DIVIDE & CONQUER ALGORITHMS

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WHAT IS DIVIDE AND CONQUER?

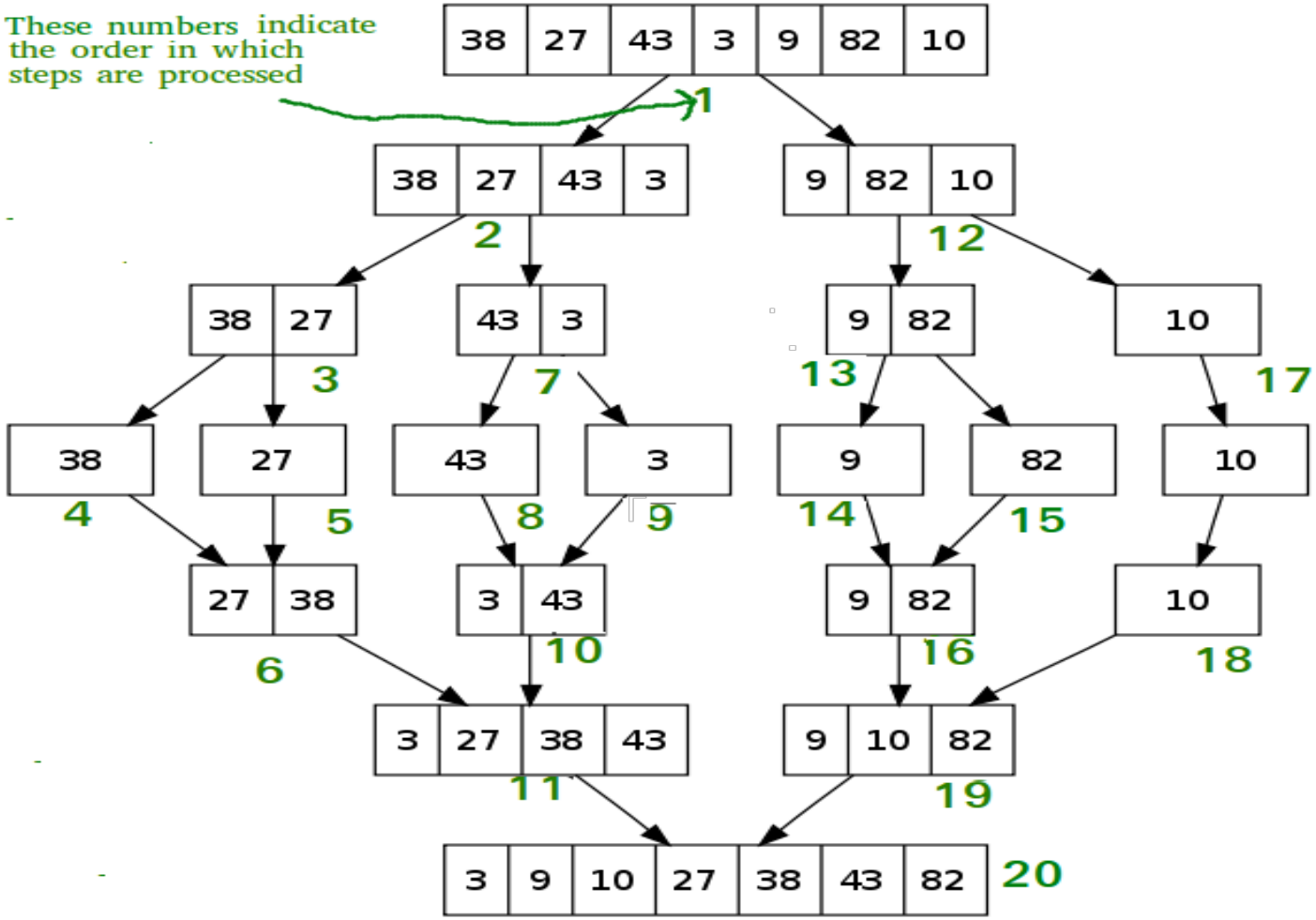
- *Divide and Conquer is an algorithmic paradigm in which the problem is solved using the Divide, Conquer, and Combine strategy.*

1. **Divide:** This involves dividing the problem into smaller sub-problems.
2. **Conquer:** Solve sub-problems by calling recursively until solved.
3. **Combine:** Combine the sub-problems to get the final solution of the whole problem.

