

# Problem Title: Find the Greatest Common Divisor (GCD) of N Numbers

Company: Amazon

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## Scenario:

In large-scale systems, finding a common pattern or factor among multiple datasets is often required for optimization. Similarly, in number theory, the **Greatest Common Divisor (GCD)** helps determine the largest number that divides a set of numbers without leaving a remainder.

Your task is to **compute the GCD of  $n$  integers** efficiently.

## Problem Statement:

Given  $n$  numbers, find the greatest common denominator between them.

For example, given the numbers [42, 56, 14], return 14.

## Input Format:

- First line: integer  $n$  (number of integers).
- Second line:  $n$  integers separated by space.

## Output Format:

- A single integer representing the GCD of the given numbers.

## Example 1:

```
Input:  
3  
42 56 14
```

```
Output:  
14
```

## Explanation:

- Factors of 42  $\rightarrow \{1, 2, 3, 6, 7, 14, 21, 42\}$
- Factors of 56  $\rightarrow \{1, 2, 4, 7, 8, 14, 28, 56\}$
- Factors of 14  $\rightarrow \{1, 2, 7, 14\}$
- Greatest common factor = **14**

## Example 2:

Input:

4  
8 16 32 64

Output:

8

### Constraints:

- $1 \leq n \leq 10^5$
- $1 \leq \text{arr}[i] \leq 10^9$

### Approach Hints:

- Use the **Euclidean Algorithm** for efficiency:
    - $\text{gcd}(a, b) = \text{gcd}(b, a \% b)$
    - Extend to  $n$  numbers by iteratively applying  $\text{gcd}(\text{result}, \text{arr}[i])$ .
  - Time Complexity:  **$O(n \log M)$**  (where  $M$  is the largest number).
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### Practice Links:

- [LeetCode – Find Greatest Common Divisor of Array](#)
  - [GeeksforGeeks – GCD of N numbers](#)
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### Video Explanations:

- [Euclidean Algorithm – GCD Explained](#)
- [GFG – GCD of Multiple Numbers](#)