**Exercise 6: Library Management System**

**Scenario:**

You are developing a library management system where users can search for books by title or author.

**Understand Search Algorithms**

**Linear Search**

* Checks each element **sequentially** until the target is found or the end is reached.
* **Time Complexity**:
  + Best: O(1) (first item),
  + Average: O(n/2),
  + Worst: O(n)

**Binary Search**

* Works only on **sorted arrays/lists**.
* Repeatedly divides the list in half to find the target.
* **Time Complexity**:
  + Best: O(1),
  + Average/Worst: O(log n)

Binary Search is faster but **requires sorting** beforehand.

**Analysis**

**Time Complexity Comparison**

|  |  |  |  |
| --- | --- | --- | --- |
| **Algorithm** | **Best Case** | **Average Case** | **Worst Case** |
| **Linear Search** | **O(1)** | **O(n)** | **O(n)** |
| **Binary Search** | **O(1)** | **O(log n)** | **O(log n)** |

**When to Use Each**

|  |  |
| --- | --- |
| **Scenario** | **Use** |
| **Data is unsorted** | **Linear Search** |
| **Data is sorted** | **Binary Search** |
| **Small dataset** | **Linear Search** |
| **Large dataset with frequent queries** | **Binary Search (after sorting)** |