National Girls' Programming Contest 2019

Online Preliminary Contest

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https://toph.co/c/ngpc-2019-preliminary

Toph

A. Arshiya's First Code

Limits: 1s, 512 MB

Arshiya is just three and she already started programming. She has learned how to write loops. Recently, she found a simple problem written in the exercises segment of her programming book. The problem says, "Given a positive integer N, find the number of odd numbers from 1 to N inclusive". Arshiya thought to herself, "It's a piece of cake" and wrote down the following code to solve the problem:

```
#include <stdio.h>

int main() {

int N ;

scanf(“%d”,&N);

int countOdd = 0 ;

for( int i = 0 ; i < N ; i ++ ) {

      if( (i+1)%2 == 1 ) {

           countOdd ++ ;

      }

 }

 printf("%d\n",countOdd);

 return 0 ;

}
```

Excited with her achievement, Arshiya came to you and showed her code. Little did Arshiya know that her code is not optimized. In this problem, your task is to solve Arshiya's problem, efficiently.

Input

The input contains a single positive integer N (1 <= N <= 2 * 10^9), the value up to which you have to calculate the odd numbers.

Output

Output a single number, the result of the problem.

Sample

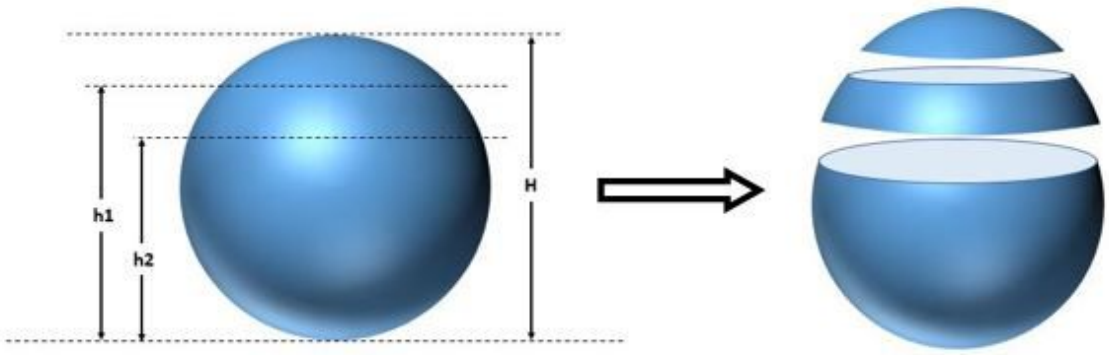
Input	Output
1	1

B. Weird Cake

Limits: 2s, 512 MB

A sphere-shaped cake is cut down with two parallel planes which gives three pieces of cake. The height of the initial cake is **H**. And the height of two cutting planes (from bottom) are **h2** & **h1** respectively.

See the picture for more clarification:



You have to tell the volume of each of these three pieces of cake.

Input

Input contains several test cases. Each test case contains three space-separated integers **H**, **h1** & **h2**.

Constraints:

- 4 <= H <= 1000
- H/2 <= h2 < h1 < H

Output

For each test case, print "**X Y Z**" in a single line without the quotation marks, where **X Y Z** are the volumes of the three pieces of cake in non-decreasing order. The answer is considered correct if the absolute error does not exceed 10^{-4}.

Sample

Input	Output
10 8 6	54.454273 129.852496 339.292007

C. Déjà Vu

Limits: 1s, 512 MB

Thor, the Thunder God is fighting a horde of monsters in a cave. The cave is so narrow that it can be represented as an infinite coordinate line. Monsters are standing in positive integer coordinate points. Thor can cast spells at any integer point while flying. The spell has a blast radius, **r**. Suppose, Thor has cast a spell at point **c**. Let some monster's current coordinate be **y**, now:

if **y**<=0, the monster is killed.

if **c**==**y**, the monster is killed.

if **c**>**y** and **c-y**<=**r**, the monster is pushed **r** units to the left, so its current coordinate becomes **y−r**.

if **c**<**y** and **y-c**<=**r**, the monster is pushed **r** units to the right, so its current coordinate becomes **y+r**.

Casting spells drains a lot of energy, so he wants to know the minimum number of spells he needs to cast to kill all the monsters.

Input

The first line contains two integers **n** and **r** (**1** ≤ **n,r** ≤ $\mathbf{10^6}$) — the number of monsters and the blast radius of the spell.

