# Exercise 6: Library Management System

# 1.UNDERSTAND THE PROBLEM:

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

**Linear Search:**

* **Description:** Sequentially checks each element until the desired element is found or the end of the list is reached.
* **Time Complexity:**
  + **Best Case:** O(1) – if the element is at the beginning.
  + **Average Case:** O(n) – for typical scenarios.
  + **Worst Case:** O(n) – if the element is at the end or not present.

**Binary Search:**

* **Description:** Efficiently searches for an element in a sorted array by repeatedly dividing the search interval in half.
* **Time Complexity:**
  + **Best Case:** O(1) – if the element is at the midpoint.
  + **Average Case:** O(log n) – for typical scenarios.
  + **Worst Case:** O(log n) – for typical scenarios.

# 2. ANALYSIS:

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

**Time Complexity Comparison:**

* **Linear Search:**
  + **Best Case:** O(1) – if the book is at the beginning.
  + **Average Case:** O(n) – for typical scenarios.
  + **Worst Case:** O(n) – if the book is at the end or not present.
* **Binary Search:**
  + **Best Case:** O(1) – if the book is at the midpoint.
  + **Average Case:** O(log n) – for typical scenarios.
  + **Worst Case:** O(log n) – for typical scenarios.

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

* **Linear Search:** Suitable for unsorted data or small datasets where sorting is not practical.
* **Binary Search:** Efficient for large, sorted datasets where quick lookups are needed.