Problem A
Another Query on Array Problem
Problem ID: queryonarray

Given an array of integers $A_1, A_2, ..., A_N$ and the initial value of all elements are 0. Now you are given M queries, each belongs to one of three following types:

- $0\ x\ y$: Find the sum of all elements from index x to index y modulo $10^9 + 7$
- $1\ x\ y$: Add $1 \times 2 \times 3$ to A_x, add $2 \times 3 \times 4$ to A_{x+1}, ..., add $(i + 1) \times (i + 2) \times (i + 3)$ to A_{x+i} and so on until A_y
- $2\ x\ y$: Subtract $1 \times 2 \times 3$ from A_x, subtract $2 \times 3 \times 4$ from A_{x+1}, ..., subtract $(i + 1) \times (i + 2) \times (i + 3)$ from A_{x+i} and so on until A_y

Input

The first line contains two integers N and M ($1 \le N, M \le 10^5$) - the size of the array and the number of queries, respectively.

Each of the next M lines containts three integers $t\ x\ y$ denotes type and range of the query.

Output

For each query of type 0, print the required answer in a single line.

Sample Clarification

In the example below:

- After the first query, the array is $[6, 24, 60, 120, 210, 336, 504, 720]$.
- The answer for the second query is $24 + 60 + 120 + 210 + 336 + 504 + 720 = 1974$.
- After the third query, the array is $[6, 24, 60, 114, 186, 276, 504, 720]$.
- The answer for the last query is $186 + 276 = 462$

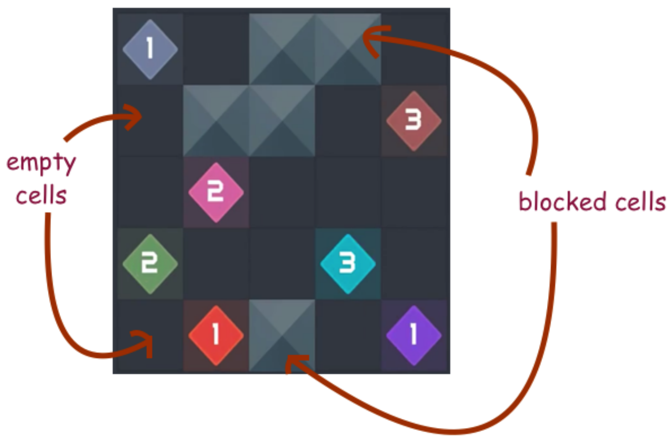
Sample Input 1	Sample Output 1
8 4 1 1 8 0 2 8 2 4 6 0 5 6	1974 462

Problem B
Board Covering
Problem ID: boardcovering

Given a board with M rows and N columns. A cell at the i^{th} row from the top and the j^{th} column from the left is denoted by (i, j). Each cell of the board is one of 3 types:

- A blocked cell.
- An empty cell.
- A number in range $[1, 9]$.

For example:

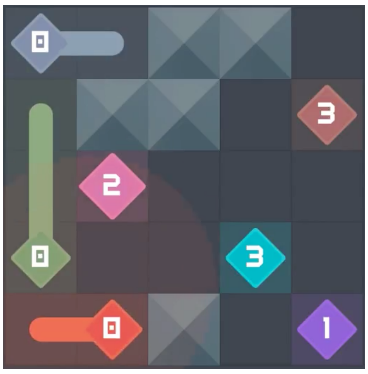


Your task is to fill all empty cells on the board. For each cell (i, j) containing a number, you need to:

- Draw 1 to 4 lines starting from cell (i, j). These lines must be parallel to side of boards and go to adjacent cells.
- The lines can only go through empty cells.
- The sum of length of these lines must be exactly equal to the number written on cell (i, j).
- No two lines can intersect (i.e. no two lines can have a common cell).

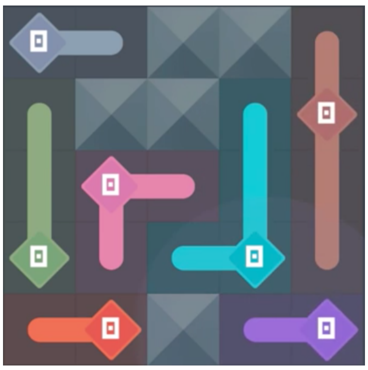
For example, starting from cell $(1, 1)$, you can draw 1 line like following image. The number in cell $(1, 1)$ became 0, this indicates that the requirement for this cell is satisfied.

