Problem A. Cirquares

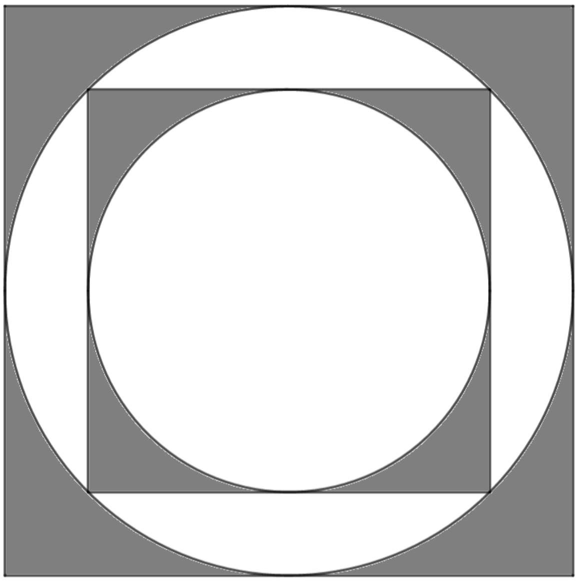
Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Mr. Geome Try is a big geometry scientist, he is one of the biggest geometry contributors in the world. Recently he created a new geometry shape that he called Cirquares.

Cirquares are shapes defined by their degree n and their initial side length a. To draw a Cirquare of length a and degree n:

- We first draw a square whose sides are parallel to ox and oy axis and having a length a.
- Then we draw a circle with maximum radius inside the last drawn square.
- Then another square with maximum side length inside the last drawn Circle.
- Then another circle with maximum radius inside the last drawn square.
- ...

We repeat the operations above n times. Take a look at the example below of a Cirquare of degree 4 and initial length 10.



Mr. Geome Try was interested in the area that lies between each square and the circle that is inside it (the colored in gray). He obviously can do it easily but he is challenging you to calculate this area given a and n.

Input

The input consists of a multiple test cases, the first line contains an integer denoting the number of them ($T \leq 10$). Each test case consists of a line that contains two Integers n and a such that $1 \leq n \leq 10^5$ and $0 \leq a \leq 10^{10}$

Output

For each test case print in a new line a single real value : the answer to the problem. Your answer will be considered correct if its absolute or relative error does not exceed 10^{-6}.

Example

standard input	standard output
3 1 5 2 5 3 5	25.0 5.365045915063792 17.86504591506379

Note

If there is no circle inside a rectangle the area is equal to the area of the square.

Problem B. String Made Easy

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes

This is a simple problem, you'll be given a string S of length N ($|S| = N$) containing only lowercase characters.

You'll be given Q queries, in each query you'll be given three integers l, r, k. You need to count the number of non-empty suffixes of the substring $[l, r]$ that have at most k distinct characters.

Input

You'll be given N and Q on the first line ($1 \leq N, Q \leq 5 * 10^5$).

Following will be the string S ($|S| = N$).

Following will be Q queries, each query will have three integers l, r, k ($1 \leq l \leq r \leq N$, $1 \leq k \leq 10^9$).

Output

For each query, output the answer in its own line.

Example

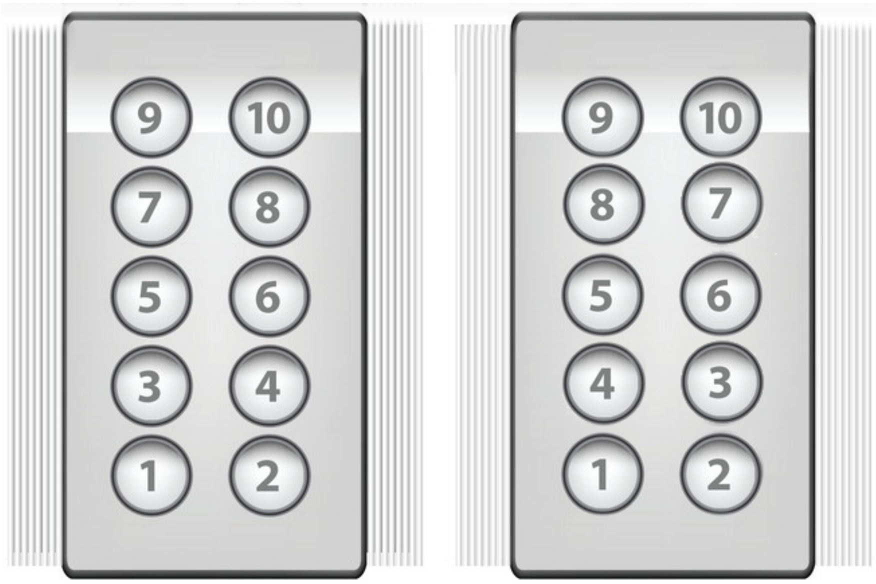
standard input	standard output
5 4 abcaa 3 5 1 3 5 2 1 5 2 1 5 10	2 3 3 5

Problem C. Elevator

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

Sofrecom is a very big company, which has 2 elevators that use two different methods for numbering the floor buttons: The first method is to start numbering each row from the left, and the other method is to alternate between floors, starting from the left in the first row, from the right in the second row, from the left in the third row, and so on.

