**Exercise 5: Task Management System**

**Understand Linked Lists:**

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

Answer –

Singly Linked List: A singly linked list is made up of nodes, each of which has a reference (or pointer) to the node after it in the sequence as well as a data portion. A null reference indicates the end of the list, and a head node indicates the beginning of the list. Quick additions and deletions at the start or finish of the list.The inefficient access to elements due to head traversal is one of its drawbacks.

Doubly Linked List: A doubly linked list is made up of nodes, each of which has a reference to the previous node, a reference to the next node, and a data portion. This permits traversal in both ways.  
Benefits: Simple bidirectional traversal and effective insertion and deletion at both ends.

**Question - Analyze the time complexity of each operation.**

Answer –

Add Task:   
Time Complexity: O(n) Explanation: It takes O(n) time to traverse to the end of the list in order to add a task.

Search:  
O(n) When you search, you browse through the list until you find the task or get to the end.

Traversing  
O(n), When traversing, every node in the list is visited once.

Delete Task:

O(n), Finding the job requires O(n) time; updating the pointers takes O(1) time. This is what deletion entail

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

Answer – The advantages of LinkedList are-

Dynamic Size: Linked lists are more adaptable for dynamic data since they can readily expand and contract in size.  
Effective Insertions/Deletions: Linked lists eliminate the necessity for shifting elements, as in arrays, allowing for the efficient insertion and deletion of elements, particularly at the beginning or end.  
Memory Usage: Linked lists prevent the requirement to pre-allocate a fixed size, as does the case with arrays, by allocating memory as needed for each element.