The next figure shows the lines from cell $(4, 1)$ and cell $(5, 2)$:



The next figure shows the lines from cell $(3, 2)$. Note that 2 lines are drawn, whose sum is exactly 2.

The final figure shows the completely filled board:



Input

The first line of input contains 2 integers M and N - the number of rows and columns of the board $(1 \leq M, N \leq 12)$. The next M lines, each contains N characters representing the board. Each character can be one of the following:

- "#" denoting a blocked cell.
- "." denoting an empty cell.
- A digit from 1 to 9, the number written on this cell.

Output

Output exactly M lines, each line contains exactly N character.

- Output "#" for a blocked cell.
- Output a digit for the number written on the cell.
- For the empty cells, output one of 4 characters "<", ">", "^", "v", the direction of the line from the number to this cell. See sample output for more clarity.

It is guaranteed that at least one solution exists. In case of multiple solutions, you can output any of them.

Sample Clarification

The sample dataset corresponds to the figures in the problem statement.

Sample Input 1

```
5 5
1.##.
.##.3
.2...
2..3.
.1#.1
```

Sample Output 1

```
1>##^
^##^3
^2>^v
2v<3v
<1#<1
```

Problem C
Cumulative Sums
Problem ID: cumulative

While learning mathematics at school, Hieu amazingly invented a new sequence of numbers. It can be defined as below:

$$A_1 = 1$$
$$A_i = A_{i-1} + sod(A_{i-1})$$

Here $sod(X)$ is the sum of digits of X (in base 10)

The first few elements of sequence A is $[1, 2, 4, 8, 16, 23, 28, 38, 49, 62, 70, 77, 91, ...]$. Hieu also researched on its cumulative sums. The cumulative sums S of the sequence A is defined as:

$$S_i = \sum_{j=1}^{i} A_j$$

Hieu found a way to quickly calculate the value of A_N but he is unable to find a way to calculate S_N. Your task is to help him to calculate this value.

Input

The input starts with the number of test cases T followed by T test cases ($T \leq 1000$). Each test case consists of a positive integer N ($1 \leq N \leq 10^{15}$).

Output

For each test case in the input, print in a single line the value S_N modulo $10^9 + 7$.

Sample Input 1	Sample Output 1
3 2 10 100	3 231 55041

Problem D
Delicious Bubble Tea
Problem ID: bubbletea

Bubble Tea is now one of the most popular drink in Vietnam. Nowadays, walking down on the street, you can find a bubble tea shop everywhere. A huge number of bubble tea brands have arrived: *Bobapop, Chago, DingTea, GongCha, Mr.GoodTea, RoyalTea, ToCoToCo,...* Bubble tea attracts students not only as a tasty drink, but also with various kinds of extra topping: alo vera, chocolate flan, coconut jelly, egg pudding, fruity pearl,... Ok, I will stop writing this statement here as I must get some bubble tea immediately. It is so so so addictive.

Bubble tea

Toppings

After teaching a philosophy class to Vietnamese students preparing for *International Philosophy Olympiad*, *PVH* invites his students to enjoy a cup of bubble tea. The tea shop sells N kinds of tea and M kinds of topping. Every kind of tea or topping has its own price. For each student, *PVH* will buy him a cup of tea with exactly one kind of topping. The cost of a cup equals to the cost of the tea plus the cost of the topping. However, not every kind of topping can be mixed with every kind of tea. For each kind of tea, we know the list of toppings can be mixed with.

Given the amount of money *PVH* has, he would like to know how many students he can invite to the party, if one student drinks exactly one cup of bubble tea. Remember, he never watches his students drinking bubble tea without drinking anything, so he must buy himself a cup of bubble tea first!

Input

- The first line contains one integer N - the amount of kinds of tea the shop has.

- The second line contains N integers - the price of all kinds of tea.
- The third line contains one integer M - the amount of toppings the shop has.
- The forth line contains M integers - the price of all kinds of topping.
- The i^{th} of the next N lines describes the toppings that can be mixed with th i^{th} kind of tea. The line starts with an integer K, followed by K integers. All these K integers are in the range $[1, M]$ and pairwise different. Each integer denotes a kind of topping which can be combined with the i^{th} kind of tea.
- The last line contains one integer X - the amount of money *PVH* has.

Output

Write the maximum number of students *PVH* can buy bubble tea for.

Constraints

The amount of money is between 1 and 10^9, inclusive. All other numbers in the input files are between 1 and 1000, inclusive.

