Library Management System

1. Linear Search:

* Linear search is searching algorithm where we search the whole array of inputs to get the target
* It is just like brute force
* We terminate when we get the target

2. Binary search:

* Binary search is a searching algorithm which works if the array is sorted
* The concept is two divide the array into two halves where first half is less than mid value and second half is more than mid value
* We find mid value by (left+right)/2 and use while loop until left<=right
* We see if mid value is target. If then we break the loop, otherwise we update left and right according to the condition (array[mid]>target)
* Thus we reduce the number of iterations from N to Log N

3. Linear search vs Binary search:

a. Best case:

* Linear search: O(1), this occurs when the target element is at the very first index
* Binary search: O(1), this occurs when the array length is odd and target element is at exactly middle

b. Average case:

* Linear search: O(n), this occurs when the element is within the array but not in the first index
* Binary search: O(log n), this occurs when the element is within the array but not in the middle

c. Worst case

* Linear search: O(n), this occurs when the target element does not exist in the array or when the target element is found at the last index.
* Binary search: O(log n), this occurs when the target element does not exist in the array or when the target element is found after maximum iterations when the target element is the only element left in the search space.

4. Use Case:

* Linear Search is easy and versatile, suitable for small data sets or unsorted data.
* Binary Search works much quicker with large data sets but needs sorted data, which can incur overhead if data is frequently changing.