For example, if each row contains 2 buttons, the first method will look like the left panel and the second one will look like the right panel in the following picture



One of the managers in Sofrecom had to bring his little son to his work, and to keep him busy, he asked him t question. If we have infinite floors, and you are given the number of floors in each row of an elevator's panel k, and a floor number n, does the floor number have the exact same position on the board in both numbering methods? Help the little boy solve the problem.

Input

The first line contains t $(1 \leq t \leq 10^5)$

Then t lines follow, each line contains two integers n and k, the floor number and the number of buttons per row respectively $(1 \leq n, k \leq 10^9)$

Output

For each question, print YES if the n^{th} floor is at the same position on the two elevators of k buttons per row, and NO otherwise in a single line, note that the output is **case sensitive.**

Example

standard input	standard output
3 2 2 3 2 5 3	YES NO YES

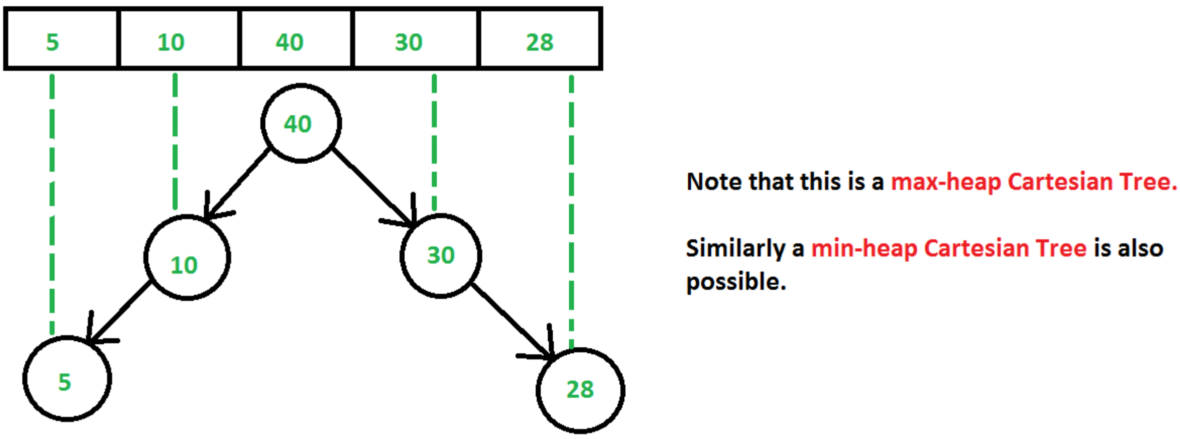
Problem D. Cartesian Tree

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

A Cartesian tree is a tree data structure created from a set of data that obeys the following structural invariants:

1. The tree obeys in the min (or max) heap property : each node is less (or greater) than its children.
2. An inorder traversal of the nodes yields the values in the same order in which they appear in the initial sequence.

Suppose we have an input array- 5,10,40,30,28. Then the max-heap Cartesian Tree would be



A sequence and its corresponding Cartesian tree

It's possible to build a Cartesian tree from a sequence of data in linear time. Beginning with the empty tree,

Scan the given sequence from left to right adding new nodes as follows:

1. Position the node as the right child of the rightmost node.
2. Scan upward from the node's parent up to the root of the tree until a node is found whose value is greater than the current value.
3. If such a node is found, set its right child to be the new node, and set the new node's left child to be the previous right child.
4. If no such node is found, set the new child to be the root, and set the new node's left child to be the previous tree.

Given an array of N integer, we want you to calculate the number of nodes of the corresponding max-heap Cartesian tree that are strictly smaller than their children.

Input

The first line of the input file contains one integer denoting the number of test cases ($1 \leq T \leq 100$).

Each test case starts with one integer N denoting the number of elements in the array ($1 \leq N \leq 10^5$).

The next line contains N integers a_i denoting the array ($1 \leq a_i \leq 10^6$). You are guaranteed that the N integer are different.

Output

For each test case output one integer : the answer to the problem. Print each integer in a separate line.

Example

standard input	standard output
1 5 1 2 3 4 5	0

Problem E. Probability Scares Mourad

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

Mourad is bad at gambling, but he gambles anyway. He gambles a lot, and he can't stop since he thinks each time that he'll win ("lyom njibha"he says, which roughly translates to: "today I'm gonna lose tons of money"). We tried everything to stop him from playing, but he doesn't want to stop.

