Understanding Sorting Algorithms

Cracking Coding Interview @ Ostad
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Introduction to Sorting

- **Definition**: Sorting is the process of arranging elements in a specific order, often in ascending or descending order.
- Fundamental operation in computer science with applications in databases, search algorithms, and more.

Example-

Unsorted array

6	3	0	9	2

↓ Sorting algorithm

Sorted array

0	2	3	6	9
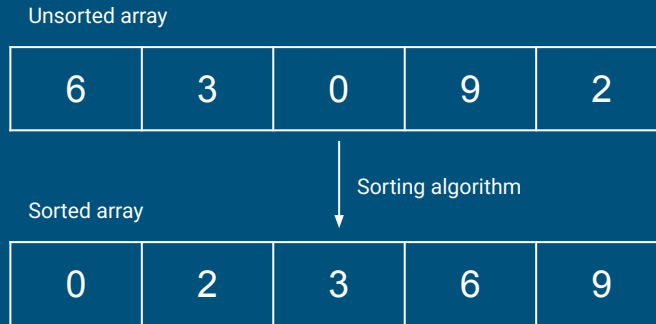
Common Sorting Algorithms

Sorting Algorithm	Time Complexity (Best case)	Time Complexity (Worst case)	Time Complexity (Average)	Space Complexity
Bubble Sort	n	n2	n2	1
Selection Sort	n2	n2	n2	1
Insertion Sort	n	n2	n2	1
Merge Sort	nlog n	nlog n	nlog n	n
Quicksort	nlog n	n2	nlog n	log n
Counting Sort	n+k	n+k	n+k	max
Radix Sort	n+k	n+k	n+k	max
Bucket Sort	n+k	n2	n	n+k
Heap Sort	nlog n	nlog n	nlog n	1
Shell Sort	nlog n	n2	nlog n	1

Bubble Sort

Bubble sort is a sorting algorithm that compares two adjacent elements and swaps them until they are in the intended order.

Just like the movement of air bubbles in the water that rise up to the surface, each element of the array move to the end in each iteration. Therefore, it is called a bubble sort.

Visualgo: https://visualgo.net/en/sorting

Selection Sort

Selection sort is a sorting algorithm that selects the smallest element from an unsorted list in each iteration and places that element at the beginning of the unsorted list.

Visualgo: https://visualgo.net/en/sorting

Insertion Sort Algorithm

Insertion sort is a sorting algorithm that places an unsorted element at its suitable place in each iteration.

Insertion sort works similarly as we sort cards in our hand in a card game.

We assume that the first card is already sorted then, we select an unsorted card. If the unsorted card is greater than the card in hand, it is placed on the right otherwise, to the left. In the same way, other unsorted cards are taken and put in their right place.

Visualgo: https://visualgo.net/en/sorting

Merge Sort

Merge Sort is one of the most popular sorting algorithms that is based on the principle of **Divide and Conquer** Algorithm.
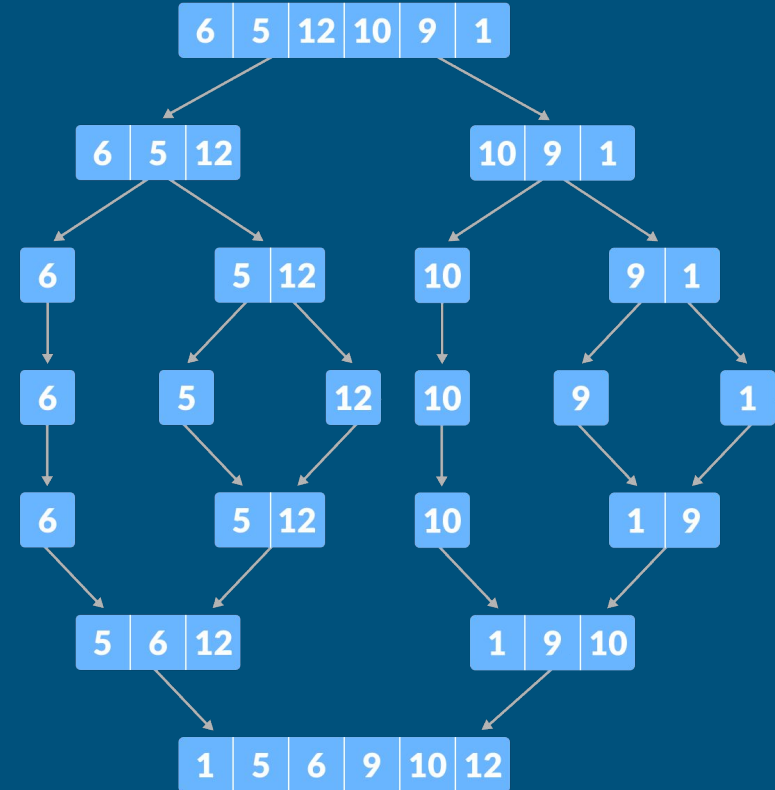
Quick Sort

Quicksort is a sorting algorithm based on the **Divide and Conquer** approach where an array is divided into subarrays by selecting a pivot element (element selected from the array).

1. While dividing the array, the pivot element should be positioned in such a way that elements less than pivot are kept on the left side and elements greater than pivot are on the right side of the pivot.
2. The left and right subarrays are also divided using the same approach. This process continues until each subarray contains a single element.
3. At this point, elements are already sorted. Finally, elements are combined to form a sorted array.

Visualgo: https://visualgo.net/en/sorting

Counting Sort

Counting sort is a sorting algorithm that sorts the elements of an array by counting the number of occurrences of each unique element in the array. The count is stored in an auxiliary array and the sorting is done by mapping the count as an index of the auxiliary array.

Visualgo: https://visualgo.net/en/sorting

Q & A