**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.

Solution:

* Linear Search:
  + Algorithm: Start from the beginning and check each element until the target is found or the end is reached.
  + Time Complexity: O(n) in the worst case, where n is the number of elements.
* Binary Search:
  + Algorithm: Divide the search interval in half repeatedly. Requires a sorted list.
  + Time Complexity: O(log n) in the worst case, where n is the number of elements.

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).

Solution:

Setup and Implementation part is in attached java file.

1. **Analysis:**
   * Compare the time complexity of linear and binary search.

Solution:

Time Complexity:

* Linear Search: O(n) because it may need to examine each element in the worst case.
* Binary Search: O(log n) because it reduces the search space by half each step, but requires the list to be sorted.
  + Discuss when to use each algorithm based on the data set size and order.

Solution:

When to Use Each Algorithm:

* Linear Search:
  + Best for small or unsorted lists.
  + Simple to implement.
* Binary Search:
  + Best for large, sorted lists.
  + More efficient for large datasets but requires maintaining the list in sorted order.