Problem A. Alternative Accounts

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

Everybody knows that $jiry\_2 = Syloviaely$.

There are n different accounts on the website, and some of them competed in the recent k contests. However, Mike suspects that there are lots of alternative accounts: two or more accounts owned by the same person.

There are axioms believed by everyone:

- Nobody can use two different accounts in one contest simultaneously.
- Nobody shares an account, which means that each account can only be owned by one person.

So, a set of accounts may be owned by the same person if no two of them took part in the same contest.

Mike wants to know the minimum possible number of different people behind the given list of accounts.

Input

The first line contains an integer T $(1 \le T \le 10^5)$ indicating the number of test cases. For each test case:

The first line contains two integers n, k $(1 \le n \le 10^5, 1 \le k \le 4)$.

Each of the following k lines contains an integer m $(1 \le m \le n)$ first, followed by m distinct integers x_i $(1 \le x_i \le n)$ indicating the accounts participating in the contest.

Some accounts may not participate in any contests.

It is guaranteed that $\sum n \le 5 \cdot 10^5$.

Output

For each test case, output one line with one integer: the answer.

Example

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

Problem B. Bitset Master

Input file:	*standard input*
Output file:	*standard output*
Time limit:	6 seconds
Memory limit:	512 mebibytes

It's well known in China that $O(n^2)$ algorithms can pass in a problem with $n = 10^6$ easily.

You are given a tree with n vertices and $n-1$ edges $(u_1, v_1), (u_2, v_2), \ldots, (u_{n-1}, v_{n-1})$. For each vertex u, there is a set S_u. Initially $S_u = \{u\}$.

There are two types of operations:

- "1 u": output the number of sets S_v $(1 \le v \le n)$ that contain u.
- "2 p": take the sets S_{u_p} and S_{v_p} and assign $S_{u_p} \cup S_{v_p}$ to both of them.

You need to perform m operations. Output the answer for each operation of the first kind.

Input

The first line contains two integers n, m $(2 \le n \le 2 \cdot 10^5, 1 \le m \le 6 \cdot 10^5)$.

Each of the following $n-1$ lines contains two integers u_i, v_i describing an edge of the tree $(1 \le u_i, v_i \le n)$.

Each of the following m lines contains two integers t, w describing an operation $(1 \le t \le 2, 1 \le w \le n+1-t)$.

Output

For each operation of the first kind, output an integer on a separate line.

Example

standard input	standard output
5 11 1 2 1 3 1 4 1 5 2 4 2 3 2 2 2 1 1 1 1 2 1 3 2 2 2 3 1 4 1 5	5 2 3 4 5

Problem C. Cyclic Distance

Input file:	*standard input*
Output file:	*standard output*
Time limit:	3 seconds
Memory limit:	512 mebibytes

The trick from problem "Alien" is a great way to improve a naive $O(nk)$ dynamic programming to $O(n \log n)$. More problems with this trick can make the contest better, like the two unsolved problems in 300iq Contest 2.

You are given a weighted tree with n vertices and $n - 1$ edges. The i-th edge connects vertices u_i and v_i and has length l_i. Let $\text{dis}(u, v)$ be the distance (sum of weights on simple path) between vertex u and vertex v in the tree.

Find k distinct vertices $p_1, p_2, \ldots, p_k$ that maximize $\sum_{i=1}^{k} \text{dis}(p_i, p_{i \bmod k+1})$. Output the maximum sum.

Input

The first line contains an integer T $(1 \le T \le 10^5)$ indicating the number of test cases. For each test case:

The first line contains two integers n, k $(2 \le n \le 2 \cdot 10^5, 2 \le k \le n)$.

Each of the following $n - 1$ lines contains three integers u_i, v_i, l_i $(1 \le u_i, v_i \le n, 1 \le l_i \le 10^6)$.

It is guaranteed that $\sum n \le 2 \cdot 10^5$.

Output

For each test case, output one line with one integer: the answer.

Example

standard input	standard output
1 5 3 1 2 4 1 3 1 1 4 8 4 5 9	44

Problem D. Data Structure Quiz

Input file:	*standard input*
Output file:	*standard output*
Time limit:	8 seconds
Memory limit:	512 mebibytes

After learning KD-tree, you came up with the following problem. It should be a great quiz for this data structure.

You are given an $n \times n$ matrix A. All elements are zero initially.

First, you need to perform m_1 range addition operations. For each operation, you are given x_1, y_1, x_2, y_2, w ($1 \le x_1 \le x_2 \le n$, $1 \le y_1 \le y_2 \le n$). You need to add w to all the elements $A_{i,j}$ where $x_1 \le i \le x_2$ and $y_1 \le j \le y_2$.