Sample clarification

In this example, there are three kinds of tea with price 10, 20 and 30; as well as five kinds of topping with price from 1 to 5.

The cheapest combination of tea and topping is the first kind of tea with the forth kind of topping, with a total cost of 14. Note that, while combining the first kind of tea with the first kind of topping gives lower price (11), it is not allowed since the first kind of tea is only combinable with toppings of kind 4 and 5. (See the 5^{th} line of the input).

Hence, with the amount of money of 42, *PVH* can buy three cups of tea, one for him and two more for his students!

Sample Input 1	Sample Output 1
3 10 20 30 5 1 2 3 4 5 2 4 5 3 1 2 3 5 1 2 3 4 5 42	2

Problem E
European Trip
Problem ID: europeantrip

After winning Vietlott, a woman decided to go on a trip to Europe! Let's refer to her as *Ms. Mask*.

Like other women, *Ms. Mask* really loves shopping and guess where her first stop is? Of course, it is London, a dream land for shopaholics. She has already discovered three greatest shopping centers in London: Westfield Stratford City, Piccadily Arcade and Fortnum & Mason. On the Cartesian plane, these three shopping centers can be depicted by three points.

Ms. Mask wants to rent a house to stay during the whole trip, so that the total distance from her house to those shopping centers are as small as possible. Help her find an optimal position for her house, assuming that she can put her house everywhere, even in Green Park or on Thames River!

Input

The input consists of three lines, each line contains two integers x and y (between 0 and 10^3, inclusive) representing the coordinates of three shopping centers.

It is guaranteed that those three points are not collinear.

Output

Write in one line two real numbers x and y representing the place where *Ms. Mask* should hire a house and stay.

Let P be the total distance from your point to three points given in the input, and J be the total distance from jury's point. Your answer is considered correct iff P differs from J at most 10^{-4} in term of either absolute or relative value.

Sample Input 1

```
0 0
1 0
0 1
```

Sample Output 1

```
0.211324865 0.211324865
```

Sample Input 2

```
174 711
980 989
976 384
```

Sample Output 2

```
803.563974893 697.742533711
```

Problem F
Familiar Digit
Problem ID: familiar

A digit is called familiar to an array of positive integers if that digit appears in every elements of the array. For example, an array $[14, 1470, 161240, 111000444]$ has 2 familiar digits: 1 and 4. Also note that, 0 is not a familiar digit because 0 doesn't appear in the first element 14 (we don't count leading zeros).

Given A, B, k and d, your task is to count the number of increasing arrays $X = [X_1, X_2, ..., X_K]$ of length K that has exactly d familiar digits where: $A \leq X_1 < X_2 < ... < X_K \leq B$

Input

The input starts with the number of test cases T ($T <= 100$). Then T test cases follow, each is printed in a line and consists of 4 numbers A, B, K and d ($1 \leq A \leq B < 10^{18}$, $2 \leq K \leq 10$, $0 \leq d \leq 10$).

Output

For each test case, print the result modulo $10^9 + 7$ in a single line.

Sample Input 1	Sample Output 1
3 1 9 2 0 1 9 2 1 1 99 2 1	36 0 1503

Problem G
Ginger Candy
Problem ID: gingercandy

Mr. G is one of the most excellent students in *North River High School for Gifted Students*. Despite having impressive performance in a programming competition and making it to the next round, he was not totally happy since his best friend did not get such a great achievement. In order to appease the poor girl, *Mr. G* has to deal with a very hard challenge: Buy her some ginger candies!

The road system in *North River province* consists of N junctions and M bidirectional roads. Junctions are numbered from 1 to N, and roads are numbered from 1 to M, inclusive. On the i^{th} road, which connects two junctions u_i and v_i, there is a shop in which *Mr. G* can buy c_i ginger candies. No two roads have the same number of candies. *Mr. G* wants to meet his friend at some junction, travel through several roads **without visiting the same road twice**, buy **all** candies on those roads, and finish at the same junction where he starts.

Using his humble knowledge in Physics, *Mr. G* calculates the amount of energy he needs to spend as follow: Let L be the **maximum** number of candies he buys in one road, and K be the number of roads he passes through. The amount of energy he needs to spend is $L^2 + \alpha K$, where α is some constant he has already known.

Help him to satisfy his friend with the minimum amount of energy.

