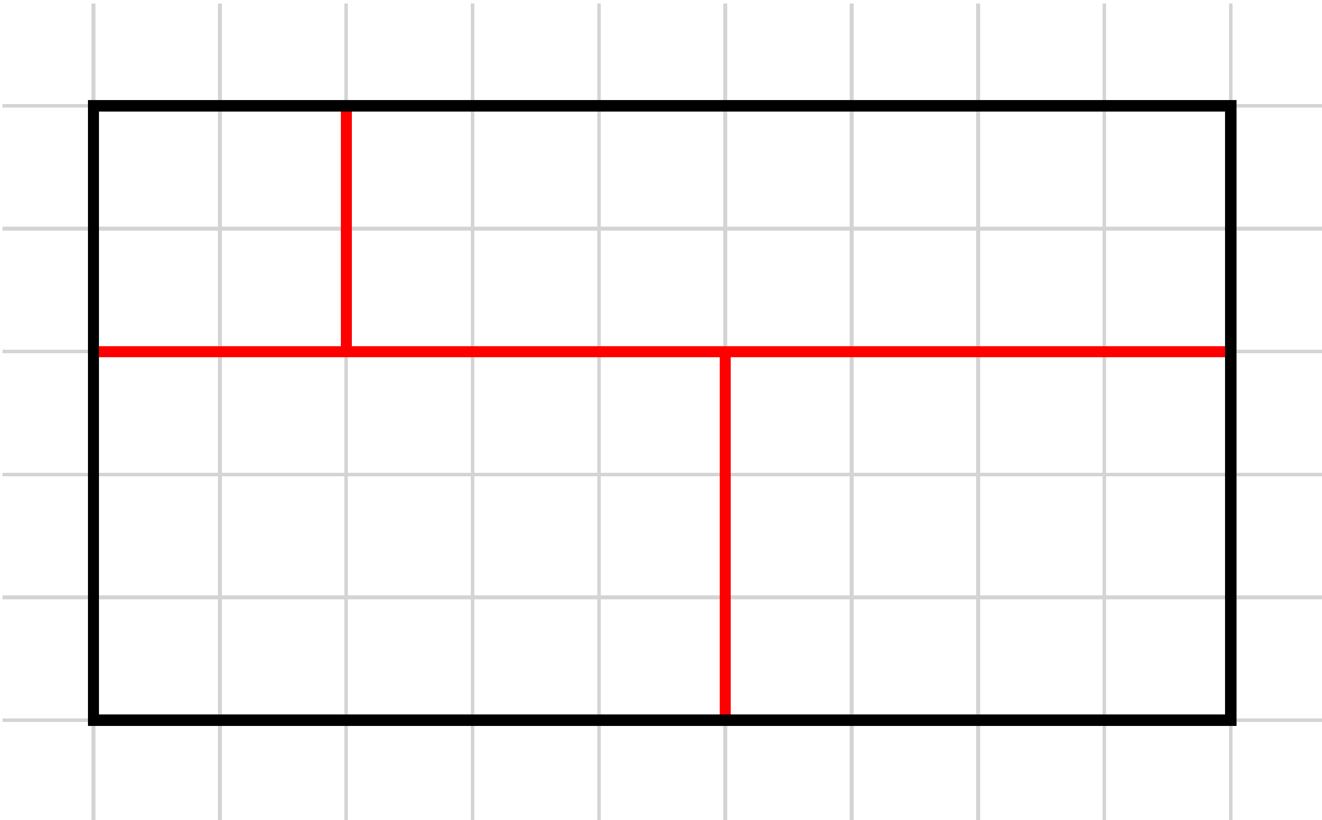
Problem A. Floor Tiles in a Park

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

Grammy is enjoying her holiday in Pigeland City Park. She was interested in the floor tiles in the park. After careful examination, she found out that each of the floor tiles is a $W \times H$ rectangle grid with vertical and/or horizontal colored segments on it. The colored segments have ends on grid points, and they split the rectangle into exactly k subrectangles.

For instance, the following illustration shows a floor tile with $W = 9, H = 5, k = 4$.



Grammy wants to know the number of different floor tiles satisfying the condition. Please tell her the answer. Since the answer may be too large, you should output the number modulo $998\,244\,353$.

Note that two floor tiles are considered different if and only if a grid line is colored in one tile but not in the other. If two tiles can turn into the same by rotation or reflection, they may still be considered as different tiles.

