# LABORATORY MANUAL

**18CSL38-DATA STRUCTURES LAB**

2019-20


DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING
ATRIA INSTITUTE OF TECHNOLOGY
Adjacent to Bangalore Baptist Hospital
Hebbal, Bengaluru-560024

# SYLLABUS

## DATA STRUCTURES LABORATORY
## (Effective from the academic year 2018 -2019)
## SEMESTER – III
## Laboratory Code 18CSL38, IA Marks 40, Exam Marks 60

1. Design, Develop and Implement a menu driven Program in C for the following Array operations

a. Creating an Array of N Integer Elements

b. Display of Array Elements with Suitable Headings

c. Inserting an Element (ELEM) at a given valid Position (POS)

d. Deleting an Element at a given valid Position (POS)

e. Exit. Support the program with functions for each of the above operations.

2. Design, Develop and Implement a Program in C for the following operations on Strings

a. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP)

b. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR Support the program with functions for each of the above operations. Don't use Built-in functions.

3. Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX)

a. Push an Element on to Stack

b. Pop an Element from Stack

c. Demonstrate how Stack can be used to check Palindrome

d. Demonstrate Overflow and Underflow situations on Stack

e. Display the status of Stack

f. Exit Support the program with appropriate functions for each of the above operations

4. Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^(Power) and alphanumeric operands.

5. Design, Develop and Implement a Program in C for the following Stack Applications a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b. Solving Tower of Hanoi problem with n disks

6. Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX)

a. Insert an Element on to Circular QUEUE

b. Delete an Element from Circular QUEUE

c. Demonstrate Overflow and Underflow situations on Circular QUEUE

d. Display the status of Circular QUEUE

e. Exit Support the program with appropriate functions for each of the above operations

7. Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo

a. Create a SLL of N Students Data by using front insertion.

b. Display the status of SLL and count the number of nodes in it

c. Perform Insertion / Deletion at End of SLL d. Perform Insertion / Deletion at Front of SLL(Demonstration of stack)

e. Exit

8. Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, PhNo

a. Create a DLL of N Employees Data by using end insertion.

b. Display the status of DLL and count the number of nodes in it

c. Perform Insertion and Deletion at End of DLL

d. Perform Insertion and Deletion at Front of DLL

e. Demonstrate how this DLL can be used as Double Ended Queue.

9. Design, Develop and Implement a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes

a. Represent and Evaluate a Polynomial P(x,y,z) = 6x2 y 2 z-4yz5 +3x3 yz+2xy5z-2xyz3

b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) Support the program with appropriate functions for each of the above operations

10. Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers

**a.** Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 **b.** Traverse the BST in Inorder, Preorder and Post Order

c. Search the BST for a given element (KEY) and report the appropriate message

e. Exit

11. Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities a. Create a Graph of N cities using Adjacency Matrix. b. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method.

12. Given a File of N employee records with a set K of Keys(4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2- digit) of locations in HT. Let the keys in K and addresses in L are Integers. Design and develop a Program in C that uses Hash function H: K →L as H(K)=K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

# Viva Questions

1. Differentiate between Malloc() and Calloc() of DMA.
2. What is a Structure? Differentiate between nested and self-referential structure.
3. Define Pointer. What is dangling Reference?
4. What is an array?
5. What are the advantages and disadvantages of array?
6. What are the disadvantages of static memory allocation?
7. What are the different Dynamic Memory Allocation functions?
8. What is Data Structure? Explain its types
9. What is a Null Pointer?
10. Is array a linear data structure or non-linear data structure?
11. Explain the different looping structures.
12. Explain switch-case with an example.
13. What is the difference between a string copy (strcpy) and a memory copy (memcpy)? When should each be used?
14. What is the use of a '\0' character?
15. How to find duplicate characters in a String?
16. What are the different pattern matching algorithms available? Explain any one.
17. Write a program to reverse a string without built-in function.
18. Explain the different built in string functions supported by C.
19. Give the applications of stack.
20. What is a Stack?what is the principle on which the stack works?
21. What are the basic operations performed on stack?
22. What is a Palindrome?
23. Explain Push and Pop functions.
24. What is an infix expression?
25. What is an postfix expression?
26. What is the necessity of converting an infix expression to an postfix expression?
27. Convert the given infix expression to its equivalent postfix expression.
    a. a+b*d/e-(f*g)
    b. ((a/b-f)-e+g*(m/n-x))
28. What is recursion? What are the 2 important properties of recursion?
29. Give examples of the functions which makes use of recursion.
30. Explain Akermans Function.
31. Explain Tower Of Honai Problem.
32. What is recursion? What are the 2 important properties of recursion?
33. Give examples of the functions which makes use of recursion.
34. Explain Akermans Function.
35. Explain Tower Of Honai Problem.
36. Explain the algorithm to evaluate a postfix expression.
37. Evaluate the given postfix expression.
38. What is a queue?
39. What is the disadvantage of normal queue which led to the circular queue?
40. What are the applications of queue?
41. What is a priority queue? What are its applications?

42. What is a doubly ended queue?
43. How do you convert a normal queue into a circular queue.
44. What is a linked list?
45. What are the disadvantages and advantages of singly linked list?
46. What are the applications of singly linked list?
47. How linked list can be used to implement stacks and queues?
48. What is circular singly linked list?
49. Explain singly linked list with header node.
50. How to reverse a linked list recursively.
51. What is a doubly linked list?
52. What are the disadvantages of singly linked list that led to doubly linked list?
53. What are the advantages and disadvantages of doubly linked list?
54. Explain doubly linked list with header node.
55. Explain circular doubly linked list.
56. Write a code to insert a node at a specified position.
57. What is a polynomial?
58. What is the degree of a polynomial?
59. What is a singly circular linked list?
60. Explain the function to evaluate the given polynomials.
61. Evaluate the following polynomials.
62. Define the following:
    Tree
    Root node
    Ancestors of a tree
    Depth of a tree
63. What is a Binary Tree? Explain different representation of binary trees?
64. What are different Binary Tree traversals?
65. What is a threaded binary tree?
66. Explain binary search tree.
67. What are different types of efficient binary search trees?
68. Differentiate between Full Binary Tree and Complete Binary tree.
69. Trees belong to which data structure?
70. Define graph?
71. What are vertices and edges?
72. What are different graph representations?
73. Differentiate between BFS and DFS.
74. What is a cycle?
75. Which data structure used to represent a graph?
76. A graph belongs to which data structure?
77. What is hashing?
78. Explain the different methods used to overcome collision in hashing.
79. Explain linear probing.
80. Explain how hash table is used to overcome collision.
81. What are macros?