WEEK\_1\_ALGORITHMS\_DATA\_STRUCTURES

Exercise 5: **Task Management System**

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

Singly Linked List - A data structure where each node contains a data part and a reference (or link) to the next node in the sequence. Traversal can only be done in one direction (from head to tail). Insertion, deletion, and traversal requires traversing the list to find the desired position.

Doubly Linked List - A doubly linked list is a data structure similar to a singly linked list, except in it each node contains a reference to both the next and the previous node. Traversal can be done in both directions (from head to tail and from tail to head).

1. Analyze the time complexity of each operation.

Add Task: O(n) (inserting at the end requires traversing to the end).

Search Task: O(n) (linear search through the list).

Traverse Tasks: O(n) (iterating through the entire list).

Delete Task: O(n) (finding the task and updating references).

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

* Dynamic Size: Linked lists can grow and shrink in size dynamically without the need for resizing, unlike arrays.
* Efficient Insertions/Deletions: Insertions and deletions can be more efficient, especially when adding or removing elements at the beginning or middle of the list, without needing to shift elements as in arrays.
* Memory Utilization: Linked lists can be more memory-efficient when dealing with unpredictable sizes, as they do not require pre-allocated memory and are not stored in continuous locations in the memory.