Data Structures and Algorithms Assignment 3

1. What is a LinkedList?

   The Linked List is a Linear Data Structure in which the elements are not stored in a contiguous memory location. A linked list contains nodes where each nodes contains a data field and a reference link to the next node in the list. The second node acts as a pointer. Iteration in a Linked List takes place because of these pointers. The node in a Linked List is created as a inner class and new memory location will be allocated the objects hence they are not in contiguous memory locations.

2. What are the different forms of linked lists?

   There are three different types of linked list. And they are Singly Linked List, Circular Lined List and Doubly Linked List.

   Singly Linked List: - A singly linked list is the most common form of a linked list. In these each node has data and a pointer the points to the next node.

   Doubly Linked List: - In a doubly Linked List the pointer is added to the previous node. This enables the doubly linked list to iterate over in both the forward and backward direction.

   Circular Linked List: - A circular linked list is a variation of a linked list in which the last element is linked to the first element. This forms a circular loop.

3. What is a linked list's purpose?

   The main purpose of a Linked List is that it assigns a placeholder generic data type to objects , so that makes it easier for code reuse of any data type. Linked list is a sequence of links which contains items. Each link contains a connection to another link. Each link of a linked list can store a data called an element. Each linked list will have the reference address to the next link. Every linked list will have a head node, where the chain starts from. The end of the linked list will always refer to a null object.

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

   - Linked List being a dynamic data structure can shrink and grow at the runtime by deallocating or allocating memory.
   - Due to linked list ability to allocate and deallocate memory at runtime only the required amount of memory is being used by the linked list. Hence there is no memory wastage in using a linked list.
   - While inserting and deleting elements in a linked list there is no need to shift the elements as in the case of an array.

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

Circular linked list is utilized in scenarios where there is a requirement of a circular loop. They are used in Round Robin Scheduling, Most Recent and, they are extensively used by BACK buttons used in a browser. The Advantages of a circular linked list are that they can be traversed from any node of the list. It saves times when we must go from the first node to the last node. Previous node reference can easily be found in a circular linked list. Where a circular loop is required, a circular linked list is the go-to data structure.

6. How will you explain Circular Linked List?

A circular linked list is a variation of a linked list in which the last node points to the first node, completing a full circle of nodes. That is, this variation of the linked list will not have a null element at the end as the last elements will be pointed to the first node forming a circular loop. The Advantage of the data structure design is that any node in this linked list can be a starting point. Also, the whole list can be traversed starting from any node. Due to its circular nature, it becomes advantageous to perform enqueue and dequeue operations.

This implementation of the linked list will have the same time and space complexities a normal singly linked list except that, traversing from the last node to the head node can be done in constant time.

The insertion, search, delete and traverse operations in a circular linked list will be like that of other linked list, with only minute differences.