Segunda Fecha Gran Premio México 2018

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Problems book

General information

This book contains a total of 10 problems; Pages are numbered from 1 to 15 not including this page. Verify your book is complete.

Problem A. Amusement Park

Source file name:	`A.c, A.cpp, A.java, A.py2, A.py3`
Input:	`Standard`
Output:	`Standard`
Author(s):	`Juan Pablo Marín Rosas`

ohn is having his vacations out of town and he decided to visit an amusement park to ride all the exciting attractions that the park has, he is very brave and loves to have adventures from time to time so he can distress from all the work he has at home.

Vacations are finishing and he will have to return home, while he was spending some time in the amusement park he realized he has to bring some souvenirs home, however, as he already have made his baggage he can take only two small items. Being the adventurer man he is, John knows exactly what he will be getting home, the first item he is interested is a fridge magnet so he can remember his trip each time he will get some food from the fridge, the other item is a keychain so that he can remember the trip each time he is going to open a door. There are several souvenir stores in the park on some of them they sell the keychain, on others they sell the fridge magnet but none of them sell both items so John needs to go to two stores to get the souvenirs he wants to bring home.

John is standing near a map of the park, the map depicts the park as a rectangular matrix divided in N x M cells where a '.' represents a cell where John can walk, a 'K' is a place where a store sells keychains a 'F' is a place where a store sells fridge magnets, a 'J' represents where John is standing and 'E' represents the exit. The map shows the amusement park attractions with a '#' and John can not walk over them. John can walk freely on any of the stores, the exit, and the starting point, but he will not exit the amusement park until he reaches the exit having bought both of the souvenirs.

Time is flying and John needs to move fast to get the two items before walking to the exit of the park. Can you help John to find the smallest number of steps he needs to make to exit the amusement park? A step is a movement John makes from the current cell to another cell. John can move between cells only if them share a side.

Input

The first line contains an integer number T, the number of test cases. Each test case starts with a line containing two integer numbers N and M representing the dimensions of the park. The following N lines contain a string with exactly M characters these being one of '.', 'K', 'F', 'J', 'E', or '#'.

- $1 \leq T \leq 10$
- $5 \leq N, M \leq 1000$
- The map has only a starting point for John and an exit
- There will be at least one store that sells keychains and one store that sells fridge magnets
- The map is surrounded by '#'

Output

For each test case your program should print a single line with an integer number representing the minimum number of steps John has to make in order to buy both souvenirs and go to the exit. The input maps have always a solution.

Example

Input	Output
2 5 5 ##### #F.K# #FJF# #..E# ##### 6 6 ###### #.J..# ###F.# #K#F## #..FE# ######	4 11

Problem B. Baker's Gang

Source file name:	`B.c, B.cpp, B.java, B.py2, B.py3`
Input:	`Standard`
Output:	`Standard`
Author(s):	`Eddy Ramírez`

Baker is a cat with a very delicate and exclusive taste for "cat nuggets", which are very expensive, though. Since Baker really wants to increase his share of cat nuggets, he with some other N cats, have planned to steal the nugget factory.

They executed their plan and it was very successful, they got quite a bunch of nuggets. Since the amount of nuggets was huge, Baker and his gang, decided to hide the nuggets in order to come sometime later and make the division in equal parts.

But ... since cats are very suspicious, specially from each other, starting with Baker, they cheated on each other.

Baker was the first, he arrived to the hideaway and counted every nugget, there were K nuggets, he took his share $\frac{K1}{N}$ of the nuggets and he realized that after dividing the amount of nuggets by N, the remainder was 1, so he took that extra nugget for his mother.

The second cat arrived a little later and he counted the nuggets and realized that the remainder after dividing by N was 1, he took his share and the one extra-nugget and left the rest.

The third cat arrived and did the same, with the same surprising fact that when dividing by N the remainder was still 1. He took "his share" and the extra-nugget.

