**ANSWER**

**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**:

* **Description**: Linear search is a straightforward search algorithm that checks each element in a list sequentially until the desired element is found or the list ends.
* **Time Complexity**: O(n) for best, average, and worst cases.
* **Use Cases**: Suitable for small or unsorted datasets.

**Binary Search**:

* **Description**: Binary search is an efficient algorithm that finds the position of a target value within a sorted array. It repeatedly divides the search interval in half, comparing the target value to the middle element.
* **Time Complexity**: O(log n) for best, average, and worst cases.
* **Use Cases**: Suitable for large, sorted datasets.

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

**Linear Search**:

* **Best Case**: O(1)
* **Average Case**: O(n)
* **Worst Case**: O(n)

**Binary Search**:

* **Best Case**: O(1)
* **Average Case**: O(log n)
* **Worst Case**: O(log n)
  + **Discuss when to use each algorithm based on the data set size and order.**

**Linear Search**:

* **Use When**:
  + The dataset is small.
  + The dataset is unsorted or rarely sorted.
  + Simplicity and ease of implementation are priorities.
  + Memory overhead needs to be minimal.

**Binary Search**:

* **Use When**:
  + The dataset is large and sorted.
  + Fast search times are crucial.
  + The overhead of sorting the data (if necessary) is acceptable.