Number theory Practice Problems

Q1.Given a natural number, calculate sum of all its proper divisors. A proper divisor of a natural number is the divisor that is strictly less than the number.

For example, number 20 has 5 proper divisors: 1, 2, 4, 5, 10, and the divisor summation is: 1 + 2 + 4 + 5 + 10 = 22.

Examples:

Input : num = 10
Output: 8
// proper divisors 1 + 2 + 5 = 8

Input : num = 36
Output: 55
// proper divisors 1 + 2 + 3 + 4 + 6 + 9 + 12 + 18 = 55

Input:

The first line of input contains an integer T denoting the number of test cases.

The first line of each test case is N.

Output:

Print sum of divisors of N.

Constraints:

1 <= T <= 200

2 <= N <= 10^6

Example:

Input:

2

6

10

Output:

6

8

Q2.Given an array A, of N integers A.
Return the highest product possible by multiplying 3 numbers from the array.
Note: Solution will fit in a 32-bit signed integer

Input Format:
The first and the only argument is an integer array A.
Output Format:
Return the highest possible product.
Constraints:
1<=N<=5*10^5

Example
Input 1:
A = [1, 2, 3, 4]
Output 1:
24
Explanation 1:
2 * 3 * 4 = 24

Input 2:
A = [0, -1, 3, 100, 70, 50]
Output 2:
350000
Explanation 2:
70*50*100=350000

Q3.Given an array of n integers. The task is to find the sum of sum of each of sub-sequence of the array.
Examples :

Input : arr[] = { 6, 8, 5 }
Output : 76

All subsequence sum are:
{ 6 }, sum = 6
{ 8 }, sum = 8
{ 5 }, sum = 5
{ 6, 8 }, sum = 14
{ 6, 5 }, sum = 11
{ 8, 5 }, sum = 13
{ 6, 8, 5 }, sum = 19
Total sum = 76.

Input : arr[] = {1, 2}
Output : 6

Q4.Peter recently learned Fibonacci numbers and now he is studying different algorithms to find them. After getting bored of reading them, he came with his own new type of numbers that he named *XORinacci* numbers. He defined them as follows:

- **f(0)=a**
- **f(1)=b**
- **f(n)=f(n−1)⊕f(n−2) when n>1, where ⊕ denotes the bitwise XOR operation.**

You are given three integers a, b, and n, calculate f(n).

You have to answer for T independent test cases.

Input

The input contains one or more independent test cases.

The first line of input contains a single integer T (1≤T≤10^3), the number of test cases.

Each of the T following lines contains three space-separated integers a, b, and n (0≤a,b,n≤10^9) respectively.

Output

For each test case, output f(n).

Example

input

3

3 4 2

4 5 0

325 265 1231232

output

7

4

76

Note

In the first example, $f(2)=f(0)\oplus f(1)=3\oplus 4=7$.

Q5.Today, Osama gave Fadi an integer X, and Fadi was wondering about the minimum possible value of max(a,b) such that LCM(a,b) equals X. Both a and b should be positive integers.

LCM(a,b) is the smallest positive integer that is divisible by both a and b. For example, LCM(6,8)=24, LCM(4,12)=12, LCM(2,3)=6.

Of course, Fadi immediately knew the answer. Can you be just like Fadi and find any such pair?

Input

The first and only line contains an integer X ($1 \le X \le 10^{12}$).

Output

Print two positive integers, a and b, such that the value of max(a,b) is minimum possible and LCM(a,b) equals X. If there are several possible such pairs, you can print any.

Examples

input

2

output

1 2

input

6

output

2 3

input

4

output

1 4

input

1

output

1 1

Q6.Peter wants to generate some prime numbers for his cryptosystem. Help him! Your task is to generate all prime numbers between two given numbers!

Input

The input begins with the number t of test cases in a single line (t<=10). In each of the next t lines there are two numbers m and n (1 <= m <= n <= 1000000000, n-m<=100000) separated by a space.

