**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**.**
2. **Setup:**
   * Create a class Book with attributes like bookId, title, and author.
3. **Implementation:**
   * Implement linear search to find books by title.
   * Implement binary search to find books by title (assuming the list is sorted).
4. **Analysis:**
   * Compare the time complexity of linear and binary search.
   * Discuss when to use each algorithm based on the data set size and order.

**ANSWER:**

**Explain linear search and binary search algorithms.**

Linear Search:

* Linear search iterates through each element in the list one by one until it finds the target element or reaches the end of the list.
* Time Complexity: O(n), where n is the number of elements in the list.

Binary Search:

* Binary search works on a sorted list and repeatedly divides the search interval in half. If the target value is less than the middle element, it searches the left half; otherwise, it searches the right half.
* Time Complexity: O(log n), where n is the number of elements in the list.

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

| **Cases** | **Linear Search** | **Binary Search** |
| --- | --- | --- |
| **Worst case** | O(n) | O(log n) |
| **Average case** | O(n) | O(log n) |
| **Best case** | O(1) | O(1) |

**Discuss when to use each algorithm based on the data set size and order.**

* Use linear search when the dataset is small or unsorted.
* Use binary search when the dataset is large and sorted, as it is more efficient in terms of time complexity.