Next **n** lines contain an integer x_1, x_2, …, x_n ($1 \le x_{1..n} \le 10^6$) — the initial positions of the monsters.

Output

Print the minimum number of spells he needs to cast to kill all the monsters.

Sample

Input	Output
4 1 5 2 3 5	3

Notes

There are monsters at points 2, 3 and 5. Thor casts a spell at point 5 and kills the two monsters. He casts a spell at point 3, thus kills the monster at point 3 and pushed the monster at point 2 to point 1. He casts a spell at point 1 and kills the last monster. As a result, he needed 3 spells.

D. The Archipelago of Mirpur

Limits: 1s, 512 MB

The archipelago of Mirpur consists of **N** islands. The famous architect PogPog was hired to connect all these islands by creating bi-directional bridges among them. PogPog can create a bridge only when the Euclidean distance between two islands is less than or equal to **K**. For each pair of islands; if their distance is less than or equal to **K**, PogPog will definitely connect them through a bridge.

In this problem, each island is represented by a point with 2-dimensional coordinate system. Moreover, the coordinates of two different islands can be the same too! Suppose, the coordinate of one island is (X_1, Y_1) and the coordinate of another island is (X_2, Y_2). The Euclidean distance between them is defined as

$$((X_1 - X_2)^2 + (Y_1 - Y_2)^2)^{0.5}$$

In the archipelago, a group of islands connected together is called a kingdom. If it's possible to travel to an island from another island through a bridge or sequence of bridges, the islands are considered to be in the same kingdom. Similarly, if there is no way to travel to an island from another island, the islands are in different kingdoms.

You will be given some queries, each containing an integer **M**. For each query, you have to tell the minimum value of **K** such that Mirpur Archipelago contains at most **M** kingdoms.

Input

Input starts with an integer **N**, the number of islands. The following **N** lines describe the coordinates of the islands. Each line contains two space-separated integers **X** and **Y**, the coordinate of an island.

Then, an integer **Q** is given, the number of queries. Each of the following **Q** lines contains an integer **M**, the number of kingdoms for which you have to find the answer as described in the problem statement.

Constraints:

$1 \leq N \leq 1000$

$0 \leq X, Y \leq 1000$

$1 \leq Q \leq 1000$

$1 \leq M \leq N$

Output

For each query, print the minimum value of **K** in a single line. Your answer will be considered correct if the absolute error between your answer and the correct answer is less than or equal to 10^{-6}.

In this problem, consider that **K** can never be negative i.e. the minimum possible value for **K** is 0.

Sample

Input	Output
3 3 4 0 0 11 10 3 3 2 1	0.000000000 5.000000000 10.000000000

When K = 0, PogPog can not connect any of the islands, so the number of kingdoms are 3. In other words, the minimum value of K that satisfies M = 3 is K = 0. When M = 2, the minimum value of K = 5 as island no 1 and island no 2 are connected then. Thus the number of kingdoms is 2, one kingdom consists of the islands 1 and 2 while the other kingdom consists of island 3 only. Similarly, the minimum value of K for M = 1 is 10 as island 2 and island 3 becomes connected then and thus the number of kingdoms is 1.

E. Modulo

Limits: 4s, 512 MB

Let's get straight into the problem. In this problem, there will be multiple test cases. In each test case, you will be given an array **A[]** of **N** integers. Then there will be **Q** queries. In each query, you will be given an integer **M**. For every i where 1<=i<=N, you have to change **A[i]** to **A[i] mod M**. After executing all queries you have to print the array **A[]** in the order of input.

Input

Input will start with a single integer **T**. **T** denotes the number of test cases. For each test case, the first line will contain an integer **N**. **N** is the size of the array **A[]**. Second-line will contain N space-separated integers in the range **[1,2^{60}].** Third line will contain an integer Q. Q is the number of queries. Fourth line will contain Q integers in the range **[1,2^{61}]**. Each of the Q integers are the M explained in the statement.

Limits are:

1<=T<=10^5

1<=N<=10^5

1<=Q<=10^5

It is guaranteed that the sum of total N over all test cases doesn't exceed 500000. It is guaranteed that the sum of total Q over all test cases doesn't exceed 500000.

Output

For each test case print "Case x:" in a line without quotations where x is the test case number. Then print the elements of array A[] separated by spaces in the next line. See sample input-output for better understanding.