SOME STANDARD ALGORITHMS:

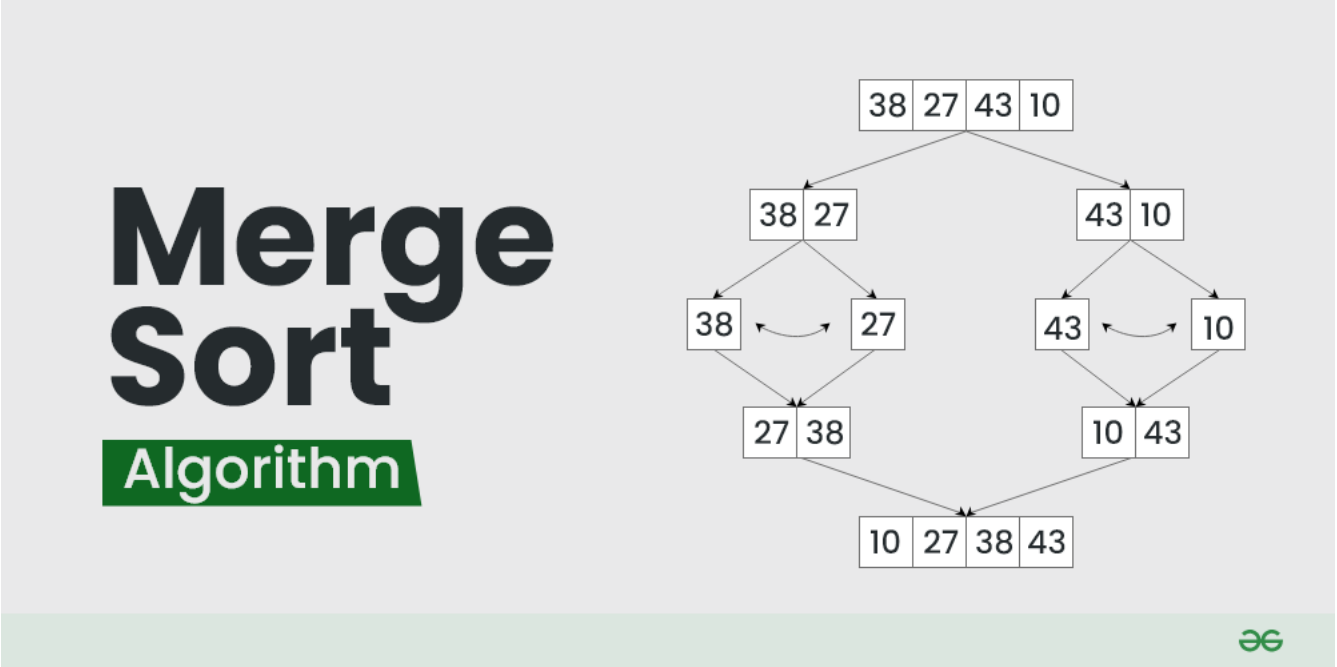
1. Binary Search
2. **Merge Sort**
3. Quick Sort
4. **Calculate pow(x, n)**
5. Karatsuba algorithm for fast multiplication
6. Strassen's Matrix Multiplication
7. Convex Hull (Simple Divide and Conquer Algorithm)
8. Quickhull Algorithm for Convex Hull

EXAMPLE OF DIVIDE AND CONQUER ALGORITHM



MERGE SORT

- *Defined as a sorting algorithm that works by dividing an array into smaller subarrays, sorting each subarray, and then merging the sorted subarrays back together to form the final sorted array.*

