

## CHAPTER

## 1

## Introduction to Stacks, Queues and Linked Lists

## Syllabus Topics

Introduction to Data Structures: Linear and Non Linear Data Structures, Static and Dynamic Data Structures. Concept of Stack and Queue. Array Implementation of Stack and Queue, Circular Queue, Double Ended Queue, Priority Queue. Concept of Linked Lists. Singly linked lists, doubly linked lists and circular linked lists. Insertion, deletion, update and copying operations with Singly linked lists, doubly linked lists and circular linked lists. Reversing a singly linked list.

**Self-learning Topics :** Linked List Implementation of Stack, Linked List implementation of Queue, Circular Queue, Double Ended Queue, Priority Queue.

1.1	Introduction to Data Structures .....	1-6
1.1.1	Data Structures.....	1-6
<b>UQ. 1.1.1</b>	<b>What is Data structure? (MU - Dec. 13, Dec. 17, 1 Mark)</b> .....	1-6
1.2	Need of Data Structures .....	1-6
1.3	Elementary Data Structure Organization .....	1-7
1.4	Data Type .....	1-8
1.4.1	Primary Data Types.....	1-8
1.4.2	Derived Data Types.....	1-9
1.5	Abstract Data Type (ADT).....	1-10
<b>UQ. 1.5.1</b>	<b>What is Abstract Data Type ? (MU - Dec. 13, Dec. 17, 1 Mark)</b> .....	1-10
1.6	Implementation of Data Structures .....	1-10
1.7	Types of Data Structures .....	1-11
<b>UQ. 1.7.1</b>	<b>Explain linear and non linear data structures.</b>	
	<b>(MU - Dec. 17, Dec. 18, May 19, Dec.19, 2 Marks)</b> .....	1-11
<b>UQ. 1.7.2</b>	<b>What are the different linear and non-linear data structures ? (MU - Dec. 18, 3 Marks)</b> .....	1-11
1.7.1	Linear Data Structures .....	1-11



1.7.2	Non Linear Data Structures .....	1-11
1.7.2(A)	Difference between Linear and Non Linear Data Structure.....	1-12
<b>UQ. 1.7.3</b>	Distinguish between linear data structure and non linear data structure. (MU - May 15, 2 Marks).....	1-12
1.7.3	Static Data Structures.....	1-12
1.7.4	Dynamic Data Structures .....	1-12
<b>UQ. 1.7.5</b>	Write note on : Dynamic Data Structures. (MU - May 17, 2 Marks) .....	1-13
1.8	Operations on Data Structures .....	1-13
1.9	Concept of Stack.....	1-13
<b>UQ. 1.9.1</b>	What is stack ? (MU - May 14, 2 Marks) .....	1-13
<b>UQ. 1.9.2</b>	Define Stack. (MU - Dec. 17, May 18, 1 Mark).....	1-14
1.10	Stack as an ADT (Abstract Data Type).....	1-14
1.10.1	Operations on Stack .....	1-15
1.11	Array Implementation of Stack.....	1-15
<b>UQ. 1.11.1</b>	Write an algorithm for implementing stack using array. (MU - Dec. 17, Dec.18, May 19, Dec.19, 10 Marks).....	1-16
1.11.1	Initializing Stack.....	1-16
1.11.2	Inserting Element in the Stack.....	1-17
1.11.3	Deleting Element from the Stack.....	1-17
1.11.4	Displaying Element of Stack.....	1-17
1.11.5	Algorithm of Program to Demonstrate Stack Implementation using Array .....	1-18
1.11.6	Program to Demonstrate Stack Implementation using Array .....	1-18
<b>UQ. 1.11.5</b>	Write a program to implement STACK ADT using array. (MU - May 15, 10 Marks) .....	1-20
1.12	Concept of Queue.....	1-20
<b>UQ. 1.12.1</b>	What is a queue ? (MU - Dec. 14, 3 Marks) .....	1-20
1.13	Queue as an ADT (Abstract Data Type).....	1-20
<b>UQ. 1.13.1</b>	Specify ADT for Queue. (MU - Dec. 14, 3 Marks) .....	1-20
<b>UQ. 1.13.2</b>	What is Queue ADT ? Mention its operations. (MU - Dec. 16, 3 Marks).....	1-21
1.13.1	Operations on Queue .....	1-21
1.14	Difference between Stack and Queue .....	1-22
1.15	Array Implementation of Queue .....	1-22
<b>UQ. 1.15.2</b>	Write an algorithm to implement queue using array ? (MU - Dec. 18, May 19, 10 Marks) .....	1-22