Then you need to perform m_2 range maximum queries. For each operation, you are given x_1, y_1, x_2, y_2 ($1 \le x_1 \le x_2 \le n$, $1 \le y_1 \le y_2 \le n$). You need to find the maximum element among the elements $A_{i,j}$ that satisify $x_1 \le i \le x_2$ and $y_1 \le j \le y_2$.

Input

The first line contains three integers n, m_1, m_2 ($1 \le n \le 5 \cdot 10^4$, $1 \le m_1 \le 5 \cdot 10^4$, $1 \le m_2 \le 5 \cdot 10^5$).

Each of the following m_1 lines contains five integers x_1, y_1, x_2, y_2, w ($1 \le x_1 \le x_2 \le n$, $1 \le y_1 \le y_2 \le n$, $1 \le w \le 10^9$).

Each of the following m_2 lines contains four integers x_1, y_1, x_2, y_2 ($1 \le x_1 \le x_2 \le n$, $1 \le y_1 \le y_2 \le n$).

Output

Output m_2 lines, each line containing one integer: the answer to the respective query.

Example

standard input	standard output
5 5 5 1 1 4 5 4 4 1 4 1 10 1 3 3 3 3 1 1 5 5 8 2 4 4 5 8 2 1 2 1 4 1 5 4 1 2 3 5 2 1 5 3 1 3 5 5	12 22 20 22 20

Problem E. Evil Subsequence

Input file:	*standard input*
Output file:	*standard output*
Time limit:	3 seconds
Memory limit:	512 mebibytes

It's just a problem to waste your time.

You are given two sequences $a_1, a_2, \ldots, a_n$ and $b_1, b_2, \ldots, b_m$.

Two sequences $(x_1, x_2, \ldots, x_p)$ and $(y_1, y_2, \ldots, y_q)$ match iff $p = q$ and $x_i = x_j \Leftrightarrow y_i = y_j$ for every possible pair $1 \le i, j \le p$.

Output the number of subsequences of $a_1, a_2, \ldots, a_n$ that match $b_1, b_2, \ldots, b_m$.

Input

The first line contains two integers n, m ($1 \le n \le 3000$, $1 \le m \le \min(5, n)$).

The second line contains n integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le n$).

The third line contains m integers $b_1, b_2, \ldots, b_m$ ($1 \le b_i \le m$).

Output

Output one integer: the answer.

Examples

standard input	standard output
10 5 1 5 5 4 1 4 3 3 4 2 3 4 3 2 1	20
4 2 2 2 2 2 2 2	6

Problem F. Fast as Ryser

Input file:	*standard input*
Output file:	*standard output*
Time limit:	4 seconds
Memory limit:	512 mebibytes

After reading the paper *Counting Perfect Matchings as Fast as Ryser*, you learned how to count the number of perfect matchings in a general graph in $O(2^n n^2)$. So you decided to write this problem to encourage people to read the paper and learn new technology.

You are given an undirected graph with n vertices and m edges, and also a constant c. We define the weight of an edge set S as follows:

- If there are two edges in set S sharing common vertices, the weight is 0.
- Otherwise, the weight is $c^{|S|}$. Note that the weight of an empty set is 1.

Compute the sum of the weight of all subsets of edges. The answer can be large, so output it modulo $10^9 + 7$.

Input

The first line contains three integers n, m, c ($1 \le n \le 36$, $0 \le m \le \frac{n(n-1)}{2}$, $1 \le c \le 10^9 + 6$).

Each line of the following m lines contains two integers u, v ($1 \le u, v \le n$, $u \ne v$) indicating an undirected edge (u, v) in the graph. All edges are distinct.

Output

Output one integer: the answer.

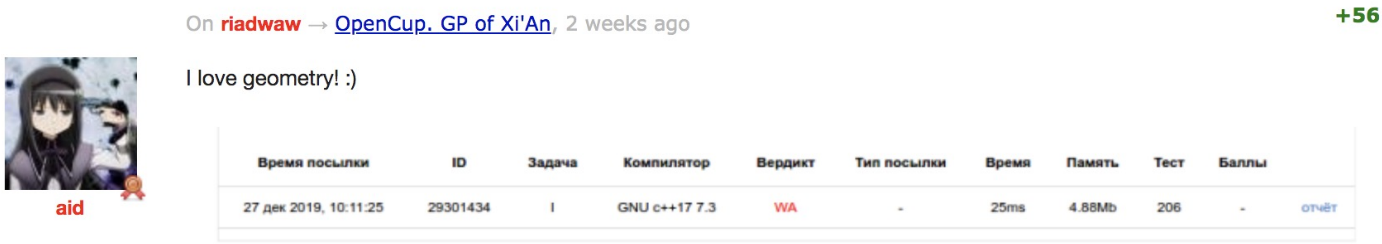
Examples

standard input	standard output
6 10 100 3 6 1 3 2 4 3 4 4 6 1 2 4 5 2 3 1 4 3 5	2171001
8 11 818466928 6 7 3 6 6 5 7 3 6 2 8 1 1 7 4 3 5 1 6 1 6 4	425176360

