**Exercise 5: Task Management System**

1. **Understand Linked List**
   1. Singly Linked List: A singly linked list is a linear data structure where each node contains:
2. Data
3. A pointer to the next node in the list

While it is easier to implement, uses lesser memory as compared to Doubly Linked List, and can insert and deleted nodes at beginning and ending O(1) time, it can’t traverse backwards.

* 1. Doubly Linked List: A doubly linked list is a linear data structure where each node contains:
     1. Data
     2. A pointer to the next node
     3. A pointer to the previous node

It can traverse in both directions, easier to delete a given node, and more flexible for complex operations. Still, it requires extra memory and is complex to implement.

1. **And 3. Setup and Implementation**: Shown in code.

**4. Analysis:**

a. Time complexity of each operation:

i. Add Task: O(n)

ii. Search Task: O(n)

iii. Traverse: O(n)

iv. Delete Task: O(n)

b. Advantages of Linked List over Arrays for dynamic data:

* Size flexibility: Unlike Arrays, where the size is fixed from declaration or initialisation, linked lists can grow or shrink as and when required.
* Insertion/ Deletion efficient: Arrays require elements to be shifted every time an element is added or deleted which isn’t the case in linked list. In linked list, it is O(1) time to add elements at head and O(n) elsewhere.
* Memory usage: Arrays may waste memory if place remains unused. In linked list, no place is unused.