1.15.1	Enqueue : Inserting an Element in Queue .....	1-22
1.15.2	Dequeue : Deleting an Element from Queue .....	1-22
1.15.3	Algorithm to Delete an Element from Queue.....	1-23
<b>UQ. 1.15.4</b>	Write a program to implement queue using array. (MU - Dec. 13, May 16, Dec. 16, Dec. 17 10 Marks) .....	1-23
<b>UQ. 1.15.5</b>	Write a program for implement array based queue. (MU - Dec. 14, 6 Marks) .....	1-23
1.16	Types of Queue .....	1-25
<b>UQ. 1.16.1</b>	Explain different types of queues in data structures. (MU - Dec. 19, 3 Marks) .....	1-25
1.17	Circular Queue .....	1-25
1.18	Doubly Ended Queue (De-queue) .....	1-28
<b>UQ. 1.18.1</b>	Define double ended queue and give its applications. (MU - May 14, 3 Marks) .....	1-28
<b>UQ. 1.18.2</b>	Define double ended queue. Specify ADT for it. Implement any 2 operations of it. (MU - Dec. 14, 10 Marks) .....	1-28
<b>UQ. 1.18.3</b>	Define Double Ended queue. List the variants of Double ended queue. (MU - May 15, Dec. 18, 3 Marks) .....	1-28
<b>UQ. 1.18.4</b>	Write short note on : Double Ended Queue (De-Queue). (MU - Dec. 19, 5 Marks) .....	1-28
1.18.1	Representation of De-queue .....	1-28
1.18.2	Difference between Circular Queue and Double-Ended Queue .....	1-32
1.19	Priority Queue .....	1-33
<b>UQ. 1.19.1</b>	What is priority queue? Give implementation of it. (MU - May 15, May 16, 10 Marks) .....	1-33
<b>UQ. 1.19.2</b>	Explain : Priority Queue. (MU - May 17, 5 Marks) .....	1-33
1.19.1	Advantages of Priority Queue .....	1-33
1.19.2	Applications of Priority Queue .....	1-33
1.19.3	Types of Priority Queue.....	1-33
1.19.4	Elements of Priority Queue .....	1-34
1.19.5	Implementation of Priority Queue.....	1-34
1.19.6	One Way List Representation of Priority Queue .....	1-34
<b>UQ. 1.19.8</b>	Write an algorithm to implement priority queue ? (MU - Dec. 18, 10 Marks) .....	1-35
<b>UQ. 1.19.9</b>	Write a program to implement Priority Queue. (MU - Dec. 16, 10 Marks) .....	1-35
1.20	Concept of Linked Lists.....	1-37
1.20.1	Memory Allocation and De-allocation of Linked List.....	1-38
1.20.2	Linked List .....	1-38



**UQ. 1.20.2** What is Link List ? (MU - Dec. 13, May 14, Dec. 14, May 15, Dec. 15,  
May 16, Dec. 16, Dec. 17, Dec.18, May 19, 2 Marks)

## 1.21 Basic Terminologies of Liked List

1.21.1 Advantages of Linked List

**UQ. 1.21.6** State advantages of linked list. (MU - May 15, Dec. 17, Dec. 18, 3 Marks)

1.21.2 Disadvantages of Linked List

1.21.3 Differentiate between Array and Linked List

## 1.22 Types of Linked List

**UQ. 1.22.1** State the different types of Link List.

(MU - Dec. 13, May 14, Dec. 14, Dec. 16, Dec. 18, May 19, 2 Marks)

## 1.23 Singly Linked Lists

**UQ. 1.23.1** Write an algorithm for following operations on singly linked List

(1) Insertion (2) Deletion (3) Traversal (MU - Dec. 17, Dec.19, 10 Marks)

**UQ. 1.23.2** What is singly linked list? (MU - Dec.19, 2 Marks)

## 1.24 Operations on Singly Linked List

1.24.1 Traversing a Singly Linked List

1.24.2 Counting Number of Node in Singly Linked List

1.24.3 Searching a Linked List

1.24.4 Inserting a Node in Singly Linked List

**UQ. 1.24.9** Write functions to implement insert( ) of singly inked list.

(MU- May 14, Dec. 14, May 15, May 17, Dec. 17, 3 Marks)

