Library Management System

1. Understand Search Algorithms

Linear Search:

Definition: Linear search is a straightforward algorithm that checks each element in the list sequentially until the target element is found or the list ends.

Time Complexity: O(n), where n is the number of elements in the list.

Use Case: Suitable for small or unsorted lists where the overhead of sorting is not justified.

Binary Search:

Definition: Binary search is an efficient algorithm that works on sorted lists. It repeatedly divides the search interval in half and compares the target value to the middle element.

Time Complexity: O(log n), where n is the number of elements in the list.

Use Case: Ideal for large, sorted lists where search operations are frequent and fast performance is crucial.

Analysis

Time Complexity Comparison:

Linear Search: O(n)

Each element is checked sequentially until the target is found or the end of the list is reached.

Performance degrades linearly with the size of the list.

Binary Search: O(log n)

The search interval is halved with each step.

Performance remains logarithmic with respect to the size of the list, making it significantly faster for large datasets.