DAILY DSA | DAY-8 | SORTING ALGORITHMS – Quick Sort|
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We will talk about the **"Quick sort" - An efficient time complexity approach to sort large datasets.**

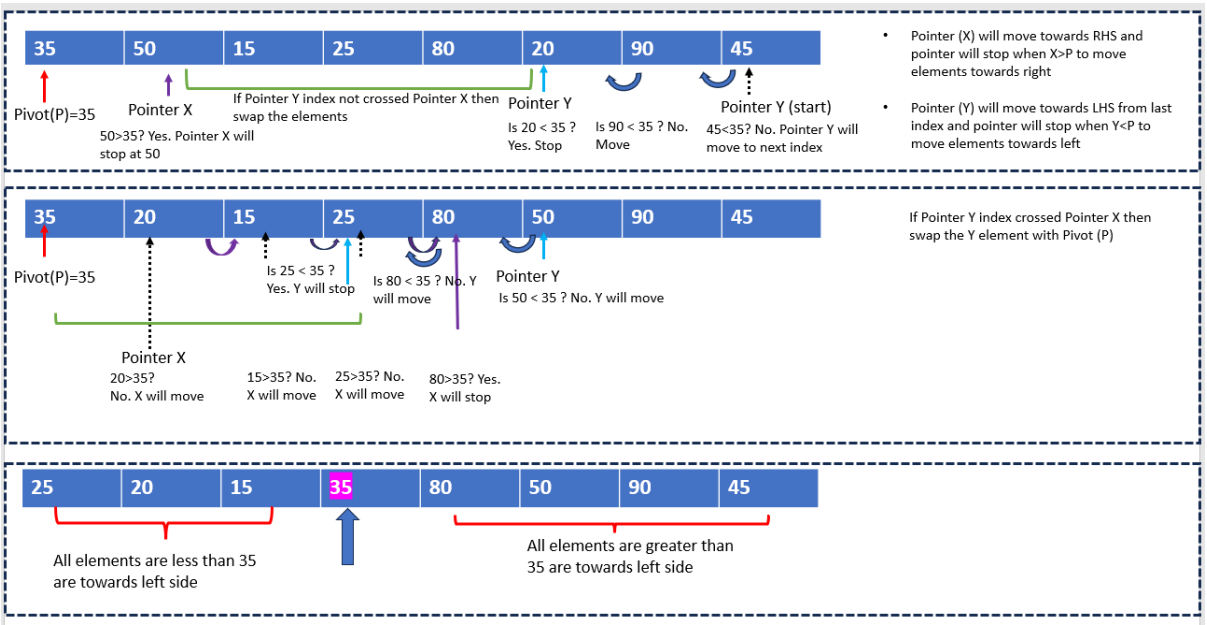
Quick sort is a fast sorting algorithm based on the Divide and Conquer strategy (Splitting the array of data into smaller sub-arrays)

Approach:
The quick sort algorithm has 3 major steps:

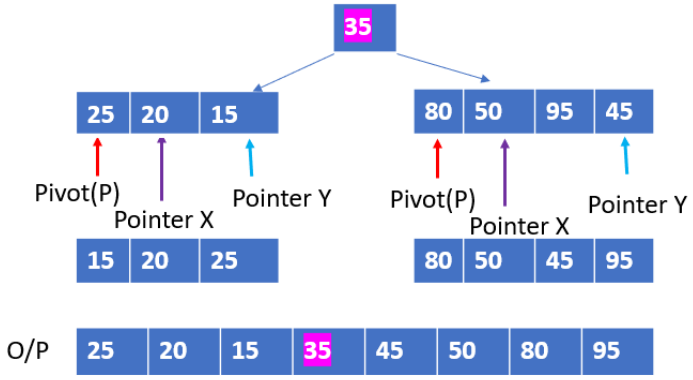
1. **Pick (Pivot element) P**: Select an element either
   a. Any element at random
   b. The first or last element
   c. Middle element
2. **Divide**: Split the array at the pivot element, Move smaller elements to the left side of the pivot element and larger elements to the right.
3. **Repeat and combine**: Repeat the steps & combine the arrays that have been previously sorted.

Input array: [35, 50, 15, 25, 80, 20, 90, 45]

- The pivot element (P) is considered as the first element 35 (P=35)
- Re-arranging array: Rearrange the array such that all elements < pivot are arranged towards left & elements>pivot are arranged towards right



- Repeat the process to list the left side of the Pivot (P) and the right side of the pivot (P) separately



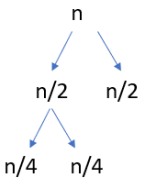
Time complexity:

- **Best case complexity**: When the partitioning algorithm chooses the middle element or near middle element as Pivot (P)

  T(n) = T(n/2) + T(n/2) + n

  T(n) = 2T(n/2)+n

  T=O(N log N)



- **Worst case complexity:** Worst case complexity is when the partitioning algorithm picks the largest or smallest element as the pivot element every time. The worst-case complexity:

  T(n) = T(O) + T(n-1) +O(n)

  T(n) = O(N**2)

Advantages:

1. It works **rapidly & efficiently**
2. It has the **best time complexity** when compared to the other sorting algorithm
3. Quick sort has the complexity of O(long), making **good choices when space is limited.**

Disadvantages:

1. **Unstable:** This sorting technique is considered unstable since it does not maintain key-value pair initial order
2. **Worst case complexity:** When the pivot element is largest or smallest, or when all of the elements are of the same size. The performance will be significantly impacted.