A • Which Base is it Anyway?

Programming languages such as C++ and Java can prefix characters to denote the *base* of constant integer values. For example, hexadecimal (base 16) constants are preceded by the string "**0x**". Octal (base 8) values are preceded by the character "**0**" (zero). Decimal (base 10) values do not have a prefix. For example, all the following represent the same integer constant, albeit in different bases.

```
0x1234
011064
 4660
```

The prefix makes it clear to the compiler what base the value is in. Without the "**0x**" prefix, for example, it would be impossible for the compiler to determine if 1234 was hexadecimal. It could be octal or decimal.

For this problem, you will write a program that interprets a string of decimal digits as if it were an octal value, a decimal value or a hexadecimal value.

Input

The first line of input contains a single decimal integer P, ($1 \le P \le 10000$), which is the number of data sets that follow. Each data set should be processed identically and independently.

Each data set consists of a single line of input. It contains the data set number, ***K,*** followed by a single space, followed by a string of at most 7 decimal digits.

Output

For each data set there is one line of output. The single output line consists of the data set number, ***K***, followed by a space followed by 3 space separated decimal integers which are the value of the input as if it were interpreted to as octal, decimal and hexadecimal respectively. If the input value cannot be interpreted as an octal value, use the value 0.

Sample Input	Sample Output
4 1 1234 2 9 3 1777 4 129	1 668 1234 4660 2 0 9 9 3 1023 1777 6007 4 0 129 297

B • FBI Universal Control Numbers

The ***FBI*** has recently changed its *Universal Control Numbers* (*UCN*) for identifying individuals who are in the FBI ¶V fingerprint database to an eight digit base 27 value with a ninth *check* digit. The digits used are:

```
0123456789ACDEFHJKLMNPRTVWX
```

Some letters are not used because of possible confusion with other digits:

```
B->8, G->C, I->1, O->0, Q->0, S->5, U->V, Y->V, Z->2
```

The *check* digit is computed as:

```
(2*D1 + 4*D2 + 5*D3 + 7*D4 + 8*D5 + 10*D6 + 11*D7 + 13*D8) mod 27
```

Where `D`n is the n^{th} digit from the left.

This choice of *check* digit detects any single digit error and any error transposing an adjacent pair of the original eight digits.

For this problem, you will write a program to parse a *UCN* input by a user. Your program should accept decimal digits and *any* capital letter as digits. If any of the *confusing* letters appear in the input, you should replace them with the corresponding valid digit as listed above. Your program should compute the correct *check* digit and compare it to the entered check digit. The input is rejected if they do not match otherwise the decimal (base 10) value corresponding to the first eight digits is returned.

Input

The first line of input contains a single decimal integer P, $(1 \leq P \leq 10000)$, which is the number of data sets that follow. Each data set should be processed identically and independently.

Each data set consists of a single line of input. It contains the data set number, ***K,*** followed by a single space, followed by 9 decimal digits or capital (alphabetic) characters.

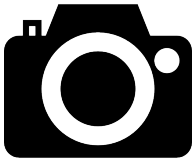
Output

For each data set there is one line of output. The single output line consists of the data set number, ***K*** IROORZHG E\ D VLQJOH VSDFH Invalid RU WKH GHFLPDO value corresponding to the first eight digits.

Sample Input	Sample Output
3 1 12345678A 2 12435678A 3 12355678A	1 11280469652 2 Invalid 3 Invalid

Problem C

Cameras



Your street has n houses, conveniently numbered from 1 to n. Out of these n houses, k of them have security cameras installed. Mindful of gaps in coverage, the Neighborhood Watch would like to ensure that every set of r consecutive houses has at least two different houses with cameras. What is the minimum number of additional cameras necessary to achieve this?

Input

The first line of input contains three integers, n ($2 \leq n \leq 100{,}000$), k ($0 \leq k \leq n$), and r ($2 \leq r \leq n$).

