**Exercise 6: Library Management System**

**Understand Search Algorithms:**

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

Answer -

Linear Search: In a linear search, each element in the list is examined one after the other until the target element is located or the list's end is reached. O(n) is the time complexity, where n is the number of elements in the list, in both the worst and average cases. If the target element is at position 1, then the best case scenario is O(1).

Binary Search: This algorithm is a proficient means of locating a certain element within a sorted list. It operates by halving the search interval on multiple occasions. The search proceeds in the bottom half if the target value is smaller than the middle element, and in the upper half otherwise.  
In both the worst and average cases, time complexity is O(log n), where n is the number of

**Analysis:**

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

Answer – Time complexity for Linear search linear i.e O(n), and time complexity for Binary Searc is O(log n).

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

Answer - Linear Search

Appropriate for small or unsorted datasets when it is not feasible to sort the list beforehand.  
Benefits: Easy to use and eliminates the need to sort the list.  
A disadvantage is that its O(n) time complexity makes it inefficient for huge datasets.

Binary Lookup:  
Appropriate for huge, sorted datasets when effective search performance is needed.  
Benefits: O(log n) time complexity means that huge datasets are processed much more quickly.  
Cons: The list must be sorted, and there is more work involved in keeping the sorted order.