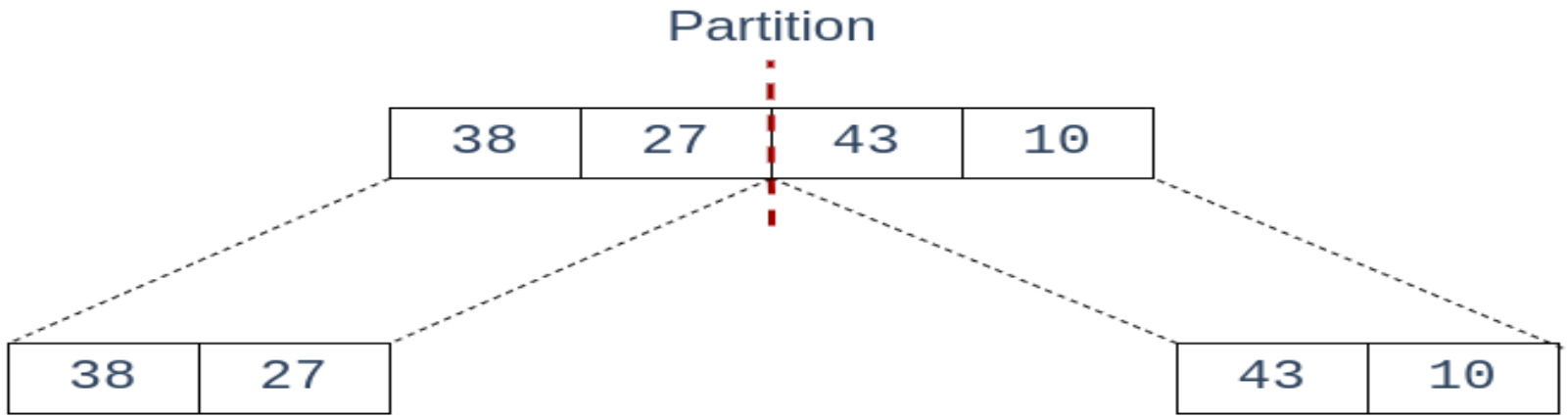


COMPLEXITY OF MERGE SORT

- Merge Sort is a recursive algorithm and time complexity can be expressed as following recurrence relation. $T(n) = 2T(n/2) + O(n)$ The solution of the above recurrence is O(nLogn).

