Problem A. A Simple Problem about Election

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

ZZZZSGW is a cute hamster living in a beautiful city named WWW. However, the COVID-19 spread like a wild fire in his city, many people infected. With great grief and motivation, he really wants to do something for his hometown. Therefore he applied for the volunteer of his community to help his neighbors.

There are n candidates and the voluntary team only needs several volunteers in total. To ensure the quality of the team, they decided to hold an election to pick out the volunteers. Every resident has to nominate exactly m candidates and mustn't give more than one nomination to one candidate. (of course one can save one of the nominations for himself/herself). The candidates then will be ranked by the nominations they get in descending order, if there are candidates have the same number of nominations, they will be ranked by their names in lexicographically increasing order.

It's evident that the name **ZZZZSGW** won't take much chance, so when he has the same nominations with others, you can just suppose that he will always be the last! What's worse, the order to nominate is also according to the names, which means that this poor guy will also be the last one to make his decision among the residents!

However, as each coin has two sides, the last to make decision also means the one who knows everything ------ since everyone can see the current result when making nominations! Now it's **ZZZZSGW**'s turn, he knows the current result and the final result only depends on his own decision. But he is too nervous to make a clear judgment! Can you help him to get the highest place under this situation?

Input

The input consists of several test cases. The first line of the input is an integer T, the number of the test cases.

For each test case, the first line will be two integers n, m. The number of candidates and the number of nominations that each resident can make.

The next line will be n integers $\{a_1, a_2, ..., a_n\}$ separated by spaces, which are the current number nominations of each candidate. The first integer always refers to the nominations of **ZZZZSGW**.

For each test case, $0 \leq a_i \leq 10^9$, $1 \leq m \leq n \leq 10^5$. And there is $\sum n \leq 2 * 10^5$ for all test cases.

Output

For each test case, output a single integer ans in a line, which is the best place **ZZZZSGW** can get after his turn.

Example

standard input	standard output
2 5 3 5 1 2 6 7 5 3 5 1 2 5 7	3 2

Note

There are more hidden rules in the election than you think, so don't be surprised that the sum of nominations can't be divided by m.

Problem B. Build the Huoshenshan Hospital

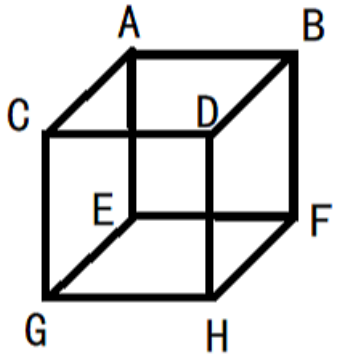
Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

ZSGW is a cute Hamster studying civil engineering in the Wuhan Hamster University (aka: WHU).

Due to the outbreak of the COVID-19, the local government planned to build two more hospitals, named HSS and LSS, to rescue the increasing number of patients. To finish the construction as quickly as possible, ZSGW also participated in this great task.

The first thing to build the hospital is to build the main frame. For simplicity, the main frames will be built by the basic unit, which can be considered as $1 \times 1 \times 1$ cube formed by steel bars. Account for the different requirements in different places, there will be four types of basic unit to be used.

We will describe these unit in the following way: Firstly, we named the eight vertices of the cube as the following image:



1. A-type unit, the most simple one, where 12 bars lies on the edges of the cube. That is, A-type unit has 12 bars connecting (A, B), (A, C), (C, D), (B, D), (E, F), (E, G), (G, H), (H, F), (C, G), (D, H), (B, F), (A, E).

2. B-type unit, based on the A-type unit, it has one more bar on the diagonal of each of the 6 faces of the cube, which means apart from the bars on the A-type unit, B type unit has 6 more bars connecting (A, D), (D, F), (F, A), (C, H), (H, E), (E, C).

3. C-type unit, which add one more bar on the another diagonal of the face, has 6 more bars than the B-type unit, which are (B, C), (B, H), (B, E), (G, D), (G, F), (G, A).

4. D-type unit, based on the C-type unit, it removed all the crossing bars except the top and the bottom face, so it only has bars connecting (A, D), (C, B), (G, F), (E, H) and bars of the A-type.

