Problem A. Zero AAMP Currents

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

Thomas Edison stumbled upon an alien electrical device that appears to break known laws of physics! The device consists of n batteries connected by m unidirectional wires, which we will represent as vertices and edges that form a graph. The i-th wire is directed from battery v_i to battery u_i, $v_i \neq u_i$. Let $(v_i \to u_i)$ denote such a wire.

To make this device work, Thomas must assign a current strength to each wire such that this assignment results in a successful configuration. For a configuration to be successful, two conditions must be met:

1) All current strength values are non-zero integers in the range $[-1000, 1000]$ AAMP (Alien Amperes).

2) For every cycle found in this device, the sum of AAMP values from all wires in it must be 0. A cycle is a sequence of edges (wires) $(a_1 \to a_2), (a_2 \to a_3), \ldots, (a_{k-1} \to a_k), (a_k \to a_1)$. If edges $(x \to y)$ and $(y \to x)$ both exist, they also form a cycle – the wires are unidirectional.

Help him with this task.

Input

The first line contains two integers n and m – the number of batteries and the number of wires in the device, respectively. Next, m lines contain two integers each v_i and u_i, which mean that the i-th wire goes from battery v_i to u_i.

$1 \leq n \leq 10^5$,

$1 \leq m \leq 2 \cdot 10^5$,

$1 \leq v_i, u_i \leq n$, $v_i \neq u_i$.

Output

Print m lines containing one number each: the i-th number should be the current strength of i-th wire (in AAMP). Each number should be non-zero and in the range of $[-1000, 1000]$. If multiple answers exist, you may print any one of them.

Example

standard input	standard output
4 7 1 2 2 3 3 1 1 4 2 4 1 4 3 2	-1 -1 2 -2 -1 -2 1

Note

Note that there can be multiple wires from battery x to y. Also note that wire $(x \to y)$ with strength 3 AAMP is not the same as $(y \to x)$ with strength -3. As mentioned before, wires are unidirectional and can have a negative current strength - that's one of the mysteries of this device ...

Problem B. Lightbulbs

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

Thomas Edison is actively working on a better version of a lightbulb. During that process, he covers entire fields with batches of lightbulbs and conducts tests on them. In his current experiment, he arranged N rows with M lightbulbs in each row. Each lightbulb has a chance P of working, otherwise, it's faulty and won't light up. Thomas wants to find the expected value of the length of the longest horizontal sequence of lightbulbs that are working.

For example, in the setup below, where 1 is a working lightbulb and 0 is faulty, the length of the longest horizontal sequence of lightbulbs that are working is 3, since there are three consecutive ones in the second row (and also in the fourth row).

1 0 1 1

0 1 1 1

0 1 0 0

1 1 1 0

1 1 0 1

Note that we're interested in horizontal sequences only.

Input

You're given three numbers separated by spaces – positive integers N and M, and a real number P. $1 \leq N, M \leq 2000$, $0 \leq P \leq 1$.

Output

Output the answer to the problem. Your answer would be considered correct if its absolute or relative error is less than 10^{-4}.

Examples

standard input	standard output
`2 3 0.5`	`1.828125000000`
`47 74 1`	`74.000000000000`

Problem C. Squaring the Triangle

Input file:	`standard input`
Output file:	`standard output`
Time limit:	5 seconds
Memory limit:	256 megabytes

Wesley creates a graph G that contains N vertices. For each pair of vertices $\{u, v\}$, there is a probability of $\frac{p}{q}$ that an edge exists between u and v. The probabilities are independent of each other.

Let $\Delta(G)$ denote the number of triangles in G. A triangle is a set of 3 vertices that are connected by 3 edges.

Please help Wesley find the expected value of $(\Delta(G))^2$.

Input

Line 1 contains integer T ($1 \leq T \leq 10^6$), the number of cases.

T lines follow. The i^{th} line contains integers N, p, q ($3 \leq N \leq 10^6, 1 \leq p < q \leq 10^6$), separated by spaces.

Output

Output T lines, one line for each case.

