4. Analysis:

Performance Comparison:

Bubble Sort:

- Time: O(n^2)

- Space: O(1)

- Pros: Simple to implement

- Cons: Very slow on large datasets

Quick Sort:

- Time: Best/Average O(n log n), Worst O(n^2)

- Space: O(log n)

- Pros: Fast, efficient for large datasets

- Cons: Recursive, not stable by default

Why Quick Sort is Preferred:

- Bubble Sort becomes unusable with large data due to quadratic growth.

- Quick Sort balances performance and simplicity, especially with good pivot strategies.

- In real systems, optimized sorting libraries (like Java’s Arrays.sort using Dual-Pivot QuickSort) are used.