For simplicity, you don't need to consider the rotation of these units, therefore face $ABCD$ is always on the top and face $CDGH$ is always in the front and face $ACEG$ is always on the left.

The main frame then can be regarded as these units piling up one by one and face to face. Moreover, if there are two bars coincide on the touching face of two units, we can save one of the bars. For example, if we need to build the frame which is piled up by two A-type unit, we will using only 20 bars instead of 24.

Now ZSGW has got the blueprint of the main frame, he wonders how many steel bars are needed to build the main frame.

It's an emergency task, so please gkd as much as possible!

Input

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

Each cases started with three integers r, c, h, denoted the size of the frame.

The following part contains $r * h$ lines of c characters, each r lines described a cross section of the frame, from the bottom to the top in order. For each $r \times c$ matrix, each character described the unit at this place. the uppercase letter from A to D refer to that kind of unit, and the dot '.' means that there is no unit at this place.

Therefore, if the i-th row and j-th column of the k-th matrix contains a letter 'A', the position (i, j, k) lies a A-type unit according to the Cartesian coordinate system.

for each test case, all the given numbers are no more than 50, and for all test cases $\sum r, \sum c, \sum h \leq 500$.

Output

For each test case, print a number *ans* in one line, denoting the required numbers of steel bars to build the frame.

Example

standard input	standard output
4 1 1 1 A 1 1 2 A A 2 2 2 AB .A .A .. 2 2 2 A. .A .A ..	12 20 42 33

Note

It might be possible and weird to have some unit "suspending" in blueprint and seems to be against the physical laws. That's because not only steel bars are used in the construction, so those "empty" spaces might be filled with other materials.

Problem C. Calculate the Sanity Value

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	256 megabytes

Coronavirus is a evil virus, it prefers to put everthing in RNA so its RNA can contain anyone of 26 lowercase letters apart from "agcu"!

Now **GGG**, who is an expert in the field of biochemistry has found a standard called **Sanity Value**, or **SAN Value** for short to calculate the danger level of COVID-19.

The standard has been defined as follow:

The RNA sequence of COVID-19 is represented as a string S. The string S can be divided into consecutive and identical substrings without intersection, and its **SAN Value**(represented as V) is the maximum number of identical substrings we can get among all the division of string S.

For example, "abababab" can be divided into "ab", "ab", "ab", so the **SAN value** of "abababab" is 3. And "ababa" can not be devided into consecutive and identical substrings, so its **SAN value** of "ababa" is 1.

Now **GGG** has comfirmed the virus's RNA sequence, can you help him to calculate the maximum **SAN Value** of all the substrings appearing in the sequence?

Input

The first line $T(1 \le T \le 10)$ represents the number of testcases.

For each testcase, there is a string $S(1 \le |S| \le 10^5)$ containing only lowercase letters in a line.

Output

For each testcase, output the maximum **SAN Value** V of all the substrings in S in one line.

Example

standard input	standard output
2 ccababababc daabbccaa	3 2

Problem D. Deploy the Medical Team

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

The outbreak of the COVID-19 has infected more than 50,000 people in Wuhan and nearly 70,000 people in Hubei province, which brings on great pressure on the local hospital and medical workers. To help the people in Hubei defeating the virus and returning to normal life as soon as possible, many other province deployed their medical teams to Hubei and offered lots of help.

Now it's the time for a hospital in Bitland to choose who will be sent to join this great mission. There are n medical workers in the hospital ready to deploy and you can send arbitrary numbers of persons to the team. Also, a medical team need a captain in charge of all the work, so once we confirm the people in the team, we need to set one of them as captain too. However, being a captain needs a lot experience, so there are only m people capable with the responsibility of a captain. Therefore, A team cannot be made up of people without someone that can be the captain.

And here's the question: How many ways are there to pick up a medical team with a captain? Notice that two teams are consider different as long as they have different participants or have different captain.

Also, due to the large memory of Bitland, the number of workers in hospital can be as large as 10^9! And that means your answer can be very large, so please output the result of the answer modulo $10^9 + 7$.

Input

The input consists of multiple test cases. The first line of the input contains an integer T --- the number of the test cases.

For each test cases, there will be two integers n,m separated by space in one line, which means the number of workers in hospital and the numbers of people who can be the captain. Here $1 \leq m \leq n \leq 10^9$.