The next k lines of input contain the distinct locations of the existing cameras.

Output

Print, on a single line, a single integer indicating the minimum number of cameras that need to be added.

Sample Input	Sample Output
15 5 4 2 5 7 10 13	3

D xA Rational Sequence (Take 3)

An infinite full binary tree labeled by positive rational numbers is defined by:

- The label of the root is 1/1 .
- The left child of label p/q is p/(p+q) .
- The right child of label p/q is (p+q)/q .

The top of the tree is shown in the following figure:

A rational sequence is defined by doing a level order (breadth first) traversal of the tree (indicated by the light dashed line). So that:

)))))) «

Write a program to compute the n^{th} element of the sequence, F(n) . Does this problem sound familiar? Well it should! We had variations of this problem at the 2014 and 2015 Greater NY Regionals.

Input

The first line of input contains a single integer P, (1 d P d 1000), which is the number of data sets that follow. Each data set should be processed identically and independently.

Each data set consists of a single line of input. It contains the data set number, K, and the index, N, of the sequence element to compute (1 <= N <= 2147483647).

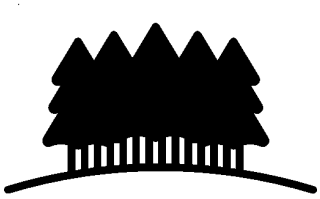
Output

For each data set there is a single line of output. It contains the data set number, K, followed by a single space which is then followed by the numerator of the fraction, followed immediately by a I R U Z D U G) ROORZHG Kimmediate1 by the denominator of the fraction. Inputs will be chosen so neither the numerator nor the denominator will overflow an 32-bit unsigned integer.

Sample Input	Sample Output
4 1 1 2 4 3 11 4 1431655765	1 1/1 2 1/3 3 5/2 4 2178309/1 346269

Problem E

Enclosure



In the Dark Forest, the territory you control is defined by the smallest convex polygon that contains all trees you control. Your power is defined by the area of the territory you control.

You currently control k out of n trees in the Dark Forest. What is the highest power you can achieve by gaining control over a single additional tree somewhere in the forest?

Input

The first line of input consists of two space-separated integers n and k ($3 \leq k < n \leq 100{,}000$).

Next follow n lines each with two space-separated integers x_i and y_i ($|x_i|, |y_i| \leq 10^9$) specifying the locations of the n trees. You control the first k trees given in the list; the other $n - k$ trees do not belong to you. (Note that some of these may still be inside your territory.)

It is guaranteed that no three trees have collinear locations.

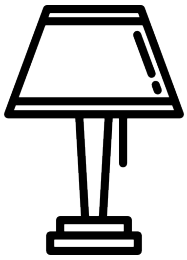
Output

Print, on a single line, the maximum power you can achieve by gaining control over a single additional tree. The output should be rounded and displayed to exactly one decimal place.

Sample Input	Sample Output
5 3 -5 -5 -5 5 5 -5 -4 6 5 5	100.0

Problem F

Illumination



You inherited a haunted house. Its floor plan is an n-by-n square grid with l lamps in fixed locations and no interior walls. Each lamp can either illuminate its row or its column, but not both simultaneously. The illumination of each lamp extends by r squares in both directions, so a lamp unobstructed by an exterior wall of the house can illuminate as many as $2r + 1$ squares.

If a square is illuminated by more than one lamp in its row, or by more than one lamp in its column, the resulting bright spot will scare away ghosts forever, diminishing the value of your property. Is it possible for all lamps to illuminate a row or column, without scaring any ghosts? Note that a square illuminated by two lamps, one in its row and the other in its column, will not scare away the ghosts.

Input

The first line of input contains three positive integers, n, r and l ($1 \leq n, r, l \leq 1{,}000$).

Each of the next l lines contains two positive integers r_i and c_i ($1 \leq r_i, c_i \leq n$), indicating that there is a lamp in row r_i and column c_i.

