Primera Competencia

A. Nate and Game

3.0 s, 256 MB

Nate found a game under his bed! He was not familiar with it, so he decided to load it in his game console. When the game finally started, Nate was greeted with the title screen, "AttAck on Eoten!" Nate was excited because this was his favorite cartoon! He was excited for an action-packed game with a compelling story. Strangely though, it seems like the models were all off. The giants, which were supposedly humanoid, now look like triangles!

Although Nate was *slightly* disappointed, he still pushed through with the game. After playing for 420 minutes, he forgot they were giants so he just simply called them as triangles.

The mechanics of the game is fairly simple. Nate was stationed in a castle on the leftmost of the screen and he had to shoot with his gun to destroy triangles. The game is fairly old, so he could only shoot in a horizontal trajectory. He also noticed that hitting even just the border of a triangle would destroy it. After playing for 6969 minutes, he noticed that the game was lazily coded: some triangles were overlapping.

After playing for 42069 minutes, he got a sniper rifle with exactly 1 piercing shot. A piercing shot can shoot through any number of triangles as long as they all intersect the line of fire. Nate was pretty tired already, and he just wants to shoot as many triangles in one shot. Since there were a lot of triangles on the screen, he could not determine how many he could shoot at once. Can you help him find the maximum number of triangles he can shoot in one shot?

Input

The first line of input contains a single integer n, the number of triangles.

The next n lines of input each contain six space-separated integers, $x_0, y_0, x_1, y_1, x_2, y_2$, respectively, where $(x_0, y_0), (x_1, y_1), (x_2, y_2)$ are the three vertices of a triangle. It is guaranteed that the triangles are non-degenerate, i.e. the three points of each triangle are not collinear.

Constraints

$1 \leq n \leq 142069$

$-1000000 \leq x_0, y_0, x_1, y_1, x_2, y_2 \leq 1000000$

Output

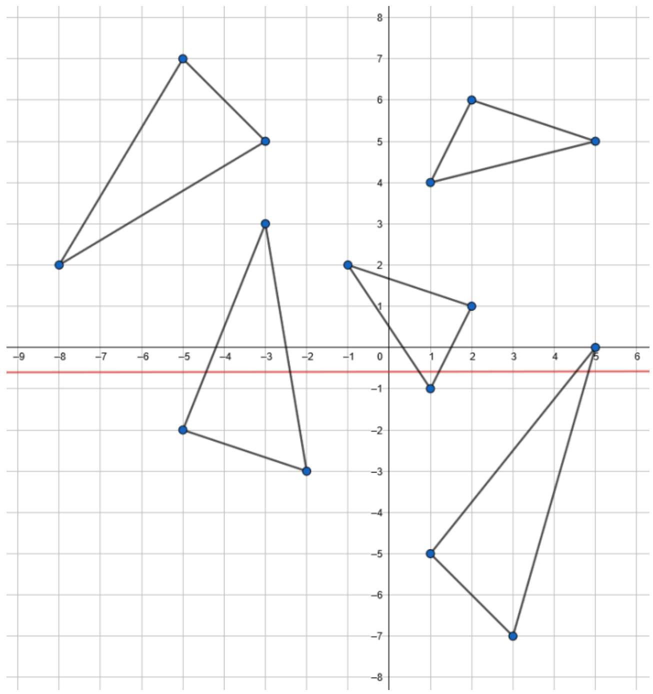
Output a single integer, the maximum number of triangles Nate can hit.

input
```
1
0 6 -5 1 6 -8
```
output
```
1
```

input
```
2
0 4 -10 7 6 9
-2 -2 -6 -9 3 -7
```
output
```
1
```

input
```
5
-3 5 -8 2 -5 7
1 -5 3 -7 5 0
1 4 2 6 5 5
-2 -3 -3 3 -5 -2
1 -1 2 1 -1 2
```
output
```
3
```

For the third test case, the input would look like this. Nate can hit 3 triangles by shooting his rifle as in the red line in the figure. There are other ways for Nate to hit 3 triangles, but Nate cannot hit more than 3 triangles in one shot.



B. Nate and Actual 3D Girls

1.0 s, 256 MB

Nate is tired of 2D girls and has decided that this year he will try looking for the real thing. Although Nate is too shy to go out and talk to one, he realized he could avoid having to go through the ordeal of real-life interaction by writing an anonymous *tegami* (letter) to his prospective 3D girl. He can do this by cutting up letters from his old Pokémon trading cards.

However, as much as Nate would be happy with any living, breathing 3D girl, he still wants someone with substance. To provide the recipient with a challenge, he decided to **encrypt** his letter using a simple cipher.

Nate will think of a number k which is the number of times he will shift the alphabet to the left. For example, if Nate chooses $k = 3$, then the alphabet `[a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z]` is transformed to `[d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z, a, b, c]`.