Output

For each test case, output a single integer ans in a line, denoting the answer modulo $10^9 + 7$.

Example

standard input	standard output
3 3 3 5 4 2 1	12 64 2

Problem E. Engage the Medical Workers

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

The medical team from **Bitland** has arrived at their destination --- a city named Matrix which is suffering from COVID-19. Now they are going to distribute the manpower to the place in need properly.

The Matrix city has only horizontal and vertical roads, dividing the city into $n*n$ separated blocks. That is, you can consider the blocks in this city form a real matrix of n rows and n columns!

The COVID-19 is now spreading among the blocks, which has infected many innocent people. **xyjj**, the captain of the team, now needs to consider how may medical workers should be sent to each block. If we note the number of patients in the blocks of $i-th$ row and $j-th$ column as $A_{i,j}$, and the number of medical workers sent to that block as $B_{i,j}$, the basic rule of the arrangement will be as follows:

1. If $A_{i,j} \leq A_{i,j'}$, then $B_{i,j} \leq B_{i,j'}$;
2. If $A_{i,j} \leq A_{i',j}$, then $B_{i,j} \leq B_{i',j}$;
3. If $A_{i,j} = A_{i',j'}$, then $B_{i,j} = B_{i',j'}$.

Here i, i' means any different rows and j, j' means any different column.

Because the life expenses of the workers are covered by the local block, **xyjj** hopes that the maximum number of workers to be sent to each block to be minimum (That is, minimize the $max\{B_{i,j}\}$ among all the blocks) , so there will be less financial pressure for that block.

xyjj is too busy to solve this problem, can you help him?

Input

The first line contains an integer $n(1 \leq n \leq 1000)$, indicating that Matrix city has n rows and n columns of blocks.

In the next n lines, each line has n numbers. The j-th number in the i-th line represents the number $A_{i,j}(1 \leq A_{i,j} \leq 10^9)$ --- the number of patients in the block of the i-th row and j-th column in the Matrix city.

Output

A integer represents the minimum possible maximum number of workers required to be sent to one block.

Example

standard input	standard output
2 1 3 3 2	2

Note

To minimize the answer, the number of workers to be sent to each block will be:

```
1 2
2 1
```

So the answer is 2.

Problem F. Figure out the Sequence

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

The Coronavirus is evil and loves to store everything into its RNA, which is why it often has genetic mutation.

One day the Coronavirus get two RNA sequences, and it decided to add them to its RNA. It will add the first sequence to the end of its current RNA, and the second turn it will add the another one.

For the following turns, the virus will always **add the sequence it got in the previous turn to the beginning of the current sequence**.

For example, suppose the virus has nothing in its RNA initially, and two RNA sequences are:$\{abc, def\}$ (The RNA sequence can be far more than "agcu" !) , the final RNA sequence after the $i-th$ turn $F[i]$ will be:

$F[1] = abc$

$F[2] = def$

$F[3] = abcdef$

$F[4] = defabcdef$

$F[5] = abcdefdefabcdef$

$F[6] = defabcdefabcdefdefabcdef$

.....

As an expert in biochemistry, GGG has been devoting himself into analyzing this virus since its outbreak, whose task is to figure out the exact composition of this virus (That is: how many times does each letter appear in the final RNA sequence). However, what he can get is only how many turns the virus has changed its RNA and the initial two sequences. can you help him to solve this problem?

Input

The input only consists of one test case.

The first line and the second line will be two string s and t, which are the initial RNA sequences, the sequences are both made up of lower-case Latin letters and the virus starts with string s.

The third line will be an integer n, which is the number of turns that the virus has taken to modify its RNA.

It's guaranteed that $1 \leq n \leq 40$, the length of two strings $0 < |s|, |t| \leq 20$.

Output

The output should contain several lines for each letter in the final RNA sequence **in ascending order of the ASCII code of each letter**.

Each line should be in format like **letter: num**, where the first letter is the related letter, the second one is a colon, the third one is a space and then is an integer num which is the number of occurrences of this letter in the final RNA sequence.

If a letter doesn't appear in the sequence, you can simply ignore it.

