
Practical Problem	1. Write a program to insert string. Display each character in different lines. 2. Write a program to insert string and display the length of string. 3. Write a program to insert string and display total number of words of the string. 4. Write a program to insert string and print in reverse order. 5. Write a program to insert string and character. Display index of the first occurrence of the character in string. 6. Write a program to insert string and convert it into upper case and display it. 7. Write a program to insert string and display total number of capital alphabet, small alphabet, digits and special symbol. 8. Write a program to input string and check whether it is palindrome or not.
Objective(s)	Student can get the knowledge about the use of Array
Pre-requisite	Basics of C++
Duration	3 hours
PEO(s) to be achieved	PEO2: To provide quality practical skill of tools and technologies to solve industry problems.
PO(s) to be achieved	PO6: Ability to use the techniques, skills and modern tools as necessary for software development.
CO(s) to be achieved	CO1: Identify essential Data Structures and analyse the complexity of algorithms and identify the optimized algorithm. CO2: Recognize problem properties where Arrays, stacks, queues, and deques are appropriate data structures.
Solution must contain	Source Code, Sample Calculation and Implementation must be using Class
Nature of submission	Handwritten
Post Laboratory questions	1. What is base address? 2. What is the use of index? 3. How many elements are there in array D[1:35]? *4.* If base address of A[-4:17] is 110 then what is address of A[9]?

Assessment		
Objective	**Achieved or Not**	**Signature**
• **Array Concepts** • **String Concepts**		

Practical No: 4	**Enrollment No:**
Practical Problem	1. Write a menu driven program to demonstrate following operations on stack of positive numbers: A. Insert element (Push) B. Remove element (Pop) C. Display 2. Write a menu driven program to implement stack using student class. Student class conations property like studentid, name and marks. Following operation should be performed: A. Insert Student (Push) B. Remove Student (Pop) C. Display 3. Write a program to enter your name in stack and display it in reverse order using push and pop operations. [Note: Implement stack using array.]
Objective(s)	Student can get the knowledge about the use of Stack
Pre-requisite	Basics of C++
Duration for completion	4 hours
PEO(s) to be achieved	PEO2: To provide quality practical skill of tools and technologies to solve industry problems.
PO(s) to be achieved	PO6: Ability to use the techniques, skills and modern tools as necessary for software development.
CO(s) to be achieved	CO1: Identify essential Data Structures and analyse the complexity of algorithms and identify the optimized algorithm. CO2: Recognize problem properties where Arrays, stacks, queues, and deques are appropriate data structures.
Solution must contain	Source Code, Sample Calculation and Implementation must be using Class
Nature of submission	Handwritten
Post Laboratory questions	1. What is stack? 2. Why stack is an ADT? 3. When stack is said to be overflow? Write condition for the same. 4. Enlist the applications of stack.

Assessment		
Objective	**Achieved or Not**	**Signature**
• **Stack Operations**		

Practical No: 5	**Enrollment No:**

Practical Problem	1. Write a menu driven program to implement following functionality with queue using array: A. Insert element (Enqueue) B. Remove element (Dequeue) C. Displaythe queue 2. Write a menu driven program to implement following functionality with circular queue using array: A. Insert element (Enqueue) B. Remove element (Dequeue) C. Display the queue
Objective(s)	Student can get the knowledge about the use of Queue
Pre-requisite	Basics of C++
Duration for completion	6 hours
PEO(s) to be achieved	PEO2: To provide quality practical skill of tools and technologies to solve industry problems.
PO(s) to be achieved	PO6: Ability to use the techniques, skills and modern tools as necessary for software development.
CO(s) to be achieved	CO1: Identify essential Data Structures and analyse the complexity of algorithms and identify the optimized algorithm. CO2: Recognize problem properties where Arrays, stacks, queues, and deques are appropriate data structures.
Solution must contain	Source Code, Sample Calculation and Implementation must be using Class
Nature of submission	Handwritten
Post Laboratory questions	5. What is queue? 6. When queue is said to be full? 7. When queue is said to be empty? 8. What is the difference between stack and queue?

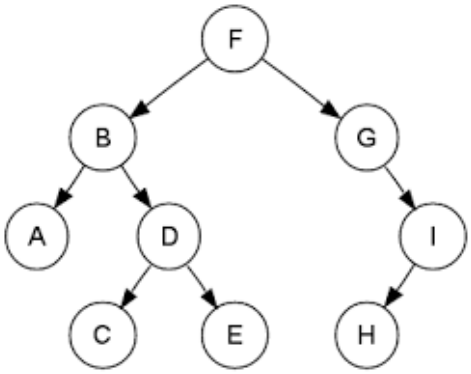
Assessment

Objective	Achieved or Not	Signature
• **Simple Queue Concepts** • **Circular Queue Concepts** • **Double Ended Queue Concepts**		

