

# Data Structures and Algorithms Assignment 3

## 1. What is a linked list?

A linked list is a sequence of data structures, which are connected together via links.

Linked List is a sequence of links which contains items. Each link contains a connection to another link. Linked list is the second most-used data structure after array. Following are the important terms to understand the concept of Linked List.

- Link – Each link of a linked list can store a data called an element.
- Next – Each link of a linked list contains a link to the next link called Next.
- LinkedList – A Linked List contains the connection link to the first link called First.

## 2. What are the different forms of linked lists?

A linked list is a linear data structure, in which the elements are not stored at contiguous memory locations. The elements in a linked list are linked using pointers. In simple words, a linked list consists of nodes where each node contains a data field and a reference(link) to the next node in the list.

### Types Of Linked List

- Singly Linked List: It is the simplest type of linked list in which every node contains some data and a pointer to the next node of the same data type. The node contains a pointer to the next node means that the node stores the address of the next node in the sequence. A single linked list allows traversal of data only in one way.
- Doubly Linked List: A doubly linked list or a two-way linked list is a more complex type of linked list which contains a pointer to the next as well as the previous node in sequence, Therefore, it contains three parts are data, a pointer to the next node, and a pointer to the previous node. This would enable us to traverse the list in the backward direction as well.
- Circular Linked List: A circular linked list is that in which the last node contains the pointer to the first node of the list. While traversing a circular linked list, we can begin at any node and traverse the list in any direction forward and backward until we reach the same node we started. Thus, a circular linked list has no beginning and no end.

### 3. What is a linked list's purpose?

Applications of linked list in computer science –

- Implementation of stacks and queues
- Implementation of graphs : Adjacency list representation of graphs is most popular which uses linked list to store adjacent vertices.
- Dynamic memory allocation : We use linked list of free blocks.
- Maintaining directory of names
- Performing arithmetic operations on long integers
- Manipulation of polynomials by storing constants in the node of linked list representing sparse matrices

Applications of linked list in real world-

- Image viewer – Previous and next images are linked, hence can be accessed by next and previous button.
- Previous and next page in web browser – We can access previous and next url searched in web browser by pressing back and next button since, they are linked as linked list.
- Music Player – Songs in music player are linked to previous and next song. you can play songs either from starting or ending of the list.

### 4. What are the advantages of linked lists over arrays?

Advantages of Linked List over Array

#### 1) Dynamic Data Structure:

Linked List being a dynamic data structure can shrink and grow at the runtime by deallocating or allocating memory, so there is no need for an initial size in linked list.

Whereas an initial size has to be declared in an array, and the number of elements cannot exceed that size.

#### 2) No Memory Wastage:

As the size of a linked list can grow or shrink at runtime, so there is no memory wastage. Only the required memory is allocated.

In arrays, we have to first initialize it with a size which we may or may not fully use; hence wastage of memory may occur.

#### 3) Implementation:

Some very helpful data structures like queues and stacks can be easily implemented using a Linked List.

#### 4) Insertion and Deletion Operation:

In a Linked List, insertion and deletion operations are quite easy, as there is no need to shift every element after insertion or deletion. Only the address present in the pointers needs to be updated.

## **5. What is the purpose of a circular linked list?**

A Circular Linked List can be used for the following –

- Circular lists are used in applications where the entire list is accessed one-by-one in a loop.
- It is also used by the Operating system to share time for different users, generally uses a Round-Robin time-sharing mechanism.
- Multiplayer games use a circular list to swap between players in a loop.
- Implementation of Advanced data structures like Fibonacci Heap
- The browser cache which allows you to hit the BACK button
- Undo functionality in Photoshop or Word
- Circular linked lists are used in Round Robin Scheduling
- Circular linked list used Most recent list (MRU LIST)

## **6. How will you explain Circular Linked List?**

A circular linked list is a sequence of elements in which every element has a link to its next element in the sequence and the last element has a link to the first element.

In a circular linked list, we perform the following operations...

- Insertion
- Deletion
- Display