**Mathematical Algorithms Assignments**

**Problem 1: Find GCD of Two Numbers**

Given two non-negative integers m and n, we have to find their greatest common divisor (GCD). It is the largest number which is a divisor of both m and n (Using Brute Force Approach and Euclidean Algorithms)

**Some important note:**

* If any one of the integers is 0, then the GCD is the other number. It means, if m = 0, n != 0, then GCD(m, n) = n. Similarly, if m != 0, n = 0, then GCD(m, n) = m.
* When both m and n are 0, their GCD is undefined i.e. it can be any arbitrarily large number!
* If the smaller of the two numbers can divide the larger number then the GCD is the smaller number.

**Examples:**

* Input: m = 40, n = 32, Output: 8

Explanation: Integers 1, 2, 4, and 8 can divide both 40 and 30. Here 8 is the largest number, So, GCD (40, 30) = 10.

* Input: m = 60, n = 40, Output: 20

Explanation: Integers 1, 2, 4, 5, 10 and 20 can divide both 60 and 40. Here 20 is the largest number, So, GCD (40, 30) = 10.

**Problem 2: Prime Numbers**

A prime number is defined as a natural number greater than 1 and is divisible by only 1 and itself.

## Properties of Prime Numbers:

* Every number greater than 1 can be divided by at least one prime number.
* Every even positive integer greater than 2 can be expressed as the sum of two primes.
* Except 2, all other prime numbers are odd. In other words, we can say that 2 is the only even prime number.
* Two prime numbers are always coprime to each other.
* Each composite number can be factored into prime factors and individually all of these are unique in nature.

**Problem 3**

Given an array arr[ ] of size N having elements, the task is to find the next greater element for each element of the array in order of their appearance in the array.

Next greater element of an element in the array is the nearest element on the right which is greater than the current element.

If there does not exist next greater of current element, then next greater element for current element is -1. For example, next greater of the last element is always -1.

**Example 1:**

**Input:**

N = 4, arr[] = [1 3 2 4]

**Output:**

3 4 4 -1

**Explanation:**

In the array, the next larger element to 1 is 3 , 3 is 4 , 2 is 4 and for 4 ? since it doesn't exist, it is -1.

**Problem 4**

Given an array arr of non-negative integers and an integer sum, the task is to count all subsets of the given array with a sum equal to a given sum.

Note: Answer can be very large, so, output answer modulo 109.

**Example 1:**

**Input:** N = 6, arr = [5, 2, 3, 10, 6, 8], sum = 10

**Output:** 3

**Explanation**: {5, 2, 3}, {2, 8}, {10} are possible subsets.

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