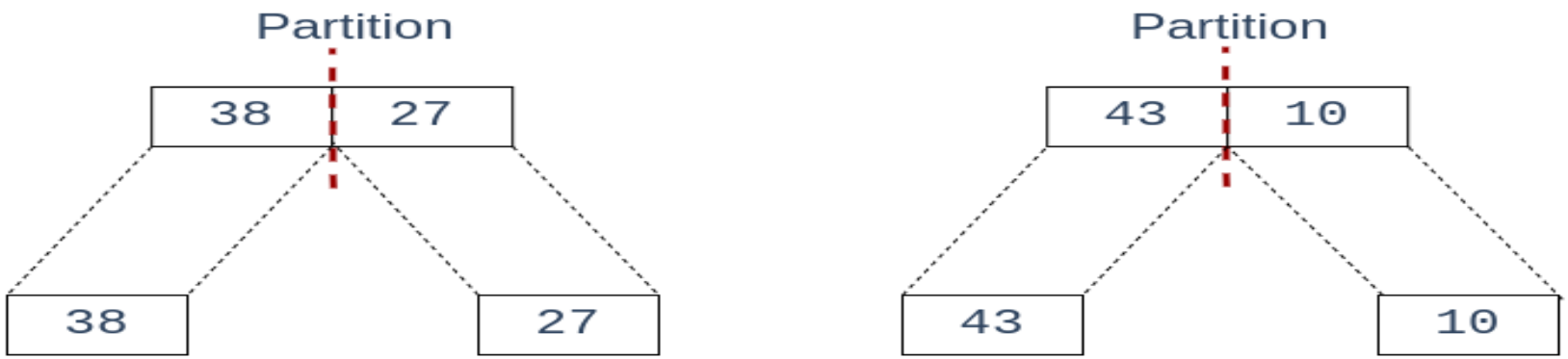
STEP 01

Splitting the Array into two equal halves



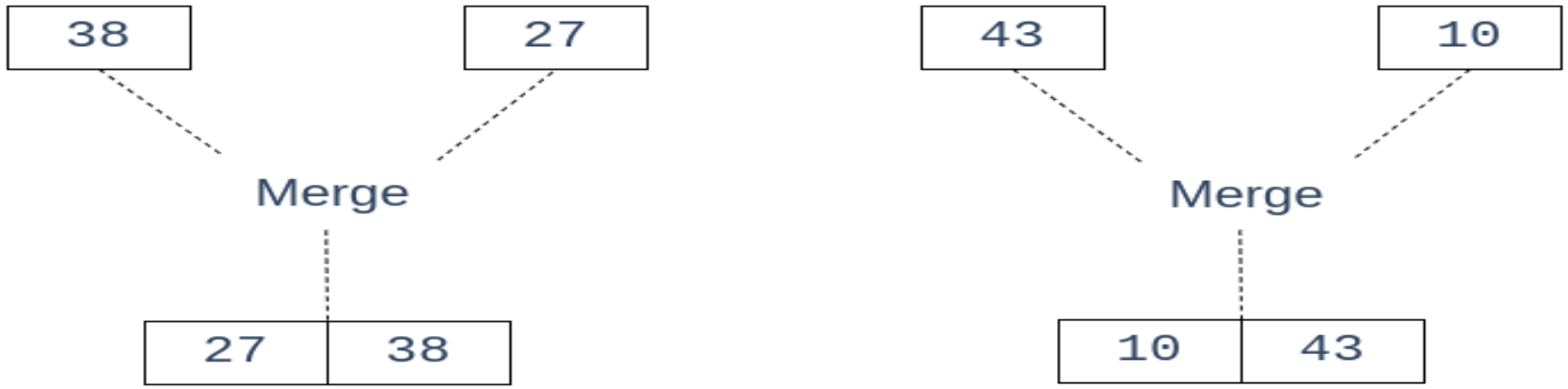
STEP 02

Splitting the subarrays into two halves



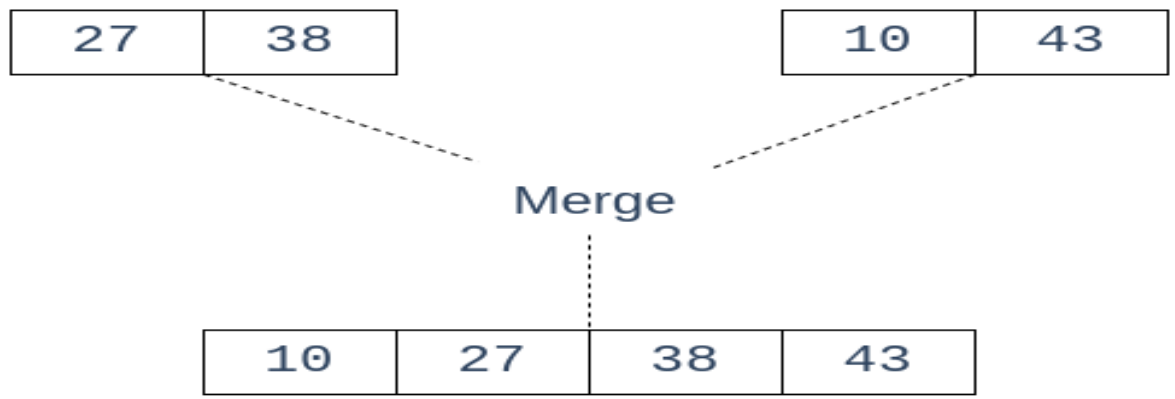
STEP 03

Merging unit length cells into sorted subarrays



STEP 04

Merging sorted subarrays into the sorted array



CALCULATE POW(X, N)

- Given two integers **x** and **n**, write a function to compute $\mathbf{x^n}$. We may assume that x and n are small and overflow doesn't happen.