It is guaranteed that all lamps are in distinct locations.

Output

Print, on a single line, `YES` if it is possible to illuminate all lamps as stated above; otherwise, print `NO`.

Sample Input	Sample Output
3 2 5 1 1 1 3 3 1 3 3 2 2	YES

Sample Input	Sample Output
3 2 6 1 1 1 2 1 3 3 1 3 2 3 3	NO

Problem G

Maximum Islands

You are mapping a faraway planet using a satellite.

Your satellite has captured an image of the planet's surface. The photographed section can be modeled as a grid. Each grid cell is either land, water, or covered by clouds. Clouds mean that the surface could either be land or water, but we can't tell.

An island is a set of connected land cells. Two cells are considered connected if they share an edge.

Given the image, determine the maximum number of islands that is consistent with the given information.

Input

The first line of input contains two space-separated integers n and m ($1 \leq n, m \leq 40$).

Each of the next n lines contains m characters, describing the satellite image. Land cells are denoted by '`L`', water cells are denoted by '`W`', and cells covered by clouds are denoted by '`C`'.

Output

Print, on a single line, a single integer indicating the maximum number of islands that is consistent with the given grid.

Sample Input	**Sample Output**
5 4 LLWL CCCC CCCC CCCC LWLL	8

Problem H
Guessing Camels

Jaap, Jan, and Thijs are on a trip to the desert after having attended the ACM ICPC World Finals 2015 in Morocco. The trip included a camel ride, and after returning from the ride, their guide invited them to a big camel race in the evening. The camels they rode will also participate and it is customary to bet on the results of the race.

One of the most interesting bets involves guessing the complete order in which the camels will finish the race. This bet offers the biggest return on your money, since it is also the one that is the hardest to get right.

Jaap, Jan, and Thijs have already placed their bets, but the race will not start until an hour from now, so they are getting bored. They started wondering how many pairs of camels they have put in the same order. If camel c is before camel d on Jaap's, Jan's and Thijs' bet, it means that all three of them put c and d in the same order. Can you help them to calculate the number of pairs of camels for which this happened?

Input

The input consists of:

- one line with an integer n ($2 \leq n \leq 200\,000$), the number of camels;
- one line with n integers $a_1, \ldots, a_n$ ($1 \leq a_i \leq n$ for all i), Jaap's bet. Here a_1 is the camel in the first position of Jaap's bet, a_2 is the camel in the second position, and so on;
- one line with Jan's bet, in the same format as Jaap's bet;
- one line with Thijs' bet, in the same format as Jaap's bet.

The camels are numbered $1, \ldots, n$. Each camel appears exactly once in each bet.

Output

Output the number of pairs of camels that appear in the same order in all 3 bets.

Sample Input #1

```
3
3 2 1
1 2 3
1 2 3
```

Sample Output #1

```
0
```

Sample Input #2

```
4
2 3 1 4
2 1 4 3
2 4 3 1
```

Sample Output #2

```
3
```

Problem I
Elementary Math

Ellen is teaching elementary math to her students and the time for the final exam has come. The exam consists of n questions. In each question the students have to add (+), subtract (−) or multiply (×) a pair of numbers.

Ellen has already chosen the n pairs of numbers. All that remains is to decide for each pair which of the three possible operations the students should perform. To avoid students getting bored, Ellen wants to make sure that the n correct answers to her exam are all different.

Please help Ellen finish constructing the exam by automating this task.

Input

The input consists of:

- one line with one integer n ($1 \le n \le 2\,500$), the number of pairs of numbers;
- n lines each with two integers a and b ($-10^6 \le a, b \le 10^6$), a pair of numbers used.

Output

For each pair of numbers (a, b) in the same order as in the input, output a line containing a valid equation. Each equation should consist of five parts: a, one of the three operators, b, an equals sign (=), and the result of the expression. All the n expression results must be different.

If there are multiple valid answers you may output any of them. If there is no valid answer, output a single line with the string `impossible` instead.

Sample Input #1

```
4
1 5
3 3
4 5
-1 -6
```

Sample Output #1

```
1 + 5 = 6
3 * 3 = 9
4 - 5 = -1
-1 - -6 = 5
```

Sample Input #2

```
4
-4 2
-4 2
-4 2
-4 2
```

Sample Output #2

```
impossible
```

Problem J
Delivering Goods

You run a delivery company and must deploy a fleet of vehicles to deliver goods to clients. All of the goods and delivery trucks are initially located at your warehouse.

The road network consists of one-way streets between junctions. The warehouse and clients are all located at a junction. You know the driving time across each street.

You guarantee extremely fast shipping: the trucks start driving immediately at the start of the day and each client i will receive the package at time T_i where T_i is the shortest possible driving time for a truck to go from the warehouse to the location of the client i.

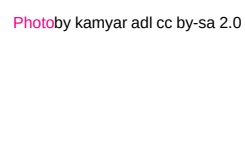


Photo by kamyar adl cc by-sa 2.0

What is the minimum number of trucks you have to deploy to ensure this guarantee is met? That is, what is the minimum number of trucks such that it is possible to give each truck a driving route so that every client i is visited by some truck at time T_i. Assume it takes no time to load the trucks with the appropriate goods at the start of the day, and it takes no time to drop goods off at a client once the truck arrives at the client. These goods are small enough that each truck can carry goods for as many clients as necessary.

Input

The input consists of a single test case. The first line of each test case consists of three numbers, N, M, and C. Here N denotes the number of junctions in the road network ($2 \leq N \leq 10^3$), M denotes the number of streets ($1 \leq M \leq 10^5$), and C denotes the number of clients ($1 \leq C \leq 300$, $C < N$).

The junctions are numbered 0 to $N-1$. The warehouse is always at junction 0. The second line consists of C distinct integers between 1 and $N-1$ indicating the junctions where the clients reside.

The rest of the input consists of M lines, each containing integers U, V, W where $0 \leq U, V \leq N-1$ and $U \neq V$. This indicates there is a one-way street from U to V with driving time W. Each street's driving time W satisfies $1 \leq W \leq 10^9$. It will always be possible to reach every client from the warehouse.

There will be at most one street from a vertex U to another vertex V, but there may be streets from both U to V and from V to U.

Output

Output a single integer that is the minimum number of vehicles required to ensure each client i is visited at time T_i by some vehicle.

Explanations of Sample Inputs

In the first sample, one vehicle can follow the path $(0; 1; 2)$ and the other can follow $(0; 3)$. In the second sample, the only solution is to use paths $(0; 1)$, $(0; 2)$, and $(0; 3)$. In the final sample, one vehicle can follow $(0; 1)$, another $(0; 4; 6)$, and the last one $(0; 2; 3; 5; 7)$.

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

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

Sample Input	Sample Output
8 11 5 1 3 4 6 7 0 1 5 0 4 1 0 2 2 0 6 6 2 3 1 2 6 3 3 5 7 4 1 5 5 7 3 6 5 6 4 6 4	3

Problem K
Kitchen Combinatorics

The world-renowned Swedish Chef is planning a gourmet three-course dinner for some muppets: a starter course, a main course, and a dessert. His famous Swedish cook-book o ers a wide variety of choices for each of these three courses, though some of them do not go well together (for instance, you of course cannot serve chocolate moose and sooted shreemp at the same dinner).

Each potential dish has a list of ingredients. Each ingredient is in turn available from a few di erent brands. Each brand is of course unique in its own special way, so using a particular brand of an ingredient will always result in a completely di erent dinner experience than using another brand of the same ingredient.