Input

- The first line contains three integers N, M, α, the number of junctions, the number of roads and the predefined constant *Mr. G* uses to calculate the amount of energy, respectively ($1 \le N \le 10^5$, $1 \le M \le 2 \times 10^5$, $1 \le \alpha \le 20$).
- In the next M lines, each contains three integers u, v, c ($1 \le u \le N$, $1 \le v \le N$, $10^6 \le c \le 10^9$), meaning that there is a road connecting two junctions u and v, which sells c ginger candies.

It is guaranteed that all c in the above M lines are distinct.

Output

Write one integer denoting the minimum amount of energy *Mr. G* has to spend. If there is no route satisfying the condition, output *Poor girl* instead.

Sample Input 1	Sample Output 1
7 7 10 1 2 1000000 2 3 2000000 3 4 3000000 4 5 4000000 5 6 5000000 6 7 6000000 7 1 7000000	49000000000070

Sample Input 2	Sample Output 2
6 6 7 1 3 1000000 3 5 3000000 5 1 5000000 2 4 2000000 4 6 4000000 6 2 6000000	25000000000021

Sample Input 3	Sample Output 3
5 4 1 1 2 22081999 1 3 28021999 2 4 19992208 2 5 19992802	Poor girl

Problem H
How to cheat the Game of Nim
Problem ID: nimcheater

Stonehenge is perhaps the world's most famous prehistoric monument. It was built in several stages: the first monument was an early henge monument, built about 5,000 years ago, and the unique stone circle was erected in the late Neolithic period about 2500 BC. Today, along with Avebury, it forms the heart of a World Heritage Site, with a unique concentration of prehistoric monuments.

After perfectly solved all problems in an ACM contest, *Dai* and *Long* celebrated their victory by a trip to Stonehenge! In Stonehenge, *Dai* and *Long* not only saw huge henge but also discovered N heaps of gravel! Those heaps contain a_1, a_2,..., a_N pieces of gravels, respectively. The two students played the standard Nim game here. In the standard Nim game, two players take turn alternatively. In each turn the player has to choose one heap with at least one remaining gravel, remove at least one gravel from it. The player can remove a whole heap as well. The player who removes the last gravel from the last remaining heap wins the game.

Long was very angry with *Dai* since *Dai* had made so many incorrect submissions during the contests. That's why, while pretending to be friendly with *Dai* by leaving him the first move, *Long* stealthy removed gravel from some heaps so that *Dai* would surely lose the game no matter how clever he is. However, in order to avoid being detected, *Long* must leave **at least two** heaps unchanged.

Given N and the number of gravel in each heap, your task is to calculate the number of ways *Long* can remove gravel from **at most** $N - 2$ **heaps**, so that *Dai* (acting as the player moving first) loses the game no matter how he plays.

Input

- The first line of the input contains an integer N ($2 \le N \le 1000$) - the number of heaps.
- The second line contains N integers a_1, a_2,..., a_N - the number of gravels in each heap. ($1 \le a_i \le 10^{18}$).

Output

Write the number of possible ways modulo $10^9 + 7$.

Sample Input 1	Sample Output 1
3 4 5 6	3

Problem I
Integer Rotation
Problem ID: introtation

An integer m is a rotated number of some integer n if m can be obtained by moving some digits from the back of n to the front without changing their order. In this case, (n, m) is considered as a rotated pair. For example, $(1234, 4123)$ is a rotated pair since you can obtain 4123 by moving 4 from the back of 1234 to the front. Note that both n and m do not contain leading zeros.

Given two integers A and B, your task is to count the number of distinct rotated pairs (n, m) with $A \leq n < m \leq B$.

Input

The input consists of several datasets. The first line of the input contains the number of datasets, which is not greater than 100. The following lines describe the datasets.

Each dataset is printed in one line containing two integers A and B ($1 \leq A < B \leq 10^6$).

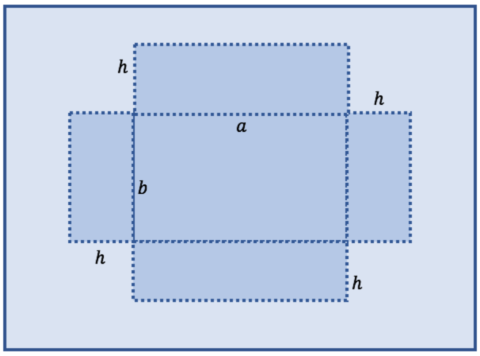
Output

For each dataset, write out on one line the number of rotated pairs.