Input

The only line contains 3 integers W, H, k $(1 \le W, H \le 10^9, 1 \le k \le \min(5, W \times H))$.

Output

Output a single integer, denoting the number of different floor tiles, modulo $998\,244\,353$.

Examples

standard input	standard output
2 3 5	7
4 3 5	307
6 372065168 5	114514

Problem B. Rotate Sum 3

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

Grammy loves geometry. Today, she takes out her precious convex polygon and plays with it.

Grammy thinks that symmetry is a fun characteristic for a convex polygon, so she draws out all the axes of symmetry on the polygon.

NIO is a naughty boy. He repeats the following operation several times. In each operation, he chooses an axis of symmetry as the rotation axis and rotates the polygon along the axis arbitrarily. Note that after rotating the polygon, the axes of symmetry will also rotate with the polygon.

Grammy wants to know the total volume that can be sweeped by the convex polygon during NIO's operations. Please help her.

Input

The first line contains an integer n ($3 \le n \le 10^5$), denoting the number of vertices of the convex polygon.

In each of the next n lines contains two integers x_i, y_i ($-10^9 \le x_i, y_i \le 10^9$), denoting the coordinates of the i-th vertex. The vertices are given in counterclockwise order.

It is guaranteed that the polygon does not self-intersect at any point.

Output

Output a real number, denoting the volume of the sweeped area. Your answer will be considered correct if the absolute or relative error is less than 10^{-6}.

Examples

standard input	standard output
3 0 -1 1 0 0 1	1.047197551197
3 1 1 4 5 1 4	0

Problem C. Oscar's Round Must Have a Constructive Problem

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

Grammy has a sequence A of length n.

Please find a permutation P such that $P_i \neq A_i$ for all i.

Input

There are multiple test cases.

The first line contains a single integer T $(1 \le T \le 100\,000)$, denoting the number of test cases.

For each test case:

The first line contains a single integer n $(1 \le n \le 100\,000)$.

The second line contains n integers $A_1, A_2, \ldots, A_n$ $(1 \le A_i \le n)$.

It is guaranteed that the sum of n does not exceed $500\,000$.

Output

For each test case:

If the permutation does not exist, output "NO" in one line.

Otherwise output "YES" in the first line, then output n integers in the second line, denoting the permutation $P_1, P_2, \ldots, P_n$.

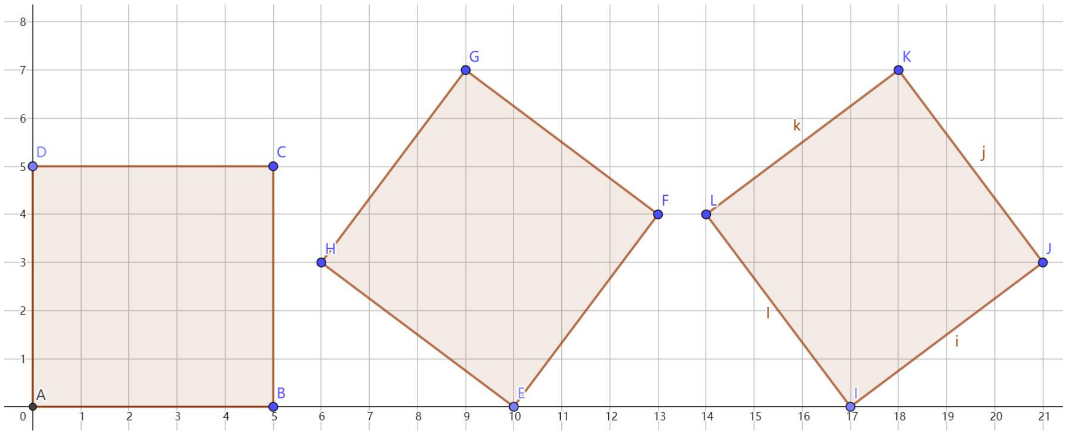
Example

standard input	standard output
3 3 3 3 3 3 3 2 1 6 1 1 4 5 1 4	NO YES 1 3 2 YES 4 5 1 2 3 6

Problem D. The Pool

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	1024 megabytes

Marisa wants to build an $n \times m$ rectangular swimming pool for Alice. To do this, Marisa can select four integral points on an infinite 2D-grid and cast magic. For example, the following picture shows three possible ways to build a 5×5 swimming pool.