Example

standard input	standard output
abc def 4	a: 1 b: 1 c: 1 d: 2 e: 2 f: 2

Problem G. Game Strategy

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Feeling bored with the life being isolated during the outbreak of the COVID-19, Alice, Bob and Cindy are playing an interesting game, each of them has an array of n integers. Each of them will remove an integer of his/her array in his/her turn, Alice plays first, Bob second, finally Cindy. In the end, everyone will have only one integer, Alice has x, Bob has y, and Cindy has z. And they will compute the value:

$$x + y + z$$

Alice wants to maximize the value, Bob wants to minimize the value, and Cindy wants to make the value be close to zero as possible, Cindy will choose the largest one if there are more than one answers. Everyone is smart enough, so that they will take the best strategy, what will be the final value?

Input

The 1st line contains an integer n ($1 \leqslant n \leqslant 100$).

The 2nd line contains n integers $a_1, ..., a_n$.

The 3rd line contains n integers $b_1, ..., b_n$.

The 4th line contains n integers $c_1, ..., c_n$.

$-10^8 \leqslant a_i, b_i, c_i \leqslant 10^8$

Output

Output the final value.

Example

standard input	standard output
2 1 2 -5 6 3 -10	-2

Note

In the case above,Alice will remove 1, Bob removes -5, and Cindy removes 3.

Problem H. Hinnjaku

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

> "I learned one thing from my short life that the ability of human-being is limited. The more one digs into strategy, the more possibly he would realize this point. Therefore, I won't be a human-being anymore, JOJO!"

During the outbreak of the COVID-19, **HamsterW** was bored at home after reading the manga drawn by **E Yu**, therefore he pick up an interesting bangumi named **JOJO's Wonderful Adventure**:

Now the bangumi comes to the most thrilling part: the battle between **JOJO** and **Dio**. The rule of their battle is as follows:

In the initial state, **JOJO** and **Dio** both have a equal health point represented by H. Whose HP returns to zero first is regarded as the defeated one. And if the duel is completed and no one has the zero HP, the one who has more HP will win the duel.

Because their attacks are through their special abilities named **stand** and normal people are not able to see them, here we will represent **JOJO** and **Dio**'s attacks as two strings s,t. the length of the two stings is equal to N, which is the seconds their battle lasts. The strings will only contain lower case characters **'a', 'd','l', 'm', 'o', 'r', 'u', 'w', 'z'**. Every character in the string stands an action their **stands** make, and the $i-th$ character is the action of the $i-th$ second.

Fighting time goes by with the appearance of characters. Every time when last three letters form a string **"ora"** in **JOJO**'s string, **JOJO's stand** named **Star Platinum** finish an attack and **Dio**'s HP decreases by one point. Meanwhile, when last four letters form a string **"muda"** in **Dio**'s string, it means that **DIO**'s **stand** named **The World** makes an attack, causing **JOJO**'s HP decreases by one point.

Apart from normal attacks, they also have the superpower called **"zawaluduo"** which can pause the time. When one side uses **"zawaluduo"**, the other side will pause attack (**i.e. The attack will be interrupted and won't take effect**). If **zawaluduo** appears in one's string, it means that he triggers this ability at the time letter **o** represents for.

Since **"ora"** is shorter than **"muda"**, **Dio** is obviously at a disadvantage. But **Dio**'s superpower is stronger than **JOJO**.

If **JOJO** uses the **"zawaluduo"**, it will have a killing effect on **Dio**, and **Dio**'s HP will turn to zero.

If **Dio** uses this ability, it will also have a killing effect on **JOJO**, and **JOJO**'s HP will turn to zero.

Since **JOJO**'s superpower is weaker than **Dio**, if **JOJO** and **Dio** use this superpower at the same time, it will be judged that **Dio** will try the superpower first and therefore **JOJO** is killed at once.

Finally, according to the strings representing their battle, you need to anticipate the result.

If **JOJO** wins, you need to output **"Wryyyyy"**.
If **Dio** wins, you need to output **"Hinnjaku"**.
If there is a tie, you need to output **"Kono Dio da"**. (This means their HP decreases to zero at the same time, or they have equal HP which is greater than zero after the duel.)