We need your help to stop him. To do that, we are going to show him the probability of him winning the next game.

The game is easy, there are n players, each with a certain probability of winning other players (which Mourad doesn't know obviously, because he gambles aimlessly without any prior investigations). Mourad chose the i^{th} player, your task is to calculate the probability of that player winning. In other words, the probability of the i^{th} player beating all of the other $n-1$ players left.

Input

The first line contains the number of test cases t ($t \leq 10$).

For each test case, the first line contains an integer denoting the number of players in the game and the index of the player that Mourad chose n, i ($1 \leq n \leq 10$, $1 \leq i \leq n$).

The next n lines contain the matrix of probability A, where a_{ij} is the probability that the i^{th} player beats the j^{th} player. Each probability is a real nonnegative number smaller than 1. Clearly, $\forall (i,j) \in [\![1,n]\!]^2,\ a_{ij} + a_{ji} = 1$ and $a_{ii} = 0$.

Output

For each test case, print the probability that the player chosen by Mourad beats all the other players. Your answer will be considered correct if its relative or absolute error doesn't exceed 10^{-4}.

Example

standard input	standard output
1 3 2 0 0.35 0.45 0.65 0 0.9 0.55 0.1 0	0.5850

Problem F. Houda and Flight Cost

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes

Houda is a Moroccan student pursuing her studies in France. One day she went to the CSA (Computer Sciency Airport) to try and book a flight back to Morocco, the currency used at the airport is just as you might have guessed; problem solving.

The problem given to Houda was of the form: given 4 arrays of integers a, b, c, and d, can you find the number of ordered tuples (i, j, k, l) such that $a_i + b_j + c_k + d_l = 0$.

Houda was too busy trying to find her missing luggage, she asked you a favor, can you book the flight for her? (obviously by solving the problem for her)

Input

The first line contains an integer $1 \le T \le 100$, the number of test cases.

Each test case starts with a line containing one integer $1 \le N \le 100$, the size of the 4 arrays.

Four lines follow, each containing N integers, denoting in order the arrays a, b, c, and d. The values of the arrays are in the range $[\![-10^9, 10^9]\!]$ $(-10^9 \le a_i, b_j, c_k, d_l \le 10^9)$.

Output

For each test case, print, in a single line, the number of tuples satisfying the above condition.

Example

standard input	standard output
1 2 1 0 -1 2 1 1 -1 0	4

Note

Note that $(i, j, k, l) \neq (j, i, k, l)$.

Problem G. Big power

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

Exponentiation is a mathematical operation, written as a^n, involving two numbers, the base a and the exponent n.

When n is a positive integer, exponentiation corresponds to repeated multiplication of the base: that is, a^n is the product of multiplying n bases: $a^n = a \times a \cdots \times a$.

You are given 3 integers a, n, k. you are asked to calculate the sum of the last k digits of a^n.

Input

The first line of the input contains the number of test cases $(1 \leq T \leq 20)$ Each test case consists of a line containing 3 integers a, n, k $(1 \leq a, n \leq 10^5,\ 1 \leq k \leq 9)$.

Output

For each test case output one line containing one integer : the sum of the last k digits of a^n.

Example

standard input	standard output
2 5 2 3 2 10 5	7 7

Problem H. MCPC Network

Input file:	`standard input`
Output file:	`standard output`
Time limit:	9 seconds
Memory limit:	256 megabytes

$Mariam$ is 2 years old and she is helping her father in managing the networks in MCPC, he faced a problem where he has a router that can cover a circle with radius R, and N contestants each located at point (X_i, Y_i)

$Mariam$ wants to **maximize** the total covered contestants. A contestant is covered by the router if and only if he is inside the circle or on its boundaries, and the location of the router must be on an integer coordinate, find the location of the router.

Input

The first line will contain $(1 \leq T \leq 100)$ the number of test cases. Each test case will contain $N + 1$ lines: The first line contains two integers N and R the number of contestants and the radius of the router respectively. $(1 \leq N \leq 1000)$, $(1 \leq R \leq 100)$. Then N lines follow, each line contains two integers X_i and Y_i the location of the $i^t h$ contestant. $(0 \leq X_i, Y_i \leq 1000)$

Output

For each test case print two lines: the first line print the maximum number of contestants covered. On the second line print two integers (x, y) the location of the router.