After every single cat did the same thing with the same outcome, they reunited for the final division, and they counted the nuggets, no cat showed surprise for the lack of nuggets they noticed, but after dividing by N the number of remaining nuggets, the remainder was 1 again! So they agreed to give that extra-nugget to a street cat and problem solved.

Your task is to find the number of nuggets K that were originally stolen by Baker and his gang.

Input

The first line is a single integer T with the amount of test cases. The next T lines have a single number N which is the amount of members on Baker's gang.

- $1 \leq T \leq 10^3$
- $3 \leq N \leq 10^6$

Output

The output is the minimum natural number that fits with the description above. As this number can be big write the number modulo 1000000007 ($10^9 + 7$).

Example

Input	Output
1 4	1021

Input	Output
3 5 6 7	15621 279931 5764795

Problem C. Cables

Source file name:	`C.c, C.cpp, C.java, C.py2, C.py3`
Input:	`Standard`
Output:	`Standard`
Adapted by:	`Juan Pablo Marín Rosas From 2001 NEERC problem C`

Mexico regional programming contest are near, yes, they will be in like 6 months but with all the planning required to have success in the event 6 months is too little time.

The Mexico regional finals committee have decided they need to work in order to organize the most fair regional contest ever. It was decided that in order to have the most fair contest they need not to provide only computers with the same operative system and software and with exactly the same hardware but that it is also required that the connection to the judging system is exactly the same.

In order to have exactly the same connection to the judging system each of the K computers that contestants will be using during the contest will be connected directly with a cable to the central hub where the judging system is connected, also, to make sure everything is exactly the same on contestant computers the cable to each computer should have the same length.

To buy network cables, the committee has contacted a local network solutions provider with a request to sell for them a specified number of cables with equal lengths. The provider does not have available the required amount of cables but they have a stock of N cables with different sizes and they can cut these cables if they know the length of the pieces they must cut. After the committee heard this, some thoughts came to their mind about the size of the cable, it would be appropriate that the cable size is as long as possible, in this way they can sit contestants as far from each other as possible, making the contest even more fair.

As the committee is too busy solving more issues with the problem set, you are here to help them by writing a program that will determine the maximal possible length of a cable that can be cut from the cables in the providers stock, to get the required amount of cables.

Input

The input consists of several test cases. The first line of input contains a number T the number of test cases that follows. The following T test cases are as follow: The first line of each test case contains two integer numbers N and K, separated by a space. N is the number of cables in the providers stock, and K is the number of requested cables. The next N lines with one number per line, that specify the length of each cable in the stock in centimeters.

- $1 \leq T \leq 20$
- $1 \leq N \leq 10^4$
- $1 \leq K \leq 10^4$
- All cables in the stock are at least 1 centimeter and at most 10^9 centimeters in length.

Output

For each testcase write to the output the maximal length (in centimeters) of the pieces that network provider may cut from the cables in the stock to get the requested number of pieces.

If it is not possible to cut the requested number of pieces each one being at least one centimeter long, then the output must contain the single number "0" (without quotes).

Example

Input	Output
1 4 11 80 70 40 50	20

Problem D. Divisible repunit

Source file name:	`D.c, D.cpp, D.java, D.py2, D.py3`
Input:	`Standard`
Output:	`Standard`
Author(s):	`Juan Pablo Marín Rosas`

n recreational mathematics, a repunit is a number like 11, 111, or 1111 that contains only the digit 1. The term stands for repeated unit and was coined in 1966 by Albert H. Beiler in his book Recreations in the Theory of Numbers.

It is suspected that any number N ending with any of the digits 1, 3, 7 or 9 have at least one multiple that is a repunit, this is, there is at least one repunit R such that the result of diving R by N has no remainder.

Your task is to help confirm the previous statement. Given a number N that ends with any of the digits 1, 3, 7, or 9 can you find how many digits have the smallest repunit that N can divide?

Input

The first line of input contains a number T, the number of test cases. Each test case is described by a line with a single number N.

- $1 \leq T \leq 10$
- $1 \leq N \leq 10^6$
- It is guaranteed that the last digit of N will be 1, 3, 7 or 9

Output

For each test case print the number of digits that has the minimum repunit that can be divided by N without reminder if such repunit exists, print -1 otherwise.

Example

Input	Output
2 3 7	3 6

Problem E. Examining groups

Source file name:	`E.c, E.cpp, E.java, E.py2, E.py3`
Input:	`Standard`
Output:	`Standard`
Author(s):	`Juan Pablo Marín Rosas`

chools usually divide students in groups usually by age or ability, this has created some polarity on people opinion, some people think this is good so that students can interact with others that may have similar skills and likes in common. Others think this is one of the main things that are dividing society.

John's school does not like to be part of this kind of discussions that's why they will limit groups by the amount of students they can put on their classrooms. Today John's school has N students divided in 1000 groups, each of these groups is represented by an integer number between 1 and 1000 and are groups conformed of students who have common skills or common age.

In order to have more diversified groups John has decided to put all students in a line with N slots numbered from 0 to $N-1$, each student is wearing a shirt that represents which group the student belongs to. After all students are in the line then John ask them to move to a random position making sure that each position in the line has exactly one student. John will take now two positions X and Y and calculate the "diversity score" of the group that they can make by creating a group with students standing in the line from position X to position Y inclusive. The "diversity score" is the number of different groups that the students between X and Y belong to at this moment.

John will be selecting several values for X and Y trying to find good "diversity scores", but as there can be a lot of students it is complicated and time consuming. Can you help John to given the arrangement of the students to find what is the "diversity score" for each selection of X and Y that he makes?

Input

The first line contains a single number T, the number of test cases. Each test case starts with a line with two integer number N and Q being the number of students and the number of selections John will make for X and Y. The next line contains N numbers separated by a space, representing where the $i-th$ element of the line is the group the $i-th$ student in the line belongs to. The next Q lines contain two integer numbers separated by a space representing each of the selectiong for X and Y that John will make.

- $1 \leq N \leq 10^5$
- $1 \leq Q \leq 10^5$
- $0 \leq X \leq Y \leq N$
- Even when the school has 1000 groups, not necessarily all groups have students.

Output

For each test your program should print exactly Q lines each line contains the "diversity score" based on the definition above for each of the X and Y selections John has made on the test case.

Example

Input	Output
2 5 3 1 2 1 2 3 0 2 3 4 0 4 4 3 1 5 5 5 1 3 0 3 0 0	2 2 3 1 2 1

Problem F. Frogs secret meeting

Source file name:	`F.c, F.cpp, F.java, F.py2, F.py3`
Input:	`Standard`
Output:	`Standard`
Adapted by:	`Juan Pablo Marín Rosas From 2007 NWERC problem B`

Lately there have been a lot of problems about frogs. It seems this is not some kind of coincidence. Frogs have been meeting secretly to plan how to get a problem set with just frogs problems on "El Gran Premio".

These reunions can lead to have a very boring set, all talking about frogs, jumps and rocks. You want to stop it and have studied how frogs behave before their meetings so you are now ready to interrupt one of the meetings and avoid at all cost that the frogs take the problem set for the next competition.

The frogs plan their reunion in a pond where a number of frogs are standing on a number of rocks. The frogs can have the meeting in a rock where all the frogs can stand at the same time. The frogs do not like to get into the water because it can make a lot of noise and then their meeting would not be secret that's why they jump from one rock to another as long as their distance is less or equal to the maximum distance D a frog can jump.

Frogs put a lot of caution before their meetings, they know that too much jumps may look suspicious so they avoid jumping out too much from any rock because doing much jumps from the same rock could look suspicious to anyone looking at the pond. As frogs are experts hiding their plans they already know exactly how many times they can jump out of each rock before jumping from that rock looks suspicious, it is not suspicious that a frog lands on a rock, only when they jump out of the rocks.

Can you find all the rocks where the frogs can have their secret meeting?