Sample

Input	Output
2 2 4 4 1 2 3 8 4 8 1 2	Case 1: 0 0 Case 2: 0 0 0

F. Day-Month-Year

Limits: 1s, 512 MB

Meena is a talented girl in her class. She likes to brainstorm in her leisure times. One day, she was observing a calendar. Suddenly, a thought crossed her mind. It was about making a mathematical problem using month, day and year. As Meena is a talented girl, she has made and solved her own problem successfully. Will you be able to solve her problem?

In Meena's problem, at first, she takes three types of paper. The types are **D**, **M** and **Y**. In **D** paper, she writes a day. In **M** paper, she writes the number of a month and in **Y** paper, she writes a year. While writing, she doesn't put any leading zeros. After that, she takes the values written on the papers **D**, **M**, **Y** one by one, merges them and converts it to a string **S**. She doesn't violate the order: **D**, **M**, and **Y**. That is to say, the first portion of the string **S** is from the paper **D**, the next portion is from the paper **M** and the last portion is from the paper **Y**. For example, if Meena wants to write the 25^{th} day of the 3^{rd} month of year 724 in the papers, she will write 25 on paper **D**, 3 on paper **M** and 724 on paper **Y**. After merging and converting them to string **S**, the string **S** will be "253724" (without the quotes). This is the one and only way of constructing string **S**. Now, you will be given the length of the string **S**. You have to find out how many strings **S** of the given length are palindrome if you construct **S** according to the way stated above.

A Palindrome is a string that reads the same backward as forward. "17122171", "91033019" are some valid palindromic strings of length 8 here. In the first string, 17 is the day, 12 is the month number and 2171 is the year. In the second string, 9 is the day, 10 is the month number and 33019 is the year.

There are **300 days** in a month and **26 months** in a year on the planet of Meena and counting of day, month and year start from 1. That is to say, the first date of the history of her planet is:

day 1, month 1, year 1. And so, **1 <= D <= 300**, **1 <= M <= 26** and **Y** will contain any positive numbers. It is possible to construct same string **S** from different values of **D**, **M**, **Y** such as: string **S = "2112"** can be constructed from **D = 2**, **M = 1**, **Y = 12** or from **D = 21**, **M = 1**, **Y = 2** etc. In such cases, they will be considered as different strings though the values of the strings are the same.

Input

Input will start with an integer **T**, the number of test cases. In each test case, there will be an integer **N** – the length of the string **S**.

Constraints:

1 <= T <= 100

1 <= N <= 10^5

Output

For each test case, output a single line containing (without the quotes) "**Case x: y**", where **x** is the case number and **y** is the number of possible palindromic string **S** of the corresponding length given in input. As **y** can be very big, print **y mod 1000000007**.

Sample

Input	Output
4 4 3 7 21	Case 1: 180 Case 2: 81 Case 3: 19413 Case 4: 696298656

G. Expected Result

Limits: 1s, 256 MB

A witch has imprisoned Bob in the **1st** room of the Central Witchland Hotel. The hotel is weird. All the rooms are numbered linearly, i.e. ***1, 2, 3,…., n, n + 1, … and so on***. Those rooms have no doors or windows except the rooms which have a room number **greater than n**. From the rooms having a room number **greater than n**, Bob can get out of the hotel. That means Bob has no way to get out of the hotel without reaching a room which has doors or windows.

Luckily, Bob has found **a device** that generates a number **M** from **0 to K – 1** with **equal probability** and it will **teleport** Bob to the **Mth** room from the **current** room. This means if Bob is currently in **Xth** room and the device generates **M**, then he will be teleported to the **(X + M)th** room. You have to determine what is the **expected number of times** he has to use that device to get out of the hotel.

Input

The first line of the input will contain an integer, **T**, number of test cases to follow. Each of the next **T** lines will continue **two** integer numbers, **n** and **k**, as discussed before.

$1 \leq \mathbf{T} \leq 10^5$

$1 \leq \mathbf{n} \leq 10^6$

$2 \leq \mathbf{K} \leq 10$

Output

Print **T** lines, answer of each test case. Your solution will be considered correct if the absolute difference between your answer and the judge's answer is less than $\mathbf{10^{-6}}$.