Input

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

Each case is lead by a line contains two positive number separated by space. The first number is N representing the length of two strings. The second number is H representing the health points of **JOJO** and **Dio**.

The second line contain a string $s1$ representing **JOJO**'s attack.

The third line contain a string $s2$ representing **Dio**'s attack.

It is guaranteed that

$1 < T \leq 1\,000, \quad 1 < N \leq 20\,000, \quad 1 < H \leq 1\,0000$

$\sum_{i=1}^{i=T} N_i \leq 2 * 10^6$

Output

For each test case, print a number one line contain a string.
If JOJO wins, you need to output **"Wryyyyy"**.
If Dio wins, you need to output **"Hinnjaku"**.
If there is a tie, you need to output **"Kono Dio da"**.

(All the output contains no quotes.)

Example

standard input	standard output
4 12 3 ororaoraorao mudamudamuda 13 1000 zawaluduoorao zawaluduomuda 12 100 oooraoraorao mudamudamuda 12 3 oraoraoraora zawaluduomud	Wryyyyy Hinnjaku Kono Dio da Hinnjaku

Note

In the first case, **JOJO** makes attack at the 5th, 8th, 11th second, and **DIO** attacks **JOJO** at the 4th, 8th, 12th second. At the 11th character, **JOJO** finishes his third attack, when the **Dio**'s HP comes to zero first. So **JOJO** wins.

In the second case, at the 9th second they both use **zawaluduo**, but **Dio**'s superpower comes first, so **JOJO** is killed and **Dio** wins.

In the third case, neither **Dio** or **JOJO**'s HP decreases to zero, and after duel their HP are equal. So there is a tie.

In the last case, though JOJO's last attack at the 9-th second would easily kill **Dio** with only one HP, **Dio** launches **zawaluduo** at this moment, which not only interrupts the attack but also kills **JOJO** at once.

Problem I. Interesting Matrix Problem

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Due to the outbreak, **CYY** has to be a NEET at home and learn online classes. Today, at 8 o'clock, the data structure class will begin, but his homework hasn't been finished.

His homework is described like this:

Given large matrix of $N \times M$, and the element of the matrix at (i, j) is equal to $i \times j$. There are q queries, each of them will give you a number k, and you should answer **what the k-th smallest number in the matrix is**. For example, the 5th smallest number in $[1, 2, 3, 4, 4, 5]$ is 4, and the same integers should contribute as many as the number of them occupying in the matrix.

Since it's early in the morning, **CYY** still hasn't got full conscious yet and fails to finish this easy task. Can you help **CYY** to finish his homework and get 4.0 GPA?

Input

The first line contains three integers: N, M, q $(1 \leqslant N, M \leqslant 10^8, 1 \leqslant q \leqslant 100)$.

Then each of the following q lines contains a integer $k(1 \leqslant k \leqslant \max(N, M))$.

Output

For each query, output a line contains the **k-th smallest number in the matrix**.

Example

standard input	standard output
3 5 3 2 3 5	2 2 3

Problem J. Jogging along the Yangtze River

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

After the isolation for a long time, Mls is finally allowed to go outside and do some exercising. What he is going to do is his favorite activity ------ jogging along the Yangtze River.

The riverside can be regarded as an infinite 2-dimensional plane, where the X-axis can be regarded as the river bank and the part where $x < 0$ is the river.

Mls starts at the point $(0, 0)$, he will reach the point $(2n, 0)$ with some limitation factors:

1. He cannot step to points that under the x-axis. (Or he will fall into water and don't know what to do)
2. Every step of jogging he can move as one of the following steps:
   (1) move forward with a large step, that is from (x, y) to $(x + 2, y)$.
   (2) move a little step toward left, this means from (x, y) to $(x + 1, y + 1)$.
   (3) move a little step toward right (if he won't step into river), which means from (x, y) to $(x+1, y-1)$

Before he starts the jogging, Mls wondered how many ways in which he can finish his exercise, he is pretty good at math and solved this problem quickly.

Now he decides to test you through this problem, can you handle it?

Input

The only line contains one integer n. $(1 \le n \le 10^5)$

Output

Output one integer, representing the desired answer modulo 998244353.

Examples

standard input	standard output
1	2
2	6

Note

For the second example, the paths are below: