Explain different sorting algorithms (Bubble Sort, Insertion Sort, Quick Sort, Merge Sort).

Bubble Sort: A simple comparison-based algorithm. It repeatedly steps through the list, compares adjacent elements, and swaps them if they are in the wrong order. This process is repeated until the list is sorted.

Time Complexity:

Best Case: O(n) (when the list is already sorted)

Average Case: O(n²)

Worst Case: O(n²)

Insertion Sort: Builds the final sorted array one item at a time. It is much less efficient on large lists than more advanced algorithms like quick sort or merge sort.

Time Complexity:

Best Case: O(n) (when the list is already sorted)

Average Case: O(n²)

Worst Case: O(n²)

Quick Sort:A divide-and-conquer algorithm. It picks an element as a pivot and partitions the array around the pivot. The process is recursively applied to the sub-arrays.

Time Complexity:

Best Case: O(n log n)

Average Case: O(n log n)

Worst Case: O(n²) (when the smallest or largest element is always chosen as the pivot)

Merge Sort:Also a divide-and-conquer algorithm. It divides the list into two halves, recursively sorts each half, and then merges the two sorted halves.

Time Complexity:

Best Case: O(n log n)

Average Case: O(n log n)

Worst Case: O(n log n)

Compare the performance (time complexity) of Bubble Sort and Quick Sort.

Bubble Sort:

* Best Case: O(n)
* Average Case: O(n²)
* Worst Case: O(n²)

Quick Sort:

* Best Case: O(n log n)
* Average Case: O(n log n)
* Worst Case: O(n²)

Discuss why Quick Sort is generally preferred over Bubble Sort.

* Quick Sort is generally much faster than Bubble Sort due to its O(n log n) average-case time complexity, compared to Bubble Sort's O(n²) average-case time complexity.
* Quick Sort scales better with larger datasets, making it more suitable for applications like e-commerce platforms where the volume of data can be substantial.
* Although Quick Sort can have a worst-case time complexity of O(n²), this can be mitigated by choosing good pivot strategies (like using the median-of-three method), which ensures it performs well in practice.