**COGNIZANT DIGITAL NURTURE – 3.0**

**JAVA FSE**

**WEEK – 1 EXERCISES**

**DATA STRUCTURES AND ALGORITHMS**

**Exercise 5: Task Management System**

**Step 1: Understand Linked Lists:**

**I. Explain the different types of linked lists (Singly Linked List, Doubly Linked List).**

**Types of Linked Lists**

* **Singly Linked List**: Each node contains data and a reference (or link) to the next node in the sequence. It allows traversal in only one direction.
* **Doubly Linked List**: Each node contains data, a reference to the next node, and a reference to the previous node. It allows traversal in both directions (forward and backward).

**Step 2: Setup**

***Refer Program Files***

**Step 3: Implementation**

***Refer Program Files***

**Step 4: Analysis:**

**I. Analyze the time complexity of each operation.**

**Time Complexity**

* **Add Operation**: O(n) – Adding a task involves traversing the list to find the end.
* **Search Operation**: O(n) – Searching involves traversing the list to find the task.
* **Traverse Operation**: O(n) – Traversing involves visiting each node once.
* **Delete Operation**: O(n) – Deleting involves traversing the list to find the task and then adjusting links.

**II. Discuss the advantages of linked lists over arrays for dynamic data.**

**Advantages of Linked Lists Over Arrays**

* **Dynamic Size**: Linked lists can grow or shrink dynamically as elements are added or removed.
* **Efficient Insertions/Deletions**: Insertion and deletion of elements (not involving the end) are efficient and do not require shifting elements as in arrays.
* **Memory Allocation**: Memory for linked lists is allocated as needed, unlike arrays which require contiguous memory allocation.