Sample Input 1	Sample Output 1
2 1 10 10 50	0 6

Problem J
Jewelry Box
Problem ID: jewelrybox

Vy is obsessed with all the little pieces of jewelry and she has collected so many of them. During her recent holiday trip, she bought even more items so she needs a new jewelry box now. She decided that she would make it on her own.



She bought a paperboard with very cute decoration which is a rectangle of size $X \times Y$. She will draw a 5-rectangle shape like the image above, cut and fold into a lidless box of size $a \times b \times h$. Having so many items, Vy wants the volume of the box to be as large as possible. Your task is to help Vy calculate the largest volume.

Input

The input starts with the number of test cases T ($T \leq 10000$). Then T test cases follow, each consists of 2 positive integers X, Y printed in a single line ($X, Y \leq 100$).

Output

For each test case in the input, print in a single line the largest volume with absolute or relative error less than 10^{-6} that Vy can achieve.

Sample Input 1	Sample Output 1
2 3 3 2 4	2.000000 1.539601

Problem K
Keep the Parade Safe
Problem ID: parade

The *1941 October Revolution Parade* of November 7^{th}, 1941, taking place in Moscow, Soviet Union, was a parade in honor of the *October Revolution* 24 years ealier. It was one of the most memorable parade because of the serious circumstance at that time: Soviet's forces had constantly been dominated since the last 4 months, and Moscow was surrounded by Nazi under an extremely high pressure. Many soldiers joined that parade, and immediately rushed into the battle field after then. The winning against Nazi later pushed Hitler's forces very far away from Moscow and completely destroyed his *Barbarossa* plan...

In order to ensure safety for the parade, Stalin gathered information about the positions of Nazi's troops. He knew that Nazi's troops can be depicted as N points on the Cartesian plane. He was also aware of S Soviet's defending castles, which can be represented by S points.

Stalin thought that one castle was in danger, if there exist a group of four Nazi's troops, which forms a **non-degenerate** quadrilateral and the castle lies inside or on its border. Recall that a quadrilateral is non-degenerate iff no three of its vertices are collinear, and its edges do not intersect (with the exception that edges can intersect at vertices). Stalin wanted to know how many castles were in danger, so that he can send a suitable protection for them.

Input

- The first line of the input contains one integer N $(4 \leq N \leq 1000)$ - the number of Nazi's tropps.
- Each of the next N lines contains two integers x and y $(0 \leq x, y \leq 10^6)$ representing one point where a Nazi's troop took place.
- The next line contains one integer S $(1 \leq S \leq 1000)$ - the number of Soviet castles.
- Each of the next S lines contains two integers x and y $(0 \leq x, y \leq 10^6)$ representing position of one castle.

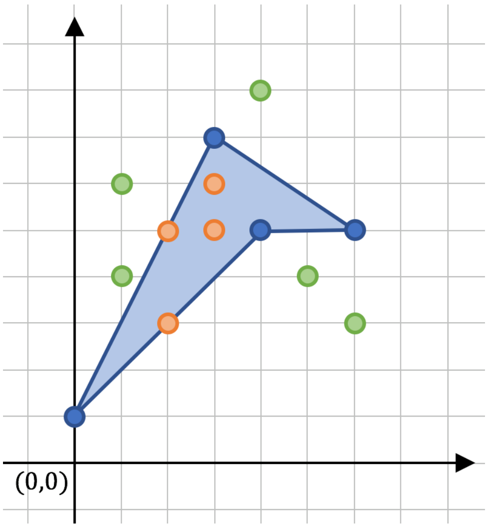
It is guaranteed that all given points are distinct.

Output

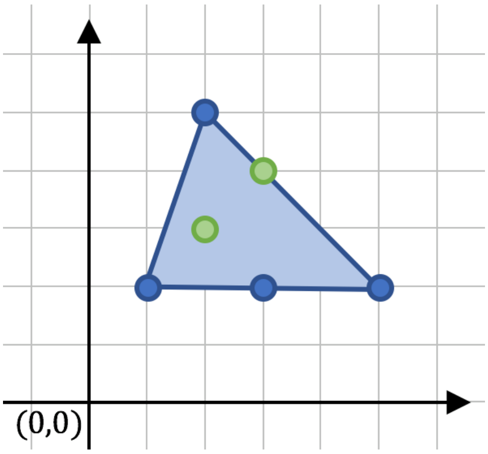
Write in one line the number castles which were in danger.

Sample Clarification

The 1^{st} sample corresponds to the following figure. Blue points represent Nazi troops' locations, oranges points represent in-danger castles, green points represent non in-danger castles.