Problem G. Geometry PTSD

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

Computational geometry is the key to modern programming contests. However, it is always hard to construct a good test case for a geometry problem, like the problem I in EC Final 2019.



On **riadwaw** → OpenCup. GP of Xi'An, 2 weeks ago

+56

aid

I love geometry! :)

Время посылки	ID	Задача	Компилятор	Вердикт	Тип посылки	Время	Память	Тест	Баллы	
27 дек 2019, 10:11:25	29301434	I	GNU c++17 7.3	WA	-	25ms	4.88Mb	206	-	отчёт

In order to manage the key to the test case preparation, you need to find three points A, B, C on a unit sphere such that $\min(|AB|, |AC|, |BC|) \geq 1.7$ and the distance from the origin point $(0, 0, 0)$ to the plane ABC is no more than 1.5×10^{-19} but greater than 0.

Input

There is no input for this problem.

Output

Output three lines.

Each line contains three integers x_i, y_i, z_i $(-10^6 \leq x_i, y_i, z_i \leq 10^6,\ x^2 + y^2 + z^2 \neq 0)$ representing the point $\left(\frac{x}{\sqrt{x^2+y^2+z^2}}, \frac{y}{\sqrt{x^2+y^2+z^2}}, \frac{z}{\sqrt{x^2+y^2+z^2}}\right)$.

Even while the checker is numerically stable, it is not done in the exact arithmetic. You might get wrong answer if your solution is too close to the constraints. For example, if the distance between A and B is $1.7 + 10^{-9}$, it might cause some trouble.

Example

standard input	standard output
(no input)	1 2 3 4 5 6 -1000000 -1000000 -1000000

Note

Note that the sample output is incorrect.

Problem H. Heavy Stones

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

After learning *Garsia–Wachs algorithm*, you came up with the following problem.

There are n piles of stones in a line. The i-th pile contains a_i stones. You want to merge all the stones into one pile.

At first, you will select the k-th pile. Then you can do the following operation on the selected pile: Choose the left or right adjacent pile of the selected one, and merge them into one pile. The new pile becomes the selected pile after the operation. After doing this operation $n-1$ times, there will be only one pile left. The cost of each merge operation is the number of stones in the new pile.

You want to know the smallest total cost if you select the k-th pile initially. For $k = 1, 2, \ldots, n$, output the answer.

Input

The first line contains an integer n ($1 \le n \le 2 \cdot 10^5$).

The second line contains n integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le 10^6$).

Output

Output n integers. The k-th number indicates the smallest total cost if you select the k-th pile initially.

Examples

standard input	standard output
5 2 1 3 5 4	35 35 36 43 49
10 18 37 81 6 58 99 87 34 75 9	2637 2637 2657 2657 2695 2949 2995 2905 2880 2880

Note

If you select the 4-th pile initially, the process can go as follows:

$\{2, 1, 3, \mathbf{5}, 4\} \to \{2, 1, \mathbf{8}, 4\} \to \{2, \mathbf{9}, 4\} \to \{\mathbf{11}, 4\} \to \{\mathbf{15}\}$.

The total cost is $8 + 9 + 11 + 15 = 43$.

Problem I. Interesting Game

Input file: *standard input*
Output file: *standard output*
Time limit: 2 seconds
Memory limit: 512 mebibytes

50th IMO 2009 *Combinatorics* **C5**

C5 NLD (Netherlands)

Five identical empty buckets of 2-liter capacity stand at the vertices of a regular pentagon. Cinderella and her wicked Stepmother go through a sequence of rounds: At the beginning of every round, the Stepmother takes one liter of water from the nearby river and distributes it arbitrarily over the five buckets. Then Cinderella chooses a pair of neighboring buckets, empties them into the river, and puts them back. Then the next round begins. The Stepmother's goal is to make one of these buckets overflow. Cinderella's goal is to prevent this. Can the wicked Stepmother enforce a bucket overflow?

Is it a notorious coincidence with this problem?