Output

For every test case print all prime numbers p such that m <= p <= n, one number per line, test cases separated by an empty line.

Input:

2

1 10

3 5

Output:

2

3

5

7

3

5

Q7.Ashu is very fond of Prime numbers and he like challenging his friends by giving them various problems based on Mathematics and Prime number. One of his friend Harshit is jealous and challenges him to solve a task. Task is :

Given a prime number X, you need to give the count of all numbers in range 1 to 10^6 inclusive which have minimum prime factor X.

Help Ashu in solving this task.

Input:

First line consist of number of test cases T.

Each test case contains a single number X.

Output:

Output for each test case count of all numbers in range 1 to 10^6 inclusive which have minimum prime factor X.

Constraints:

1 ≤ T ≤ 10^5

Prime number X where 2 ≤ X ≤ 10^6

Q8.You are given a positive integer x. Find any such 2 positive integers a and b such that GCD(a,b)+LCM(a,b)=x.

As a reminder, GCD(a,b) is the greatest integer that divides both a and b. Similarly, LCM(a,b) is the smallest integer such that both a and b divide it.

It's guaranteed that the solution always exists. If there are several such pairs (a,b), you can output any of them.

Input

The first line contains a single integer t (1≤t≤100) — the number of testcases.

Each testcase consists of one line containing a single integer, x (2≤x≤10^9).

Output

For each testcase, output a pair of positive integers a and b ($1 \le a,b \le 10^9$) such that GCD(a,b)+LCM(a,b)=x. It's guaranteed that the solution always exists. If there are several such pairs (a,b), you can output any of them.

Example

input

2

2

14

output

1 1

6 4

Note

In the first testcase of the sample, GCD(1,1)+LCM(1,1)=1+1=2.

In the second testcase of the sample, GCD(6,4)+LCM(6,4)=2+12=14.

Q9.You are given one integer number n. Find three distinct integers a,b,c such that $2 \le a,b,c$ and $a \cdot b \cdot c = n$ or say that it is impossible to do it.

If there are several answers, you can print any.

You have to answer t independent test cases.

Input

The first line of the input contains one integer t ($1 \le t \le 100$) — the number of test cases.

The next n lines describe test cases. The i-th test case is given on a new line as one integer n ($2 \le n \le 10^9$).

Output

For each test case, print the answer on it. Print "NO" if it is impossible to represent n as $a \cdot b \cdot c$ for some distinct integers a,b,c such that $2 \le a,b,c$.

Otherwise, print "YES" and any possible such representation.

Example

input

5

64

32

97

2

12345

output

YES

2 4 8

NO

NO

NO

YES

3 5 823

Q10.You are given a square matrix M with N rows (numbered 1 through N) and N columns (numbered 1 through N). Initially, all the elements of this matrix are equal to A. The matrix is broken down in N steps (numbered 1 through N); note that during this process, some elements of the matrix are simply marked as removed, but all elements are still indexed in the same way as in the original matrix. For each valid i, the i-th step consists of the following:

Elements M1,N−i+1,M2,N−i+1,…,Mi−1,N−i+1 are removed.

Elements Mi,N−i+1,Mi,N−i+2,…,Mi,N are removed.

Let's denote the product of all 2i−1 elements removed in this step by pi. Each of the remaining elements of the matrix (those which have not been removed yet) is multiplied by pi.

Find the sum p1+p2+p3+…+pN. Since this number could be very large, compute it modulo 109+7.

Input

The first line of the input contains a single integer T denoting the number of test cases. The description of T test cases follows.

The first and only line of each test case contains two space-separated integers N and A.

Output

For each test case, print a single line containing one integer — the sum of products at each step modulo 109+7.

Constraints

1≤T≤250

1≤N≤10^5

0≤A≤10^9

the sum of N over all test cases does not exceed 10^5

Example Input

1

3 2

Example Output

511620149

Explanation

Example case 1: