Ask Doubt

From <a href="https://www.learning.algozenith.com/problems/How-Many-Solutions-219">https://www.learning.algozenith.com/problems/How-Many-Solutions-219</a>

## Description

Given the value of integer N how many solutions does the following equation have?

$$\frac{1}{x} + \frac{1}{y} = \frac{1}{N}$$

If x and y are integers there is only a finite number of solutions but if x and y are real numbers then there can be an infinite number of solutions. What if x and y are floating-point numbers with limited size, e.g. x and y are floating point numbers with d digits after the decimal points, how many different solutions will be there?

## **Input Format**

Input file contains at most 2000 lines of input. Each line contains two integers N (0 <  $N \le 10000000000$ ) and d (0  $\le d \le 1000$ ), here d means that there can be maximum d digits after the decimal point. Input is terminated by a line containing two zeros. This line should not be processed.

## **Output Format**

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For each line of input, produce one line of output which contains an integer *T*. This line contains the number of different solutions the equation has for the given value of

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Number theory Page 3

## **Paired Cubes**

From < https://www.learning.algozenith.com/problems/Paired-Cubes-211>

# Description

You have given n positive integers  $A_1$ ,  $A_2$ , ...,  $A_n$ . Your task is to find the number of pairs (i, j) such that  $A_i * A_j$  is a **cube number**.

## Input Format

The first line of input contains n - the size of the array. The second line of input contains n space-separated integers  $A_1, A_2, ..., A_n$ .

## **Output Format**

Print the answer on a new line.

## Constraints

 $1 \le n \le 10^5$  $1 \le A_i \le 10^6$ 

Ask Doubt

Encremental

Processing

Using map to

track frequencies

technique

<u>logic</u>

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 $frn = P_{1/3} P_{2}^{1/3}$   $for mare p_{3/3} P_{2}^{3-42/3}$ 

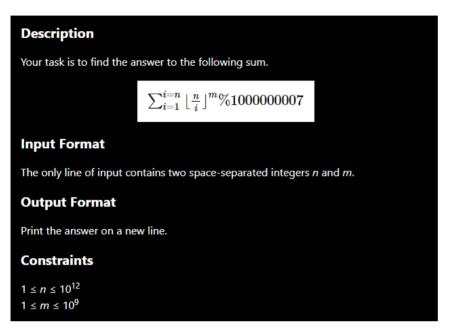
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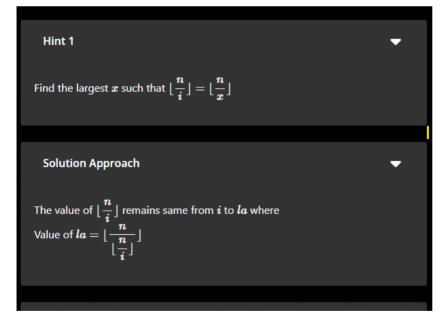
# Hard Floor

• Ask Doubt

From <a href="https://www.learning.algozenith.com/problems/Hard-Floor-217">https://www.learning.algozenith.com/problems/Hard-Floor-217</a>



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From <a href="https://www.learning.algozenith.com/problems/Multiply-All-GCDs-164">https://www.learning.algozenith.com/problems/Multiply-All-GCDs-164</a>

You are given N integers (not necessarily distinct) =>  $A_1$ ,  $A_2$ ,  $A_3$ , ...,  $A_N$ . There are  $2^N$  possible subsets (including the empty subset).

The GCD of a subset is defined as the greatest common divisor of all the integers in that subset.

You need to find the product of the GCDs of all the 2<sup>N</sup> possible subsets you can construct from *A*. Since the answer can be large, you need to output the answer modulo 1000000007. Do you think you can solve this question?

Note: The greatest common divisor of an empty subset is 1.

#### **Input Format**

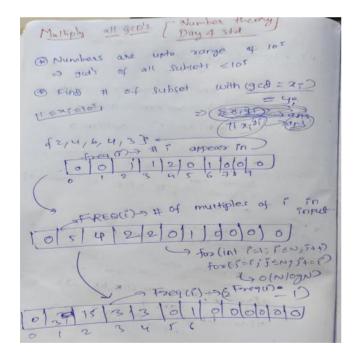
The first line of input consists of a single integer *T* denoting the number of test cases. The description of *T* test cases follow.

