**Exercise 5: Task Management System**

**Step 1: Understand Linked Lists**

**Types of Linked Lists**:

1. **Singly Linked List**:
   * **Structure**: Each node contains data and a reference (or link) to the next node in the sequence.
   * **Advantages**: Simple to implement, uses less memory compared to doubly linked lists.
   * **Disadvantages**: Only allows traversal in one direction (forward).
2. **Doubly Linked List**:
   * **Structure**: Each node contains data, a reference to the next node, and a reference to the previous node.
   * **Advantages**: Allows traversal in both directions (forward and backward), making certain operations (like deletion) more efficient.
   * **Disadvantages**: Uses more memory due to the additional reference, slightly more complex to implement.

**Step 4: Analysis**

**Time Complexity of Each Operation**:

* **Add**: O(n) - Adding a task to the end of the linked list requires traversing the list to find the end.
* **Search**: O(n) - Searching for a task by taskId requires traversing the list to find the matching node.
* **Traverse**: O(n) - Traversing the list involves visiting each node once.
* **Delete**: O(n) - Deleting a task by taskId requires finding the node and possibly adjusting the links.

**Advantages of Linked Lists Over Arrays for Dynamic Data**:

* **Dynamic Size**: Linked lists can grow and shrink in size dynamically, unlike arrays which have a fixed size.
* **Efficient Insertions/Deletions**: Insertions and deletions can be more efficient in linked lists, especially when dealing with large datasets, as they don't require shifting elements as in arrays.
* **Memory Allocation**: Linked lists allocate memory as needed for each element, avoiding the need to allocate a large block of memory upfront.

**Disadvantages of Linked Lists**:

* **Memory Overhead**: Linked lists use extra memory for storing references to the next (and possibly previous) node.
* **Sequential Access**: Linked lists do not support efficient random access to elements, making them slower than arrays for certain operations.