Some common ingredients such as pÃ¸lÃ¥rber may appear in two of the three chosen dishes, or in all three of them. When an ingredient is used in more than one of the three selected dishes, Swedish Chef will use the same brand of the ingredient in all of them.

While waiting for the meecaroo, Swedish Chef starts wondering: how many di erent dinner experiences are there that he could make, by di erent choices of dishes and brands for the ingredients?

Input

The input consists of:

- one line containing ve integers r, s, m, d, n, where $1 \cdot r \cdot 1\,000$ is the number of di erent ingredients that exist, $1 \cdot s; m; d \cdot 25$ are the number of available starter dishes, main dishes, and desserts, respectively, and $0 \cdot n \cdot 2\,000$ is the number of pairs of dishes that do not go well together.
- one line containing r integers $b_1; : : : ; b_r$, where $1 \cdot b_i \cdot 100$ is the number of di erent brands of ingredient i.
- $s + m + d$ lines describing the s starter dishes, then the m main dishes, then the d desserts. Each such line starts with an integer $1 \cdot k \cdot 20$ denoting the number of ingredients of the dish, and is followed by k distinct integers $i_1; : : : ; i_k$, where for each $1 \cdot j \cdot k$, $1 \cdot i_j \cdot r$ is an ingredient.
- n lines each containing two incompatible dishes. Each dish is identi ed by an integer $1 \cdot j \cdot s + m + d$, referring to the j'th dish given in the input (so $1 \cdot j \cdot s$ refers to the starter dishes, $s < j \cdot s + m$ refers to the main dishes, and $s + m < j \cdot s + m + d$ refers to the desserts).

Each pair of incompatible dishes in the input consists of two dishes of di erent types, and any one pair of dishes is listed at most once.

Output

If the number of di erent dinner experiences Swedish Chef can make is at most 10^{18}, then output that number. Otherwise, output `too many`.

Sample Input #1

```
6 1 1 1 0
2 3 1 5 3 2
2 1 2
3 3 4 5
1 6
```

Sample Output #1

```
180
```

Sample Input #2

```
3 2 2 1 1
2 3 2
1 1
1 2
1 2
1 3
1 1
2 3
```

Sample Output #2

```
22
```

Sample Input #3

```
3 1 1 1 1
5 5 5
3 1 2 3
3 1 2 3
3 1 2 3
2 1
```

Sample Output #3

```
0
```

Sample Input #4

```
10 1 1 1 0
100 100 100 100 100 100 100 100 100 100
4 1 2 3 4
3 5 6 7
3 8 9 10
```

Sample Output #4

```
too many
```

Problem L

Windy Path

There are n obstacles placed in a field. Your task is to design a course that visits each obstacle exactly once, in any order, following a straight line between consecutive obstacles, without ever crossing itself.

The catch? The sequence of turn directions (left or right) has already been decided, in a string of length $n-2$. If the ith character of the turn sequence is '`L`', then the locations of the ith, $(i+1)$th, and $(i+2)$th obstacles, in that order, must form a counterclockwise angle. If it is '`R`', they must form a clockwise angle.

Input

The first line of input contains a single integer n ($3 \leq n \leq 50$).

Each of the next n lines contains two space-separated integers x_i and y_i ($1 \leq x_i, y_i \leq 1{,}000$), giving the coordinates of obstacle i.

The next and final line will contain a single string with exactly $n-2$ characters consisting of only '`L`' and '`R`', representing the sequence of turn directions.

It is guaranteed that no three obstacles will be collinear.

Output

If no solution is possible, print, on a single line, the integer '`-1`'. Otherwise, print, on a single line, any permutation of the obstacles that satisfies the requirements. The permutation should be given as n distinct space-separated integers p_i with $1 \leq p_i \leq n$, and this ordering of the points should satisfy the turn directions indicated by the turn sequence.

If there are multiple possible solutions, print any of them.

Sample Input	Sample Output
4 2 2 2 1 1 2 1 1 LR	1 3 2 4