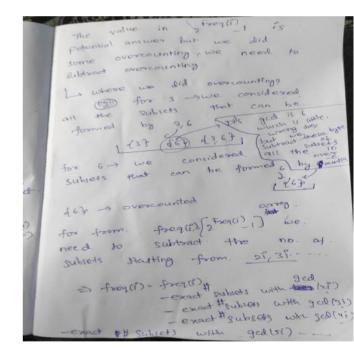
The first line of each test case consists of a single integer N. The second line of each test case consists of N space-separated integers  $A_1$ ,  $A_2$ , ...,  $A_N$ .

#### **Output Format**

For each test case, output a single integer on a separate line denoting the answer for that test case. Note that you need to output all the values modulo  $10000000007 (10^9 + 7)$ 

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## GCD of Products

Ask Doubt

From < https://www.learning.algozenith.com/problems/GCD-of-Products-92>

## Description

You have to calculate the GCD of *N* numbers. Since the numbers are too large to be written as numbers, they are written as products of smaller numbers. Find their GCD.

## **Input Format**

The first line of the input contains one integer N - the number of numbers. Each of the next N lines contains an integer M followed by M space-separated integers,  $A_1$ ,  $A_2$ ,...,  $A_M$  - the numbers whose product is the i-th number. It is guaranteed that the sum of M over all N numbers doesn't exceed  $10^6$ .

## **Output Format**

Print the GCD on a single line. Since this number might be pretty big, output it modulo  $10^9+7$ .

## Constraints

 $2 \le N \le 10^6$  $1 \le M \le 10^6$  $1 \le A_i \le 10^7$ 

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Sample Input 1

3
4 2 3 1 2
3 3 6 2
3 2 4 7

Sample Output 1

4

Note

The first number will be  $A_1 = 2*3*1*2 = 12$ The second number will be  $A_2 = 3*6*2 = 36$ The third number will be  $A_3 = 2*4*7 = 56$ The GCD of these three numbers will be GCD(12, 36, 56) = 4

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School gd method, wante Posime factorisation then take common

# Inefficient Program

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Ask Doubt

rom < https://www.learning.algozenith.com/problems/Inefficient-Program-78>

```
Description
                                                                                                          Output Format
Consider the following function.
  long long get(long long L, long long R, long long m) {
     long long sum = 0;
for(long long i = L; i <= R; i++) {
                                                                                                          Constraints
          sum += (i % m);
          sum %= 10000000007;
                                                                                                          1 \le T \le 10^5
                                                                                                          1 \le L \le R \le 10^{18}
      return sum;
                                                                                                          1 \le m \le 10^{18}
The above program is very inefficient for larger values of L, R, m.
Your challenge is to write an efficient program, that will find the value of get function
in very less time.
                                                                                                          456
                                                                                                           4 10 9
Input Format
The first line of input contains one integer T — the number of test cases. Then T test
The only line of each test case contains three space-separated numbers L, R, and m.
```

| 1.1.m + 2.1.m + - + R.1.m | + (1+2+-+(R.1.m)) |  $| R | \times (1+7+-+m-1) + (1+2+-+(R.1.m)) |$   $| R | \times (1+7+-+(R.1.m)) |$  | R

#### Fraction Rank

rom <a href="https://www.learning.algozenith.com/problems/Fraction-Rank-77">https://www.learning.algozenith.com/problems/Fraction-Rank-77</a>

Let us consider a set of fractions x/y, such that  $0 \le x/y \le 1$ ,  $y \le n$  and gcd(x, y) =For example, say n = 5. Then we have the following set in increasing order: 0/1, 1/5

You are given n, a and b. The task is to find the rank of a / b in a set of fractions a stated above which is in increasing order.

Motor Eractions should be finite

#### Input Forma

he first line of contains a number T (1  $\leq T \leq$  20) - the number of testcases. Then T nes follow.