Practical No: 6	**Enrollment No:**
Practical Problem	1. Write a menu driven program to implement following functionality with Singly Linked List: A. Creation B. Insert node at first, last and middle(upon user choice) C. Delete node from first, last and middle(upon user choice) D. Copying E. Merging F. Searching G. Traversal 2. Write a menu driven program to implement following functionality with Doubly Linked List: A. Creation B. Insert node at first, last and middle(upon user choice) C. Delete node from first, last and middle(upon user choice) D. Copying E. Merging F. Searching G. Traversal 3. Write a menu driven program to implement following functionality with circular Linked List: A. Creation B. Insert node at first, last and middle(upon user choice) C. Delete node from first, last and middle(upon user choice) D. Copying E. Merging F. Searching G. Traversal 4. Write a program for a single linked list containing integer data. Perform following operation: A. Number of data in the list B. Display minimum key value C. Display maximum key value 5. Swap two adjacent element in single and double linked list A. By interchanging elements B. By adjusting only the pointers 6. Write a menu driven program to implement following functionality with Linked Stack:

	A. Insert node (Push) B. Remove node (Pop) C. Display stack 7. Write a menu driven program to implement following functionality with Linked Queue: A. Insert node (Enqueue) B. Remove node (Dequeue) C. Display Queue
Objective(s)	Student can get the knowledge about the use of Linked List
Pre-requisite	Basics of C++
Duration for completion	7 hours
PEO(s) to be achieved	PEO2: To provide quality practical skill of tools and technologies to solve industry problems.
PO(s) to be achieved	PO6: Ability to use the techniques, skills and modern tools as necessary for software development.
CO(s) to be achieved	CO3: Implement Linked Data Structure such as Linked List and Tree.
Solution must contain	Source Code, Sample Calculation and Implementation must be using Class
Nature of submission	Handwritten
Post Laboratory questions	1. What is linked list? 2. What is the need for linked representations of list? 3. What is the drawback of singly linked list? 4. What is dynamic memory allocation?

Assessment		
Objective	**Achieved or Not**	**Signature**
• **Singly Linked List Concepts** • **Doubly Linked List Concepts** • **Linked Stack Concepts** • **Linked Queue Concepts**		

Practical No: 7	**Enrollment No:**
Practical Problem	1. Write a program to implement following tree and perform in-order, pre-order and post-order traversal.  2. Write a menu driven program to implement following functionality with Binary Search Tree. A. Insert node B. Remove node C. Update node D. Display tree using in-order traversal
Objective(s)	Student can get the knowledge about the use of Linked List
Pre-requisite	Basics of C++
Duration for completion	7 hours
PEO(s) to be achieved	PEO2: To provide quality practical skill of tools and technologies to solve industry problems.
PO(s) to be achieved	PO6: Ability to use the techniques, skills and modern tools as necessary for software development.
CO(s) to be achieved	CO4: Represent hierarchical organization of information and traversal of information in hierarchical structure like Tree.
Solution must contain	Source Code, Sample Calculation and Implementation must be using Class
Nature of submission	Handwritten
Post Laboratory questions	1. Define tree and binary tree. 2. How tree follows dynamic memory allocation? 3. How BST is different than binary tree? 4. Define sibling, leaf node and ancestor.

Assessment		
Objective	**Achieved or Not**	**Signature**
• **Tree Concepts**		

Practical No: 8	**Enrollment No:**
Practical Problem	1. Write a program to implement selection sort. 2. Write a program to implement insertion sort. 3. Write a program to implement bubble sort. 4. Write a program to implement merge sort
Objective(s)	Student can get the knowledge about sorting techniques.
Pre-requisite	Basics of C++
Duration for completion	7 hours
PEO(s) to be achieved	PEO2: To provide quality practical skill of tools and technologies to solve industry problems.
PO(s) to be achieved	PO6: Ability to use the techniques, skills and modern tools as necessary for software development.
CO(s) to be achieved	CO5: Comprehend various Sorting algorithms including Quick Sort, Merge Sort and Heap Sort.
Solution must contain	Source Code, Sample Calculation and Implementation must be using Class
Nature of submission	Handwritten
Post Laboratory questions	1. Define sort. 2. Which sorting techniques are an example of divide and conquer? 3. Can bubble sort ever perform better than quick sort? 4. What is the time complexity of quick sort?

Assessment		
Objective	**Achieved or Not**	**Signature**
• **Sorting Techniques**		

Practical No: 9	**Enrollment No:**
Practical Problem	1. Write a program to implement following linear search technique. A. Array B. Linked List C. Order List D. Binary Search 2. Write a program to implement following non-linear search technique. A. Binary Search Tree B. Binary Tree Search
Objective(s)	Student can get the knowledge about searching techniques.
Pre-requisite	Basics of C++
Duration for completion	7 hours
PEO(s) to be achieved	PEO2: To provide quality practical skill of tools and technologies to solve industry problems.
PO(s) to be achieved	PO6: Ability to use the techniques, skills and modern tools as necessary for software development.
CO(s) to be achieved	CO6: Identify the appropriate searching technique as and when require.
Solution must contain	Source Code, Sample Calculation and Implementation must be using Class
Nature of submission	Handwritten
Post Laboratory questions	1. Define ordered linear search. 2. Give any one difference between order linear search and unordered linear search. 3. What are the advantages of binary search over linear search? 4. Write down complexity of worst case and best case in unordered linear search.

Assessment		
Objective	**Achieved or Not**	**Signature**
• **Searching Techniques**		