**Sorting Algorithms**

**Bubble Sort**

* **Description:** Bubble Sort 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)
  + Average Case: O(n2)
  + Worst Case: O(n2)

**Insertion Sort**

* **Description:** Insertion Sort builds the final sorted array one item at a time. It is much less efficient on large lists than more advanced algorithms such as quicksort, heapsort, or merge sort.
* **Time Complexity:**
  + Best Case: O(n)
  + Average Case: O(n2)
  + Worst Case: O(n2)

**Quick Sort**

* **Description:** Quick Sort is a divide-and-conquer algorithm. It works by selecting a 'pivot' element from the array and partitioning the other elements into two sub-arrays according to whether they are less than or greater than the pivot. The sub-arrays are then sorted recursively.
* **Time Complexity:**
  + Best Case: O(nlogn)
  + Average Case: O(nlogn)
  + Worst Case: O(n2) (rare, depends on pivot selection)

**Merge Sort**

* **Description:** Merge Sort is also a divide-and-conquer algorithm. It works by dividing the array into two halves, recursively sorting each half, and then merging the sorted halves.
* **Time Complexity:**
  + Best Case: O(nlogn)
  + Average Case: O(nlogn), Worst Case: O(nlogn)

**Analysis**

**Time Complexity Comparison**

* **Bubble Sort**:
  + Best Case: O(n)
  + Average Case: O(n2)
  + Worst Case: O(n2)
* **Quick Sort**:
  + Best Case: O(nlogn)
  + Average Case: O(nlogn)
  + Worst Case: O(n2) (depends on pivot selection, rare)

**Why Quick Sort is Preferred Over Bubble Sort**

* **Efficiency**: Quick Sort is generally much faster than Bubble Sort for large datasets because its average time complexity is O(nlogn), while Bubble Sort is O(n2).
* **Practical Performance**: Quick Sort has a smaller constant factor and better cache performance than many other sorting algorithms, making it faster in practice despite its worst-case scenario.
* **Versatility**: Quick Sort can be implemented in-place, requiring only O(logn) additional memory space, whereas other O(nlogn) algorithms like Merge Sort require more space.