Marisa soon learns that there are many ways to build the pool since four sides of the pool can be non-parallel to coordinate axis. Here two ways are considered different if and only if the pool in one way can't be translated (moved without rotation and flipping) to the pool in the other way. Now Marisa becomes curious about the total numbers of complete 1×1 squares inside the pool for all possible ways. As the result can be very large, you should print it modulo 998244353.

Input

In the first line, there is one integer T ($1 \le T \le 10^4$), denoting the number of test cases.

For each test case, there is one line containing two numbers n and m ($1 \le n, m \le 10^{18}$), denotes the size of swimming pool.

It is guaranteed that there are at most 10 cases that $max(n, m) > 10^9$.

Output

For each test case, print one number, denoting the total number of complete 1×1 squares inside the pool for all possible ways (modulo 998 244 353).

Example

standard input	standard output
5 5 5 2 3 5 10 2197525579 1145141 91 65	51 12 228 438744975 34722

Note

As shown in the picture, there are exactly three different ways to build the pool. The corresponding numbers of complete 1×1 squares in these three ways are 25, 13, 13. So the total number is 51.

Problem E. Ternary Search

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

Recently, Grammy has learned ternary search in Tony's class. She can find the peak value in an array using this algorithm when the array is unimodal. Here we define an array $a_1, a_2, ..., a_n$ is unimodal if and only if it satisfies one of the following conditions:

- There exists an index k $(1 \le k \le n)$ such that $a_1 < a_2 < ... < a_k > a_{k+1} > ... > a_n$.
- There exists an index k $(1 \le k \le n)$ such that $a_1 > a_2 > ... > a_k < a_{k+1} < ... < a_n$.

As the tutor of Grammy, Tony wants to examine whether Grammy fully understands what he taught in class so he leaves n tasks for Grammy to try ternary search. The tasks are as follows.

Initially, there is an empty array. Each task appends a **distinct** number at the right end of the array and Grammy should do ternary search on it. However, due to Tony's carelessness, the array may not be unimodal after some addition. Since Tony has already slept, Grammy has to solve the problem by herself.

For each task, some operations should be taken before Grammy tries ternary search on it to make it unimodal. For each operation, Grammy can swap the values of a_i and a_{i+1} for some i $(1 \le i < n)$. Grammy is a lazy girl and she thinks that if she has to do many operations, she would like to wait for Tony to wake up and solve the problem. For each task, she wonders how many operations she has to do at least to make the array unimodal. Can you help her?

Input

The input contains only a single case.

The first line contains a single integer n $(1 \le n \le 200\,000)$, denoting the number of tasks. The i-th line of the following n lines contains one integer a_i $(1 \le a_i \le 1\,000\,000\,000)$, denoting the number appended in the i-th task.

It is guaranteed that a_i are pairwise distinct.

Output

The output contains n lines. Each line contains one integer, denoting the answer to the answer to the i-th task.

Example

standard input	standard output
9 11 4 5 14 1 9 19 8 10	0 0 0 0 2 3 3 6 7

Problem F. Candies

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

Grammy has a circular array $a_1, a_2, \ldots, a_n$. You can do the following operations several (possibly, zero) times:

1. Choose two adjacent positions with the same number, and erase them.

2. Choose two adjacent positions such that the numbers on these positions add up to a special number x, and erase them.

After each time you do an operation successfully, Grammy will give you a candy. Meanwhile, the remaining part of the array will be concatenated. For example, after deleting the third and fourth element of the array, the second element and the fifth element will become adjacent.

Find the maximum number of candies you can get.

Two positions $u, v (u < v)$ are adjacent if and only if $u + 1 = v$ or $u = 1, v = L$, where L is the length of the remaining array.

Input

The first line contains two integers n, x $(1 \le n \le 10^5, 1 \le x \le 10^9)$, denoting the length of the array and the special number x.

The secons line contains n integers $a_1, a_2, \ldots, a_n$ $(1 \le a_i \le 10^9)$, denoting the numbers in the circular array.

Output

Output an integer, denoting the maximum number of candies you can get.

Examples

standard input	standard output
6 5 1 1 4 5 1 4	2
10 5 1 2 5 2 1 2 3 4 8 4	3

Problem G. Regular Expression

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

Grammy has recently been interested in regular expression while focusing on cases where the alphabet consists of characters from a to z. Today she asks NIO some questions. Each question gives string A, asking the minimum length of expressions matching string A according to the matching rules and the number of all shortest expressions.