Suppose the answer to the i^{th} case is $\frac{P}{Q}$, in lowest terms. Output $PQ^{-1} \pmod{10^9+7}$. That is, output a number R such that $0 \leq R < 10^9 + 7$ and $P \equiv RQ \pmod{10^9+7}$.

Problem D. Course Selection

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

The University of Wonderfulness has accidentally admitted more students than it has the capacity to teach. Unfortunately, this means that some of its courses may be full and some students might not be able to take the courses that they would like. Can you help the university manage the situation?

Each student has selected 5 courses that they would like to take. Each course has a hard limit on the number of students that can take it. Your task is to enroll each student into as many of their 5 selected courses as possible while respecting the course limits.

The happiness level of a student is the number of courses that they are enrolled in. If they can enroll in all 5 of their selected courses, their happiness level is 5. If two of their selected courses are full and they can enroll in only 3 of their 5 selected courses, their happiness level is only 3. The university wishes to maximize the sum of the happiness levels of all the students.

The objective can be phrased in a different but equivalent way. Each student pays \$1000 in tuition for each course that they are enrolled in. A student with all 5 of their selected courses pays \$5000. A student enrolled in only 3 of their 5 selected courses pays \$3000. The university wishes to maximize the total amount of tuition it can collect.

Your task is to assign students to courses while respecting the constraints and maximizing the total happiness level of the students and the total amount of tuition collected.

Input

The first line of input contains two integers separated by a space, $5 \le c \le 1000$, the number of courses, and $1 \le s \le 10000$, the number of students. It is followed by c lines, the ith such line containing a single integer $1 \le m_i \le 10000$, the maximum number of students that can be enrolled in the ith course. These c lines are followed by s more lines, one for each student. Each of these s lines contains five distinct integers separated by spaces, the five courses that the student would like to take. Each of these course numbers is an integer $1 \le i \le c$, corresponding to the course whose limit m_i was given on the ith of the c lines following the first line of input.

Output

The first line of output should contain a single integer, the maximum sum of the happiness levels that can be achieved. This first line of output should be followed by s more lines, one for each student, in the same order as in the input. Each of these lines should contain between 0 and 5 integers separated by spaces, the course numbers $1 \le i \le c$ of the courses that the student is enrolled in to achieve the maximum sum of happiness levels on the first line of output.

If there are multiple assignments of courses to students that achieve the same maximum sum of happiness levels, you may output any one of those assignments and it will be considered correct.

Problem E. Water Flow

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

After wrapping up the work on electric grids, Thomas Edison set his sight on another industry to disrupt - water transportation. Specifically, he aims to find solutions to connect water stations to houses with a limited set of pipes available in cases where the competition is unable to do so. The types of pipes available to use can be seen in the picture below. From left to right they are: corner pipe, cross pipe, straight pipe, and T-shape pipe. Since mister Edison is quite busy, that task has been assigned to a junior employee at his company - you!

We'll model the problem as follows - given an infinite 2D grid, the water station is located at square (X_{start}, Y_{start}) and the target house is at (X_{finish}, Y_{finish}). The start and finish tiles are guaranteed to be different, and the only type of pipe you can install there is a cross pipe. You'll be given a fixed number of pipes of each type, and your goal is to build a continuous path from start to finish using those components. Once that is accomplished, we'll solder open pipes that lead to nowhere and start running the water. While building your path, each piece of pipe can be rotated by 90 degrees any number of times. Unfortunately, sometimes such a path cannot be built. Thus, your first task is to determine whether such a path exists or not.

Input

First line of input contains (X_{start}, Y_{start}) (space separated).

Second line of input contains (X_{finish}, Y_{finish}) (space separated).

The last line of input contains n_1, n_2, n_3, n_4 - the number of corner pipes, cross pipes, straight pipes, and T-shape pipes available.

$0 \leq X_{start}, Y_{start}, X_{finish}, Y_{finish} \leq 10^{10}$

$0 \leq n_1, n_2, n_3, n_4 \leq 10^{10}$

$2 \leq n_2 \leq 10^{10}$

Output

Print Yes if the task can be accomplished and No if not.

Examples

standard input	standard output

`8 7`
`14 3`
`3 2 6 0`
	`Yes`

`8 7`
`14 3`
`1 2 7 0`
	`No`