This transformed alphabet is what he uses to write the *tegami*.

Help Nate determine if he was able to obtain enough letters from his n trading cards to write the *tegami* if each letter can only be used once.

Input

The first line of input contains three space-separated integers n, m, and k, respectively. The first number, n, is the number of words Nate cut out. The second number, m, is the number of words in the *tegami*. The third number, k, is the number of times the alphabet is shifted, respectively.

The second line of input contains n space-separated strings, the words Nate cut out.

The third line of input contains m space-separated words consisting only of lowercase English letters, the message that Nate wants to encrypt and send to his potential 3D girl.

Constraints

$1 \leq n \leq 100$

$1 \leq m \leq 100$

$0 \leq k \leq 100$

The sum of the lengths of the words Nate cut out will not exceed 10^5.

The sum of the lengths of the words in the message Nate wants to encrypt will not exceed 10^5.

Output

Output `Make her kokoro go doki-doki!` if Nate has enough letters to write the encrypted *tegami*, and `It is gonna be daijoubu.` if Nate doesn't have enough letters.

input
```
4 3 3
chikorita vulpix pidgeot quagsire
date me please
```
output
```
It is gonna be daijoubu.
```

input
```
6 9 22
joltik zapdos kangaskhan pelipper cyndaquil qwilfish
will you go to under the stars with me
```
output
```
Make her kokoro go doki-doki!
```

In the second example, the alphabet is shifted $k = 22$ characters to the left as shown below:

Before: `a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z`

After: `w, x, y, z, a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v`

Using this new alphabet, the message is encrypted into `sehh ukq ck pk qjzan pda opwno sepd ia`.

Nate can write the word `sehh` using the letter `s` from the `kangaskhan` card, a letter `e` from the `pelipper` card, the letter `h` from the `qwilfish` card, and the letter `h` from the `kangaskhan` card.

Notice that different letters may come from the same card, but each letter may only be used once. He could've also used the `zapdos` card instead of the `kangaskhan` card for the letter `s`. If you continue this process you will find that he has enough characters to write the entire *tegami*.

C. Nate and Contest Invitation

3.0 s, 256 MB

Nate wants to have more people join his contest. However, he doesn't have much time. He can only directly send invitations to k people. Thankfully, if he invites someone, that person can tell all of his friends about the contest, and those friends can tell all of their friends, and so on.

Suppose that there are n people and m pairs of them are friends. What is the maximum number of people he can invite?

Input

The first line of input contains three space-separated integers n, m, and k, respectively. The first integer, n, is the number of people. The second integer, m, is the number of pairs of friends. The third integer, k, is the number of invitations Nate can directly send.

The next m lines of input each contain two space-separated strings, the names of a pair of friends. Each name is composed of only lowercase English letters and doesn't exceed 10 letters in length.

Constraints

$1 \leq n \leq 10^5$

$1 \leq m \leq 10^5$

$1 \leq k \leq \min(n, 100)$

Output

Output a single integer, the maximum number of people Nate can invite.

input
```
3 2 1
Anne Billy
Anne Charles
```
output
```
3
```

input
```
6 4 1
Dave Earl
Earl Fontana
Gillian Heather
Heather Ian
```
output
```
3
```

input
```
6 3 3
Joshua Karla
Lily Mark
Ned Oliver
```
output
```
6
```

In the first test case, Nate can invite Anne, who invites both her friends Billy and Charles.

In the second test case, Nate can invite Dave, who invites Earl, who invites Fontana. There is no way to invite all six people, as none of Dave, Earl, and Fontana are friends with Gillian, Heather, or Ian.

In the third test case, Nate can invite Joshua, Lily, and Ned, who then invite Karla, Mark, and Oliver respectively.

D. Nate and Bones

3.0 s, 256 MB

Nate loves dinosaurs very much due to the influence of the anime and card game *Dinosaur King* in his childhood. Recently, he has been collecting many variants of the new craze called "Fossilites," dinosaurs in bone/fossil form. He is very much in love with them and plays with them everyday, hence his nickname "Bones." One day, Nate discovered something horrible. While at school, his little brother played with his Fossilites! His younger brother took his dinosaurs apart and tried to fit the different bones to different bodies. His mom cleaned up the mess by just placing piles of bones into n different boxes such that each box contains m different bones.

Nate decides to focus on finding the bones of his favorite dinosaur first. Luckily, there is a way for Nate to identify them. His favorite dinosaur has weight x. A bone with length l belongs to his favorite dinosaur if and only if l and x share a common factor besides 1. That is to say, there exists an integer $d > 1$ such that both l and x are divisible by d. He can get each bone and use math to help him out. He is not patient with numbers, however, so help Nate check if he is correct through a program.

Help Nate check if he got all the bones for the dinosaur by finding the total number of bones that belong to his favorite dinosaur.