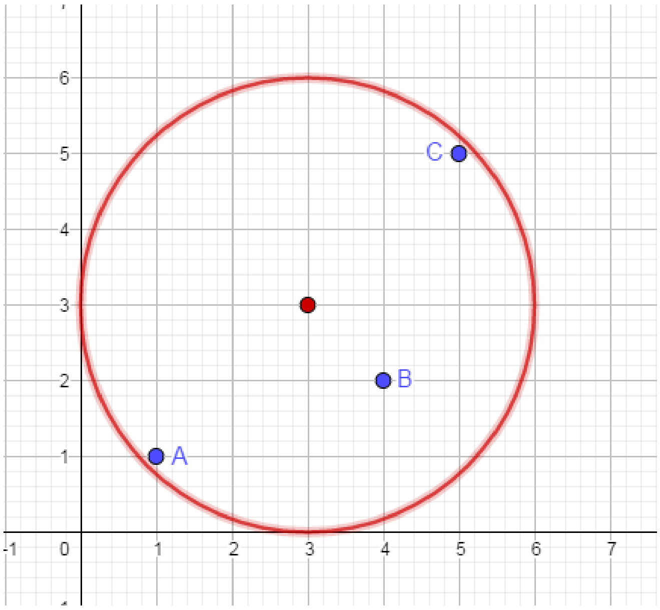
If there are multiple solutions print any of them.

Example

standard input	standard output
2 3 3 1 1 4 2 5 5 3 2 1 1 10 3 4 2	3 3 3 2 2 2

Note

Illustration for the sample:


A
B
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-1
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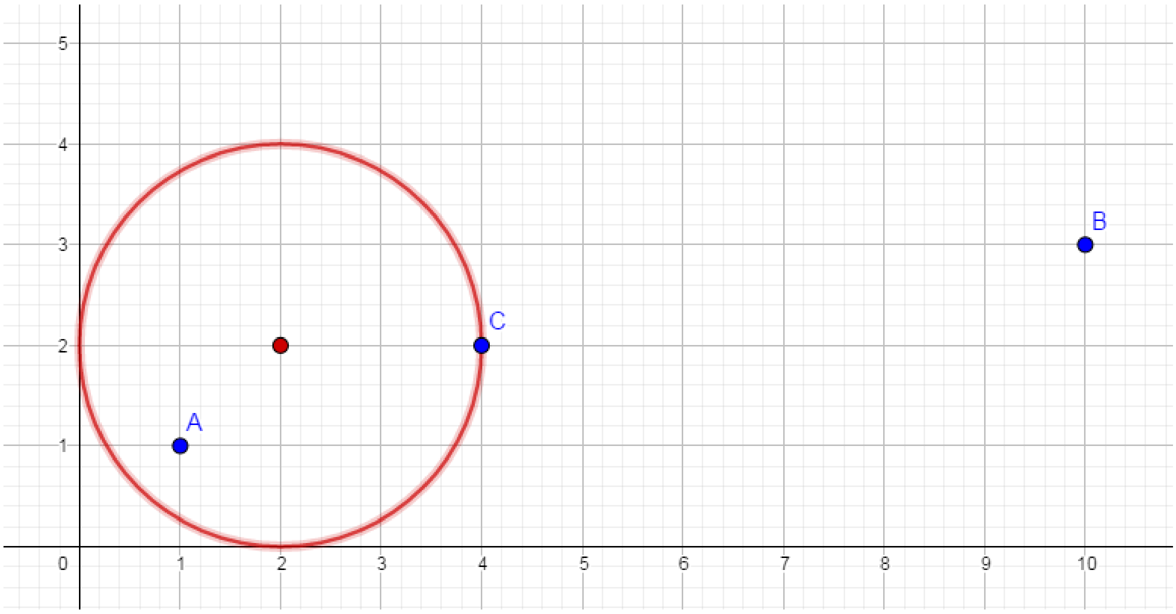
5
6
7


A
B
C
0
1
2
3
4
5
6
7
8
9
10

Problem I. Graphs Made Easy

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

Another easy graph problem obviously.

You'll be given a connected graph with N vertices and M edges, each edge will have a lowercase character (There are no self-loops and no multiple edges between any pair of nodes). Your task is simple, print the vertices of the graph in order of their shortest path from the vertex 1.

A path p is shorter than a path q, if the number of distinct characters on path p is less than the number of distinct characters in path p.

In case of equality, the path with the minimum number of edges is the shortest. In case of equality again, print the vertex with the lowest index.

Input

You'll be given N and M on the first line $\left(1 \leq N \leq 3 \times 10^5, N-1 \leq M \leq \min\left(\frac{n(n-1)}{2}, 3 \times 10^5\right)\right)$.

M lines follow, each line will have three integers u, v, c denoting that there's an edge between u and v with a lowercase character c. $(1 \leq u, v \leq n$ and $u \neq v)$.

Output

Print the vertices of the graph in order of their shortest path from the vertex 1. Each vertex should be on a line by itself.

Example

standard input	standard output
5 6 1 2 a 2 3 b 3 5 c 3 4 a 4 5 a 1 5 d	1 2 5 3 4