#### Output Format

Print 7 lines. The ath line contains the rank of a fraction a / b for a given n, a and b the a + b th line of fraction

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Hint

One way to approach this problem is to some the number of fractions which are less than or equal to the given fraction  $\frac{1}{b}$  in the given set. Once we know the count of such fractions, we can easily find the rank of  $\frac{n}{b}$  in the set by adding 1 to this count.

To count the number of fractions less than or equal to  $\displaystyle rac{a}{b}$  , we can make use of the following observation:

For any given denominator y, the fractions  $\frac{1}{y}$  which satisfy the condition  $\gcd(x,y)=1$  and  $0\leq \frac{x}{y}\leq 1$  form a farey sequence of order y, denoted a  $F_y$ . The set of all fractions satisfying the given conditions can be obtained by taking the union of all farey sequences of order y where  $1\leq y\leq n$ .

Now, we can count the number of fractions less than or equal to  $\frac{\pi}{b}$  in each farey sequence of order y, and add them up to get the total count of fractions less than or equal to  $\frac{\pi}{b}$  in the given set. To count the number of fractions less than or equal to  $\frac{\pi}{b}$ , in a Firey sequence of order y, we can make use of the following property:

If  $\frac{a}{b}$  is a fraction in a Farey sequence of order y, then the fractions  $\frac{2a}{2b}$ ,  $\frac{3a}{3b}$ , ...  $\frac{2a}{(y-1)a}$  are not in the sequence.

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\*\*/9 (2) 0 \( \( \frac{7}{3} \) \( \frac{7}{

a fraction in a Farey sequence of order y, then the fractions  $\frac{2a}{2b}$ .

Using this property, we can count the number of fractions less than or equal to  $\frac{b}{b}$  in a farey sequence of order  $y_i$  by first calculating the number of fractions  $\frac{b}{b}$  in the sequence for each  $y_i \le n$ , and then subtracting the number of

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Jook

Solution

(Formula all god's like question, we can find all possible fraction for each y [1 < y < n] \$ since we counted all possible fractions, we overcounted fractions which are reducible (like h 1, 2, 3, all reducible 2, 4)

```
possible fractions, we overcounted fractions
   which are reducible (like h 1,2,3, all reducible
fractions 4/2 are overcounted we will subsequently
   subtract them to get answer.
Finding all possible fractions & for each y
 (y-fixed)
              \alpha \leq (\alpha^{*}y)
the possible values x can take to satsify the
above equation are 0 to ay
no of possible fractions
     y=1 => 1= 1 => Say -1,
      y=2 => [29] => say f2 -> (= counted)
                                        counted which is
       y=n=> / n= ]= +n
of 1/2 is counted tox particular 2, then
definetly & will be counted as 1 = 2 and
similarly multiples of other fractions
 whatever calculated in fits equivalent fractions will be fractions
  whatever calculated in fr its equivalent
 fractions will be in type 18 fork for
                                                           as we are considering 1
    and similarly others -
                        To we can remove
                by sieve like technique.
                                                            the numerator for equivalent fraction definetly
             nothing but for (intialyize nyitt)
                                                             exist, by the same
                       ← o for (j=2*i) j(=n;j+:i)
                                                                   1 = a then 2 8 4 ...
                                                                    also < a
 while analysis says since

num and deno are integers

you are allowed to allow

multiply num and deno

by integers
                                                           and they present in the
                                                                  denominators
                                                    respective
                                                      you might ask I will multiply

Jenominator with some fraction and

will make denominator

equal to some number which is not

multiple and accordingly adjust

the numerator, but it is not possib
      ss you multiply by
 Some fractions of B, which on
    simplification (for aing num and den to be integers)
will yield as num and den multiplied by some integer
                                                                  XXE
2
 -) we got all unique fractions < ?
                                                                   YXP & YXP = no. which is not a multiple of y
    answer = rank (a) = Sum of array element
                                                                  XP (upon simplification)
            (i.e./ all unique (irreducible)
                                          Contion &
```

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