1.24.5 Deleting a Node from Singly Linked List

**UQ. 1.24.13** Write an algorithm to delete an element from a singly linked list. (MU - Dec. 17, 3 Marks)

**UQ. 1.24.18** Write a program to create singly Linked List and display the List.

(MU - Dec. 13, Dec. 15, 10 Marks)

1.24.6 Update a Singly Linked List

1.24.7 Copying a Singly Linked List

**UQ. 1.24.24** Write functions to implement insert ( ) and traverse ( ) of singly linked list.

(MU - May 17, Dec. 17, 5 Marks)

## 1.25 Doubly Linked List

**UQ. 1.25.1** What is doubly linked list ? (MU - Dec. 13, 2 Marks)

**UQ. 1.25.2** Explain Doubly Linked List. (MU - Dec. 19, 3 Marks)

1.25.1 Advantages of Doubly Linked List over Singly List





1.25.2	Operations of Doubly Linked List Insertion , Deletion .....	1-51
<b>UQ. 1.25.5</b>	Write an algorithm to implement following operations in DLL: Insertion (All cases). (MU - Dec. 13, May 17, May 19, 3 Marks) .....	1-51
<b>UQ. 1.25.6</b>	Write an algorithm to create doubly linked list. (MU - Dec. 18, 4 Marks) .....	1-51
<b>UQ. 1.25.12</b>	Write an algorithm to implement following operations in DLL : Traversal. (MU - Dec. 13, May 17, May 19, 3 Marks) .....	1-53
<b>UQ. 1.25.13</b>	Write an algorithm to display the doubly linked list.. (MU - Dec. 18, 4 Marks) .....	1-53
1.25.3	Difference between Singly and Doubly Linked List .....	1-58
1.26	Circular Linked List / Linked List Representation of Queue.....	1-59
<b>UQ. 1.26.1</b>	Solve : Circular linked list. (MU - May 14, May 17, 5 Marks).....	1-59
1.26.1	Operations on Circular Linked List .....	1-59
<b>UQ. 1.26.2</b>	Write algorithm to insert node in circular linked list. (MU - Dec. 16, 4 Marks).....	1-59
<b>UQ. 1.26.6</b>	Write algorithm to traverse data from circular linked list. (MU - Dec. 16, 4 Marks) .....	1-61
<b>UQ. 1.26.8</b>	Write a program in 'C' to implement circular queue using Link-list. (MU - May 14, 10 Marks).....	1-61
1.26.2	Advantages of Circular Linked List.....	1-63
<b>UQ. 1.26.9</b>	What are the advantages of circular linked list? (MU - Dec. 17, 3 Marks).....	1-63
1.27	Reversing a Singly Linked List.....	1-63
<b>UQ. 1.27.2</b>	Write a 'C++' function to reverse a singly linked list. (MU - Dec. 17, 4 Marks).....	1-64
1.28	Self Learning Topics : Linked List Implementation of Stack, Linked List Implementation of Queue, Double Ended Queue, Priority Queue .....	1-66
1.28.1	Linked List Implementation of Stack.....	1-66
<b>UQ. 1.28.2</b>	Write program to implement stack ADT as Linked List. (MU - Dec. 17, 10 Marks) .....	1-67
1.28.2	Circular Linked List / Queue as Linked List .....	1-68
<b>UQ. 1.28.3</b>	Solve : Circular linked list. (MU - May 14, May 17, 5 Marks).....	1-68
1.28.2(A)	Operations on Circular Linked List .....	1-69
<b>UQ. 1.28.4</b>	Write algorithm to insert node in circular linked list. (MU - Dec. 16, 4 Marks).....	1-69
<b>UQ. 1.28.8</b>	Write algorithm to traverse data from circular linked list. (MU - Dec. 16, 4 Marks) .....	1-70
<b>UQ. 1.28.10</b>	Write a 'C++' function to reverse a singly linked list. (MU - Dec. 17, 4 Marks) .....	1-71
1.28.3	Circular Queue .....	1-72
1.28.4	Double Ended Queue .....	1-72
1.28.5	Priority Queue.....	1-72
•	<b>Chapter Ends</b> .....	1-72