**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: This algorithm involves checking each element in the list sequentially until the target element is found or the end of the list is reached.

Binary Search: This algorithm works by repeatedly dividing a sorted list into halves and comparing the target element to the middle element of the current range, thus narrowing down the search interval.

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 element to be found is the first one in the list.
* Average Case: O(n/2) ~ O(n) - The element is somewhere in the middle of the list.
* Worst Case: O(n) - The element is either at the end or not present in the list.

1. Binary Search:

* Best Case: O(1) - The target element is the middle element of the list.
* Average Case: O(log n) - The search interval is halved with each step.
* Worst Case: O(log n) - The element is either absent or located at the end of the interval.
* **Discuss when to use each algorithm based on the data set size and order.**

***Linear Search:***

1. Suitable for small datasets due to its simplicity.
2. Necessary when the data is unsorted, as it can only be applied to unordered lists.

***Binary Search:***

1. More efficient for large datasets because of its (O(log n)) time complexity.
2. Requires that the data be sorted. If the dataset is sorted or can be sorted efficiently, binary search is the preferable method.