Sample

Input	Output
1 1 3	1.50000000

*You have to go to any room numbered **greater than n**, not in **n**.*

*If that device generates **0**, he'll stay in the **same** room.*

H. Messy Table

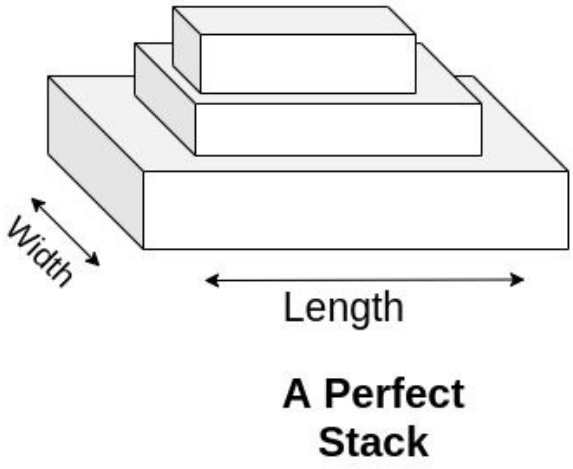
Limits: 1s, 512 MB

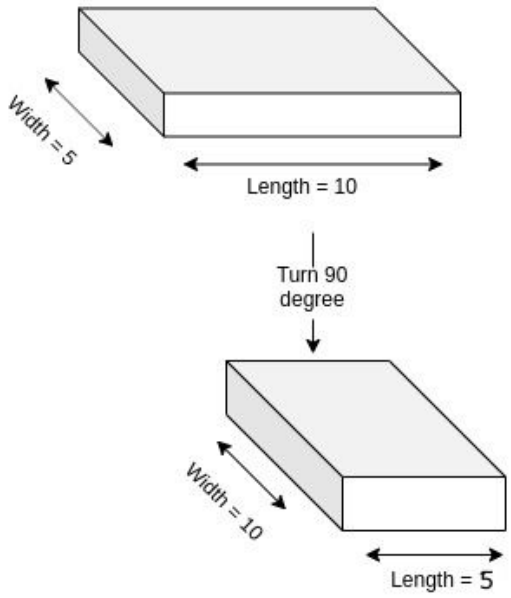
Akib is a very good student but his reading table is very messy. One Friday afternoon, Akib is sitting idle and relaxing. To make his leisure time effective, he decides to clean his table.

First, Akib wants to sort his books and make a stack of them. He calls a stack of books **perfect stack** if a book's length and width is strictly less than the previous book.

For better explanation let's consider a stack of books **A = {b_1, b_2, b_3, ……, b_m}**. A is said to be a perfect stack **if length and width of i-th book is strictly less than the length and width of the (i-1)-th book**. The size of a perfect stack is the total number of books in a perfect stack.

Akib has n books. He also knows the value of two sides of each book (i.e. width and height of each book). In the process of making a perfect stack it is allowed to rotate a book 90 degrees. If you rotate a book 90 degrees then it's width becomes length and length becomes width.





Now Akib wants to make a perfect stack of books, the size of which is as big as possible from the n books he has. Help Akib to solve this task.

Input

The first line contains an integer n (1 ≤ n ≤ 5000) — the number of books Akib has. Then there will be n lines, each of them contains two integer numbers, Ai and Bi — the length of two sides of the i-th book (1 ≤ Ai, Bi ≤ 100).

Output

Print an integer which is the maximum perfect stack size.

Sample

Input	Output
4 7 7 10 13 14 9 8 13	3

It is possible to make a perfect stack of maximum size 3. First Akib choose the 3rd book, then 4th book then the 1st book. Hence the perfect stack **A = {3, 4, 1}** of **size = 3.**

Input	Output
2 15 15 15 15	1

Akib can make a perfect stack of a maximum size of 1 by choosing the 1st book or the 2nd book.

I. Palindrome Again

Limits: 1s, 512 MB

Zain and Zion are best friends. Their favourite game is finding palindromic numbers. But today Zion wanted to make the game more interesting. So he made some rules for the game. The rules are given below:

1. The Number will be given in words. You have to convert the word into numbers. (The word will always be a valid number spelling)
2. Convert the corresponding number into binary.
3. Find if its binary form is palindrome or not.

Now, Zain got stuck with these rules. Can you help Zain to play the game by writing a simple program?

Input

First line will have T, the number of test cases. Next T lines will contain a string S which will be a valid number in words. (1 <= T <= 10000). The valid number will be less than ten thousand. All letters will be in lower case.

Output

You have to print “YES” if the number’s binary form is a palindrome, otherwise print “NO” without quotation mark.

Sample

Input	Output
2 two two hundred fifty five	NO YES

Note: In the sample, Binary of two is $(10)_2$. From the definition of Palindromic Number we know “A palindromic number is a number that remains the same when its digits are reversed”. And binary of 2(two) doesn’t meet the definition.