Input

The first line of input contains three space-separated integers n, m, and x, respectively. The first integer, n, is the number of boxes. The second integer, m, is the number of bones per box. The third integer, x, is the dinosaur's weight.

The next n lines of input each contain m space-separated integers corresponding to a bone's length l_i.

Constraints

$$1 \le n, m \le 100$$

$$2 \le l_i \le 10^5$$

$$2 \le x \le 10^5$$

Output

Output a single integer, the total number of bones that belong to dinosaur x.

input

```
2 3 12
5 7 6
29 12 20
```

output

```
3
```

input

```
5 5 100
11 2 3 4 5
1000 2000 3000 4000 5000
21 1222 99 83 75
921 182 27 40 284
6474 301 734 1000 990
```

output

```
17
```

In the first case: the factors of 12 are $1, 2, 3, 4, 6, 12$ In the first box, only 6 is divisible by one of those other than 1. In the second box, both 12 and 20 are divisible by one of the factors. The total number of correct bones is 3.

In the second case: the factors of 100 are $1, 2, 4, 5, 10, 20, 25, 50, 100$ In the first box, 2, 4, and 5 are divisible by a factor of 100. In the second box, all numbers are divisible. In the third box, 1222 and 75 are divisible. In the fourth box, 182, 40, 284 are divisible. In the fifth and last box, all numbers apart from 301 are divisible. The total number of correct bones is 17.

E. Nate and High School Nakama

1.0 s, 256 MB

It's Nate's first day in High School, and he's really nervous! Nate hopes that High School will be great, full of antics and wacky adventures, field trips and tournaments, beach episodes and kawaii demons, just like what he's seen on anime (which he's sure is a realistic and not-at-all romanticized portrayal of High School). Most of all, he hopes to find his *nakama*.

Whatever a *nakama* is, in Nate's High School class, there can be one or more *nakama*s, depending on the friendships within the class. Two students in the class can either be friends, or not be friends. Friendship is mutual: if student A is friends with student B, then student B is also friends with student A. Two students are part of the same *nakama* if they are friends. If a student is not friends with anyone else in the class, they also count as one *nakama*.

The ***nakama* rating** of a class is the number of distinct *nakama* present in the class.

Nate uses the timeline powers he got from watching Steins;Gate to examine **every possible way the people in his class could be friends with one another**. Two timelines are considered different if there exists at least one pair of students who are friends in one timeline and not friends in the other. What is the sum of the *nakama* ratings of a class of n students across all possible different timelines?

Input

The input consists of a line with a single integer n, the number of students in the class.

Constraints

$$1 \le n \le 3000$$

Output

Output a single integer, the sum of all the *nakama* ratings of a class with n students across all possible different timelines. Since the answer can get quite large, output its positive remainder when it is divided by $10^9 + 7$, a prime number.

input

```
3
```

output

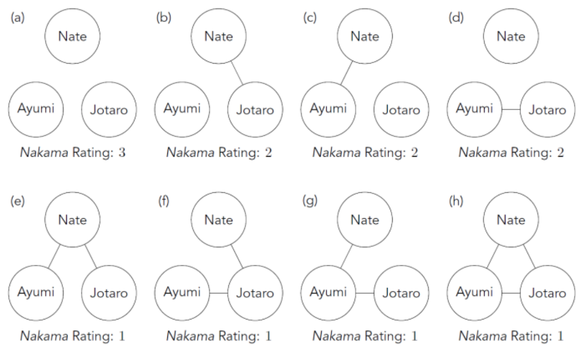
```
13
```

input

```
41
```

output
680415236

Suppose there are $N = 3$ students in the class: Nate, Ayumi, and Jotaro. Illustrated below are all 8 possible ways the class could be friends, and the *nakama* rating of each possibility.



In case (a), there are no friendships between anyone in the class, so each student counts as one *nakama*. Therefore, the *nakama* rating for this possibility is 3.

In cases (b), (c), and (d), two of the students in the class are friends with each other, forming one *nakama*. The remaining student, who isn't friends with anyone, counts as another *nakama*. Therefore, the *nakama* rating for each of these possibilities is 2.

In cases (e), (f), (g) and (h), all of the students belong to the same *nakama*, so the *nakama* rating for each of these possibilities is 1. For example, in case (e), since Nate and Ayumi are friends, they belong to the same *nakama*. Since Nate and Jotaro are also friends, they also belong to the same *nakama*, hence Ayumi and Jotaro also belong to the same *nakama*.