Input

On the first line one positive number T the number of test cases. Each of the T test cases start with one line with the integer N and a floating-point number D, denoting the number of rocks in the pond and the maximum distance a frog can jump. Each of the next N lines contains X_i, Y_i, n_i and m_i, denoting for rock i its X and Y coordinate, the number of frogs on it and the maximum number of times a frog can jump off this rock before it looks suspicious.

- $1 \leq T \leq 100$
- $1 \leq N \leq 100$
- $1 \leq D \leq 10^5$
- $-10^4 \leq X_i, Y_i \leq 10^4$
- $0 \leq n_i \leq 10$
- $1 \leq m_i \leq 200$

Output

For each test case print one line containing a space-separated list of 0-based indices of the rocks on which the frogs can have their meeting this list should be in increasing order. If no such rock exists, output a line with the single number -1.

Example

Input	Output
2 5 3.5 1 1 1 1 2 3 0 1 3 5 1 1 5 1 1 1 5 4 0 1 3 1.1 -1 0 5 10 0 0 3 9 2 0 1 1	1 2 4 -1

Problem G. Generator strings

Source file name:	`G.c, G.cpp, G.java, G.py2, G.py3`
Input:	`Standard`
Output:	`Standard`
Author(s):	`Juan Pablo Marín Rosas`

string S of lower case characters is said to be a generator string of the string S' if S' has the same length of S and if each character that appears on S appears the same amount of times on S'.

As you can see the this definition leads that S is a generator string of S, also if S is a generator string of S' then S' is also a generator string of S.

Your task is given a list of N strings to determine how many pairs of indexes (A, B) you can take such that the $A - th$ element of the list is a generator of the $B - th$ element?

Input

The input consists of several test cases. The first line of input contains a number T the number of test cases. Each test case starts with a line containing a single integer N, followed by N lines where each line contains a string from the list, each string contains only lower case characters.

- $1 \leq N \leq 10^5$
- The length of a string L is in the range $1 \leq L \leq 100$

Output

For each test case your program should print an integer number, the number of pairs (A, B) that suffices the requirements listed above.

Example

Input	Output
2 3 abc bca cab 5 abc ab a b b	9 7

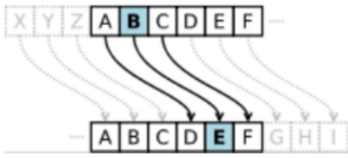
Problem H. Hiding messages

Source file name:	`H.c, H.cpp, H.java, H.py2, H.py3`
Input:	`Standard`
Output:	`Standard`
Author(s):	`Facultad de Informática Culiacán UAS`

n the ACM school students use to send message between each others. They don't want teachers to notice what these messages say. Students are really clever so they have created a coding mechanism that will allow them to send messages without teachers noticing what they say.

Students will code the message substituting each of the upper case letters in the message with the letter that is in a fixed number K of positions ahead in the alphabet.

As an example if $K = 3$ then the letter A will be substituted with the letter D, B will be substituted with the letter E, and so on. It is supposed that the alphabet is circular in such way that A is after Z, so the letter Z would be substituted with the letter C, you can see an idea of this in the following figure.



As mentioned above, students only substitute upper case letters all other characters in the message are not changed.

Your task is, given student messages to code each of those messages using the method described.

Input

The first line contains a number T the number of test cases. Each of the test cases start with two numbers N and K being the number of lines in the message and the number of positions that the letters will be shifted. The next N lines in the test case will contain a string that represents a line in the students message.

- $1 \leq T \leq 10$
- $1 \leq N \leq 100$
- $1 \leq K \leq 1000$
- Each line of the student message will contain any printable ASCII character excluding the new line character.

Output

For each line on each of the messages your program should print the encoded message using the method described above.

