

## Brute Force - Algorithm Design Technique

- it is a problem-solving approach that tries all possible solutions and selects the correct or best one.
- It is also called:
  - Exhaustive Search
  - Generate-and-Test
  - Naïve Approach
- Brute force works in three main steps:
  - Generate all possible candidate solutions
  - Test each candidate
  - Select the valid or optimal one
- No shortcuts. No optimization tricks.
- Where Brute Force is Used
  - Brute force is commonly used in:
    - Searching problems
    - Sorting (basic sorts)
    - Combinatorial problems
    - String matching
    - Optimization problems
- When to Use Brute Force
  - Use brute force when:
    - Input size is small
    - Constraints are small
    - You need a quick baseline solution
    - No optimized solution is known
    - You are verifying correctness
- How to Improve a Brute Force Algorithm
  - After writing brute force:
    - Identify repeated computations
    - Remove unnecessary comparisons
    - Use better data structures
    - Use pruning
    - Apply dynamic programming
    - Use divide-and-conquer

## Divide and Conquer - Algorithm Design Technique

- Divide and Conquer is an algorithm design technique that divides a problem into smaller subproblems, solves them recursively, and then combines their solutions to solve the original problem.

- Every Divide and Conquer algorithm follows:

1. Divide

- Break the problem into smaller subproblems.

2. Conquer

- Solve the subproblems recursively.

3. Combine

- Merge the solutions of subproblems.

- Uses recursion

- Subproblems are independent

- Reduces problem size each step

- Often improves time complexity

- Advantages

- Efficient for large inputs

- Reduces time complexity

- Structured problem solving

- Easy to parallelize

- Disadvantages

- Uses recursion (stack space)

- Extra memory (like Merge Sort)

- Not always better (depends on problem)

- When to Use Divide & Conquer

- Use when:

- Problem can be broken into independent subproblems

- Subproblems are similar to original

- Solution can be combined efficiently

- Large input size