The sum of the *Nakama* Ratings across all 8 possibilities is $3 + 2 + 2 + 2 + 1 + 1 + 1 + 1 = 13$

Translator's Note: What is a *nakama*? Well, it's a really deep word that means a group of closest friends (like in One Piece) and there really is no English equivalent to how powerful that word is, so Nate has decided to keep it untranslated. The untranslated definition of *nakama* is: 仲間 — 1. 一緒に物事をする間柄。また、その人。2.地位・職業などの同じ人々。3. 同じ種類のもの。同類。4. 近世、商工業者の同業組合。官許を得たものを株仲間といった。(デジタル大辞泉（小学館）より). You do not need to understand this definition to solve this problem.

F. Nate and Fan Meet-and-Greet

1.0 s, 256 MB

Nate is attending a meet-and-greet for his favorite celebrity voice actress, Hana Kanazawa! You might know her from her voice-over work in the Mono Guitar Hero series, Doreimon, its sequel Durararaemon, and of course, Angel Beats Agents. She announced that she would give a signed copy of her new album to whomever could guess the serial number on Volume x of her favorite manga.

Nate, of course, knows that this would be the volume of The World Dog Only Knows that introduces the character Shiori, whom she voices in the anime. He also happens to know that for this series, the serial number of Volume n, s_n, satisfies the following:

- The pilot, Volume 0, has a serial number of 0.
- The very first volume, Volume 1, has a serial number of 1.
- The serial number of every volume after the first is calculated as $s_n = 2s_{n-1} - s_{n-2}$.

Here, s_{n-1} is the serial number of Volume $n - 1$ and s_{n-2} is the serial number of Volume $n - 2$.

Nate can't think well under pressure, and a signed album from his favorite celebrity is in jeopardy! Can you help him find the serial number of Volume x?

Input

The input consists of a line with only a single integer x, the volume whose serial number must be found.

Constraints

$$1 \le x \le 10^{18}$$

Output

Output a single integer, the serial number of Volume x.

input
1
output
1

input
2
output
2

The serial number of Volume 1 is given from the definition. The serial number of Volume 2 is $2s_1 - s_0 = 2$.

G. Nate and Integer Coefficient

1.0 s, 256 MB

Nate's math teacher thinks he watches too much anime and not enough time studying for their algebra test. Nate insists that he's already prepared for the test, but in order to prove it, he has to solve the following problem that his teacher gave him.

Given a, n, and that $x^2 - ax + 1 = 0$, find b such that $x^{2n} - bx^n + 1 = 0$.

Input

The first line of input contains a single integer T, the number of test cases. The next T lines of input each contain two space-separated integers a and n, respectively, the values in the equation.

Constraints

$$1 \le T \le 10^5$$

$$|a|, |n| \le 10^{18}$$

Output

For each of the T test cases, output in its own line a single integer, b, that satisfies the equation. Since the answer can get quite large, output only the positive remainder when b is divided by $10^9 + 7$, a prime number. It can be proven that b is always an integer.

input
```
3
2 1231
2 10000000
5 0
```
output
```
2
2
2
```

H. Kleofáš and the n-thlon

1 second, 256 megabytes

Kleofáš is participating in an n-thlon - a tournament consisting of n different competitions in n different disciplines (numbered 1 through n). There are m participants in the n-thlon and each of them participates in all competitions.

In each of these n competitions, the participants are given ranks from 1 to m in such a way that no two participants are given the same rank - in other words, the ranks in each competition form a permutation of numbers from 1 to m. The score of a participant in a competition is equal to his/her rank in it.

The overall score of each participant is computed as the sum of that participant's scores in all competitions.

The overall rank of each participant is equal to $1 + k$, where k is the number of participants with **strictly smaller** overall score.

The n-thlon is over now, but the results haven't been published yet. Kleofáš still remembers his ranks in each particular competition; however, he doesn't remember anything about how well the other participants did. Therefore, Kleofáš would like to know his expected overall rank.

All competitors are equally good at each discipline, so all rankings (permutations of ranks of everyone except Kleofáš) in each competition are equiprobable.

Input

The first line of the input contains two space-separated integers n $(1 \le n \le 100)$ and m $(1 \le m \le 1000)$ — the number of competitions and the number of participants respectively.

Then, n lines follow. The i-th of them contains one integer x_i $(1 \le x_i \le m)$ — the rank of Kleofáš in the i-th competition.

Output

Output a single real number – the expected overall rank of Kleofáš. Your answer will be considered correct if its relative or absolute error doesn't exceed 10^{-9}.

Namely: let's assume that your answer is a, and the answer of the jury is b. The checker program will consider your answer correct, if $\frac{|a-b|}{\max(1,b)} \le 10^{-9}$.

input
```
4 10
2
1
2
1
```
output
```
1.0000000000000000
```

input
```
5 5
1
2
3
4
5
```
output
```
2.7500000000000000
```

input
```
3 6
2
4
2
```
output
```
1.6799999999999999
```

In the first sample, Kleofáš has overall score 6. Nobody else can have overall score less than 6 (but it's possible for one other person to have overall score 6 as well), so his overall rank must be 1.

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