**Exercise 6: Library Management System**

**Scenario:**

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

**Steps:**

1. **Understand Search Algorithms:**
   * **Explain linear search and binary search algorithms.**

Linear Search: Works by iterating through each element in the list until it finds the target element or reaches the end of the list.

Binary Search: Works by dividing the sorted list into halves and repeatedly narrows down the search range by comparing the target element to the middle element of the current range.

1. **Setup:**
   * **Create a class Book with attributes like bookId, title, and author.**
2. **Implementation:**
   * **Implement linear search to find books by title.**
   * **Implement binary search to find books by title (assuming the list is sorted).**
3. **Analysis:**

* **Compare the time complexity of linear and binary search.**

1. Linear Search:

* Best Case: O(1) - The desired element is the first element.
* Average Case: O(n/2) ~ O(n) - The desired element is somewhere in the middle.
* Worst Case: O(n) - The desired element is the last element or not present.

1. Binary Search:

* Best Case: O(1) - The desired element is the middle element.
* Average Case: O(log n) - The algorithm divides the search interval in half each time.
* Worst Case: O(log n) - The desired element is not present or at the end of the search.
* **Discuss when to use each algorithm based on the data set size and order.**

***Linear Search:***

1. For small datasets, the simplicity of linear search makes it a suitable choice.
2. When the data is not sorted, linear search is the only option.

***Binary Search:***

1. For large datasets, the efficiency of binary search (O(log n)) makes it preferable.
2. Binary search requires the data to be sorted. If the data is already sorted or can be sorted efficiently, binary search is a good choice.