Cinderella and her wicked Stepmother are playing the game. Cinderella has n non-negative integers $a_1, a_2, \ldots, a_n$ at first. There are two parameters A and B for this game.

Cinderella and Stepmother take turns playing, starting with Cinderella. One each turn, Cinderella can replace the sequence $a_1, a_2, \ldots, a_n$ by a new **integer** sequence $a'_1, a'_2, \ldots, a'_n$ such that

- $a'_1 \geq a_1, \ldots, a'_n \geq a_n$
- $\sum\limits_{i=1}^{n} a'_i \leq \sum\limits_{i=1}^{n} a_i + A$

Then Stepmother can choose B indices $i_1, i_2, \ldots, i_B$, and set $a_{i_1}, a_{i_2}, \ldots, a_{i_B}$ to 0.

The game continues forever. Let M be the maximum value of $a_1, a_2, \ldots, a_n$ for all the time. Cinderella wants to maximize M, and Stepmother wants to minimize M.

Determine the value of M if both players play optimally.

Input

The first line contains an integer T ($1 \leq T \leq 10^5$) indicating the number of test cases. For each test case:

The first line contains three integers n, A, B ($1 \leq B \leq n \leq 10^5$, $0 \leq A \leq 10^{12}$).

The second line contains n integers $a_1, a_2, \ldots, a_n$ ($0 \leq a_i \leq 10^{12}$).

It is guaranteed that $\sum n \leq 5 \times 10^5$.

Output

For each test case, output a line containing one integer: the answer.

Example

standard input	standard output
4 3 5 1 1 2 3 5 5 1 0 2 1 0 3 5 100 5 1 2 3 4 5 8 3 1 5 1 2 2 0 2 5 1	11 14 105 9

Note

A possible game process for the first test case:

$\{1,2,3\} \to \{3,4,4\} \to \{3,4,0\} \to \{6,6,0\} \to \{6,0,0\} \to \{11,0,0\}$.

Problem J. Junk Problem

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

Browsing Wikipedia and reading some random references are the best way to write problems.

Find a subset $S \in \{1, 2, \dots, n\}$ such that:

- For all pairs (a, b) such that $a, b \in S$ and $a < b$, the values of bitwise XOR of a and b should be distinct.
- $|S| \geq \lfloor \sqrt{0.5n} \rfloor$.

Input

The first line contains an integer n ($1 \leq n \leq 10^7$).

Output

The first line contains an integer m: the size of S.

The second line contains m distinct integers from 1 to n: the elements of the set S in any order.

Example

standard input	standard output
49	4 1 2 3 4

Problem K. Knowledge-Oriented Problem

Input file:	*standard input*
Output file:	*standard output*
Time limit:	5 seconds
Memory limit:	512 mebibytes

After gaining a lot of knowledge, you decided to write a knowledge-oriented problem.

You are given an undirected graph G with n vertices and m edges. You copy it k times and denote the copies by $G_1, G_2, \ldots, G_k$. You add edges between vertex u in copy G_i and the same vertex u in copy G_{i+1} for all $1 \le i \le k-1$ and $1 \le u \le n$.

Find the number of spanning trees of the new graph. The answer can be large, so output it modulo $10^9 + 7$.

Input

The first line contains three integers n, m, k ($1 \le n \le 500$, $0 \le m \le \frac{n(n-1)}{2}$, $1 \le k \le 10^{18}$).

Each of the following m lines contains two integers u, v ($1 \le u, v \le n$, $u \ne v$) indicating an undirected edge (u, v) in the graph. All edges are distinct.

Output

Output one integer: the answer.

Examples

standard input	standard output
5 6 2 3 2 5 1 3 4 2 4 5 3 1 3	4725
2 1 200 1 2	272581704
5 10 1000000000000000000 1 2 1 3 1 4 1 5 2 3 2 4 2 5 3 4 3 5 4 5	569698435

Problem L. LCM Sum

Input file:	*standard input*
Output file:	*standard output*
Time limit:	7 seconds
Memory limit:	512 mebibytes

Are you sick of solving problems like computing the prefix sum of a random number theory function? As a terrible problem writer, here I present another one for you.

Compute

$$\sum_{x=1}^{n} \operatorname{lcm}(x, x+1, \ldots, x+k).$$

The answer can be large, so output it modulo $10^9 + 7$.

Input

The first line contains two integers n, k ($1 \le n \le 10^{18}$, $0 \le k \le 30$).

Output

Output one integer: the answer.

Examples

standard input	standard output
10 3	18936
10000 6	43482752
1000000000 15	688102997