**Understand Search Algorithms:**

**Q1. Explain linear search and binary search algorithms.**

Answer:

**Linear Search Algorithm**

Linear search is a simple search algorithm that iterates through each element in a list to find a specific value. It checks each element one by one until it finds a match or reaches the end of the list.

**Example:**

java

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1public class LinearSearch {

2 public static int linearSearch(String[] arr, String target) {

3 for (int i = 0; i < arr.length; i++) {

4 if (arr[i].equals(target)) {

5 return i; // return index of target element

6 }

7 }

8 return -1; // return -1 if target not found

9 }

10}

**Binary Search Algorithm**

Binary search is a more efficient search algorithm that works by dividing the list in half and searching for the target element in one of the two halves. This process is repeated until the target element is found or the list is exhausted.

**Example:**

java

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1public class BinarySearch {

2 public static int binarySearch(String[] arr, String target) {

3 int low = 0;

4 int high = arr.length - 1;

5 while (low <= high) {

6 int mid = (low + high) / 2;

7 if (arr[mid].equals(target)) {

8 return mid; // return index of target element

9 } else if (arr[mid].compareTo(target) < 0) {

10 low = mid + 1;

11 } else {

12 high = mid - 1;

13 }

14 }

15 return -1; // return -1 if target not found

16 }

17}

**Analysis:**

**Q1. Compare the time complexity of linear and binary search.**

Answer: **Time Complexity Comparison**

| **Algorithm** | **Time Complexity** |
| --- | --- |
| Linear Search | O(n) |
| Binary Search | O(log n) |

Binary search has a much faster time complexity than linear search, especially for large datasets.

**Q2. Discuss when to use each algorithm based on the data set size and order.**

Answer:

* Use linear search when the dataset is small or unsorted.
* Use binary search when the dataset is large and sorted.

Note: In a real-world library management system, you would likely use a more efficient data structure, such as a hash table or a database, to store and search for books. These algorithms are for illustrative purposes only.