Analysis

1. Compare the time complexity of linear and binary search algorithms.

Ans.

**Linear Search:** Linear search scans through each element in a list one by one until it finds the target value or reaches the end of the list.

Time Complexity:

Best Case: 𝑂(1) — This occurs if the target value is the first element in the list.

Average Case: 𝑂(𝑛) — On average, the search will need to examine half of the elements in the list.

Worst Case: 𝑂(𝑛) — This occurs if the target value is at the end of the list or not present at all, requiring the search to check every element.

**Binary Search:** Binary search works on a sorted list by repeatedly dividing the search interval in half. It compares the target value with the middle element of the interval and eliminates half of the search space based on the comparison.

Time Complexity:

Best Case: 𝑂(1) — This occurs if the target value is the middle element of the list.

Average Case: 𝑂(log𝑛) — On average, binary search will require log𝑛 comparisons to find the target value or determine that it is not in the list.

Worst Case: 𝑂(log𝑛) — This occurs when the target value is either present in the list or not, requiring log𝑛 comparisons.

Explanation: Binary search has a time complexity of 𝑂(log𝑛) because it repeatedly halves the search space, making the number of comparisons proportional to the logarithm of the number of elements in the list.

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

Ans. Linear search is a search that finds an element in the list by searching the element sequentially until the element is found in the list. On the other hand, a binary search is a search that finds the middle element in the list recursively until the middle element is matched with a searched element.

Linear search is not suitable for the large data set. If we want to search the element, which is the last element of the array, a linear search will start searching from the first element and goes on till the last element, so the time taken to search the element would be large. On the other hand, binary search is suitable for a large data set as it takes less time.

Linear search can be used on both single and multidimensional array, whereas the binary search can be implemented only on the one-dimensional array.