The 2^{nd} sample corresponds to the following figure. Note that the quadrilateral is degenerated, so no castle is in danger.



Sample Input 1

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

Sample Output 1

```
4
```

Sample Input 2

```
4
1 2
3 2
5 2
2 5
2
3 4
2 3
```

Sample Output 2

```
0
```

Problem L
Let's play Monopoly!
Problem ID: monopoly

Monopoly is a fast-dealing property trading game, which is firstly designed by Elizabeth Magie and then published as well as owned by Hasbro. Since its first appearance in 1935, this game has quickly become well-known and deserves the best way of enjoying with friends at leisure. In this game, you can demonstrate your powerful investing skill and your great support from the God by throwing dices, travelling on a risky board and building your real estate for the purpose of forcing your opponents to pay huge amounts of money for renting your land, which eventually leads to bankruptcy. Various localized versions of Monopoly have been introduced, consisting of different famous places all over the world, while their layout share the same. The figure below shows the board of *UK Edition Monopoly*.

If you have enjoyed delightful moments with *Monopoly*, I wish you can entertain yourselves by solving this problem. Otherwise, do not worry as in this problem we are playing a significantly simplified version of this game. Forget the rules of the traditional game and read carefully the below description:

In this problem, instead of a board, the game is held in a graph with N nodes and M directed edges. Two players, Alob and Bice join the game. At the beginning, Alob is at node s_a while Bice is at node s_b. Alob starts first. Two players take turn alternatively. In each turn, a player has to move from his current node, along some edge to another node; and may pay, collect money or buy property, depending on the type of the new node. If he can not choose any edges to pass through, he has to pass that turn (do nothing).

Every node belongs to one of the following types:

- **Property**: You can purchase to own this property and force your opponents to pay you when they reach here. Each property has its own *buying cost* and *renting cost*. Initially, all properties are unowned. When you reach an unowned property, you can decide either to buy this property (you have to pay its *buying cost*) to **permanently** own it, or to ignore. After you purchase for this property, your opponent has to send you an amount of money equal to its *renting cost* everytime he reaches it. Of course, you have nothing to do while landing on your own properties.
- **Salary**: Each node of this kind has its own value, which is the amount of money you gain everytime you reach this.
- **Tax**: Each node of this kind has its own value, which is the amount of money you lose when you reach this node.

Since Alob and Bice are bored of playing an overlong game, each person will take at most K turns (including passed turns). After that, the game ends. They had already won the gameshow *Who Wants to Be a Millionaire?* so they never worry about running out of cash. Each player wants his money to be more than his opponent's money as much as possible. If he has several strategies resulting in the same difference, he always prefers the one giving him largest amount of money.

Assume that both player play optimally, your task is to determine the outcome of the game.

Input

The first line contains five integers: N, M, K, s_a, s_b - the number of nodes and edges in the graph, the maximum number of turns each player takes, and the starting nodes of Alob and Bice, respectively.

The i^{th} line of the next M lines contains two integers u_i and v_i, representing an edge from u_i to v_i.

The i^{th} line of the last N lines describes the i^{th} node of the graph in one of the following formats:

- *PROPERTY b r*: Denotes that this node has a property with *buying_cost* b and *renting_cost* r.
- *SALARY v*: Denotes that a player earns v when entering this node.
- *TAX v*: Denotes that a player loses v when entering this node.

Output

Write out in one line two space-separated integers denoting the amount of money Alob and Bice gain at the end of the game, respectively.

Constraints

- $1 \leq N \leq 10^5$
- $0 \leq M \leq 10^5$
- $10^6 \leq K \leq 10^9$
- $1 \leq s_a \leq N, 1 \leq s_b \leq N$
- All other numbers in the input files are integers between 1 and 10^9, inclusive.
- For all nodes which has property, $renting\_cost \leq \frac{buying\_cost}{\pi}$.
- For every i from 1 to M, $1 \leq u_i < v_i \leq N$.

Sample Input 1	Sample Output 1
12 12 123456789 1 2 1 3 1 5 3 7 3 9 5 9 7 11 2 4 2 6 4 8 4 10 6 8 8 12 SALARY 1 SALARY 10000 TAX 3 TAX 200 SALARY 10 TAX 1000 SALARY 7 PROPERTY 50 14 TAX 18 PROPERTY 105 33 PROPERTY 11 2 SALARY 7	4 -193