Example

Input	Output

`2`
`1 1`
`UN TEXTO, y algo MAS`
`1 120`
`AlexAndeR`
	`VO UFYUP, y algo NBT`
	`QlexQndeH`

Problem I. Intergalactic tourism

Source file name:	`I.c, I.cpp, I.java, I.py2, I.py3`
Input:	`Standard`
Output:	`Standard`
Author(s):	`Juan Pablo Marín Rosas`

ow is year 4018 and we have a lot of technological advances, a lot of them related to space and time travelling. The main technology that enables space and time travelling are transporters, basically you can stand on a transporter and be transported in no time to any planet that you decide, this makes intergalactic tourism (travelling to planets) something really easy as you can go and travel to planets without wasting time.

Given all the commodities it is now a must to do intergalactic tourism, the complex thing is that the transporters have restrictions established that will not allow you to travel to planet X unless you have travelled before to all planets that restrict access to planet X. For example if the planets that restrict access to planet 2 are planets 1 and 3 you should visit planets 1 and 3 before the transporter gives you access to travel to planet 2.

You found based on the transporters restriction that there may be more than one way to visit all the N planets in the planetary system, you want to find all of them.

Can you find given the list of planets you must visit before visiting each planet all the different ways you can visit the N planets considering that on each way you will be visiting each planet only once?

Input

The first line contains a single integer T with the number of test cases. Each of the test cases start with a line with the number N the number of planets in the planetary system. Each of the next N start with an integer number R_i the number of planets that restrict access to this planet followed by R_i numbers representing the planets that restrict access to this planet, all numbers in the line are separated by a space.

- $1 \leq T \leq 10$
- $3 \leq N \leq 10$
- $0 \leq R_i \leq N - 1$
- Planets are numbered from 0 to $N - 1$
- It is guaranteed that there is always at least one way to visit all planets.

Output

For each test case print all the ways you could visit planets based on the restrictions mentioned above. Print them in lexicographical order this is: Given two different ways of visiting the planets, $a_1, a_2 \ldots a_k$ and $b_1, b_2 \ldots b_k$, the first one is smaller than the second one for the lexicographical order, if $a_i < b_i$, for the first i where a_i and b_i differ.

Example

Input	Output
3	0 1 2
3	1 0 2
0	0 1 2
0	1 0 2
2 0 1	1 2 0
3	4 5 0 2 3 1
0	4 5 2 0 3 1
0	4 5 2 3 0 1
1 1	4 5 2 3 1 0
6	5 2 3 4 0 1
2 4 5	5 2 3 4 1 0
2 3 4	5 2 4 0 3 1
1 5	5 2 4 3 0 1
1 2	5 2 4 3 1 0
0	5 4 0 2 3 1
0	5 4 2 0 3 1
	5 4 2 3 0 1
	5 4 2 3 1 0

Problem J. Joy and misery

Source file name:	`J.c, J.cpp, J.java, J.py2, J.py3`
Input:	`Standard`
Output:	`Standard`
Author(s):	`Juan Pablo Marín Rosas`

In a land far far away pirates say that being in union will bring joy, that's why pirates usually come in pairs and have put an attribute of good luck to even numbers. In the other hand, bad luck is represented by odd numbers that will bring misery as they represent for them pairs that have been divided.

That is why every time a pirate sees an even number he will feel joy, and every time he sees an odd number he will feel misery. John the most young pirate in the dark ship is having trouble to sleep so the other pirates have suggested him to start counting sheep at night. Oh! how unfortunate is John, as when he is counting the sheep he feels joy and misery all night until he falls asleep.

Can you count how many times will John feel joy and how many times he will feel misery if he starts counting the sheep at the number X and falls asleep when he reaches the sheep with the number Y

Input

The first line of input has a single number T, the number of test cases. Each test case will consist of a single line with two numbers separated by space X and Y.

- $1 \leq T \leq 1000$
- $1 \leq X \leq Y \leq 10^6$

Output

For each test case you should print two numbers separated by a space, the first of them being the number of times John will feel joy while counting sheep, the second number is the number of times John will feel misery while counting sheep.

Example

Input	Output
4 1 1 1 4 5 11 6 12	0 1 2 2 3 4 4 3