To learn detailed rules about how regular expressions match strings, you can refer to `https://en.wikipedia.org/wiki/Regular_expression`.

Here we only consider characters from 'a' to 'z', '.', '?', '*', '+', '|', '(', ')'. It is assumed that the asterisk, the question mark and the plus sign have the highest priority, then concatenation and then alternation. Parentheses can be used to change the priority. For example, `a(b|c)` can match "ab" and "ac". If there is no ambiguity then parentheses may be omitted. For example, `(ab)c` can be written as `abc`, and `a|(b(c*))` can be written as `a|bc*`

Here are some examples of matching:

- (or): `gray|grey` can match "gray" or "grey".
- (question mark): `colou?r` matches both "color" and "colour".
- (asterisk): `ab*c` matches "ac", "abc", "abbc", "abbbc", and so on.
- (plus sign): `ab+c` matches "abc", "abbc", "abbbc", and so on, but not "ac".
- (wildcard): `a.b` matches any string that contains an "a", and then any character and then "b"; and `a.*b` matches any string that contains an "a", and then the character "b" at some later point. More precisely, "ab" can be matched by `a.*b` but not `a.b`.
- (concatenation): Let expression $R =$`(ab|c)` matches $\{ab, c\}$ and expression $S =$`(d|ef)` matches $\{d, ef\}$. Then, $(RS) =$ `((ab|c)(d|ef))` matches $\{abd, abef, cd, cef\}$

Input

The input contains only a single case.

The first line contains a single integer Q ($1 \le Q \le 100\,000$), denoting the number of questions. The i-th line of the following Q lines contain one string A consisting of lowercase letters ($1 \le |A| \le 200\,000$), denoting the string A of the i-th question. It is guaranteed that $\sum |A| \le 1\,000\,000$.

Output

For each question, output a single line containing 2 integers - the minimum length and the number to the question. Note that the answer may be extremely large, so please print it modulo 998 244 353 instead.

Example

standard input	standard output
2 a ab	1 2 2 6

Problem H. Grammy Sorting

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

Grammy has a connected undirected graph G with two special vertices A and B. Each of the vertices has a number p_i written on it, where $p_1, p_2, \ldots, p_n$ is a permutation of size n.

Grammy thinks these numbers on vertices are too chaotic. She wants to reorder the numbers such that for each vertex x, there exists a path satisfying the following conditions:

1. The path starts from A and ends at B.

2. The path contains vertex x.

3. The numbers along the path are strictly increasing.

Sadly, in each operation, Grammy can only choose a **simple** path starting from A and ending at an arbitrary vertex, then shift the numbers on the simple path by 1. That is, if the vertices on the simple path chosen by Grammy contains $a_1, a_2, \ldots, a_{k-1}, a_k$, then after Grammy's operation, these vertices will become $a_2, a_3, \ldots, a_k, a_1$.

Additionally, Grammy can only operate no more than 10 000 times.

Grammy cannot find out any plan to solve this problem, so she asked you for help.

Please help Grammy to determine whether she can reorder the numbers. You also need to output a solution if it exists.

Input

The first line contains 4 integers n, m, A, B $(2 \le n \le 1\,000, 1 \le m \le 2\,000, 1 \le A, B \le n, A \ne B)$.

The second line contains n integers $p_1, p_2, \ldots, p_n$ $(1 \le p_i \le n)$. It is guaranteed that $p_1, p_2, \ldots, p_n$ is a permutation.

In each of the next m lines, there are two integers u_i, v_i $(1 \le u_i, v_i \le n)$, denoting that there is a bidirectional edge between u_i and v_i. It is guaranteed that the graph is connected.

Output

If Grammy cannot properly reorder the numbers, output "-1" (without quotes).

Otherwise output an integer op $(0 \le op \le 10\,000)$ in the first line, indicating the number of operations Grammy needs.

For the following op lines, output an integer k, denoting the number of vertices on the chosen simple path. Then output k integers $x_1, x_2, \ldots, x_k (x_1 = A, 1 \le x_i \le n)$, indicating the vertices on the simple path. These x_i should be distinct.

It can be proved that if graph G can be properly reordered, there exists a solution with no more than 10 000 operations.

Note that you don't have to minimize op. If there are multiple solutions, output any of them.

Examples

standard input	standard output
5 6 1 2 1 2 3 4 5 1 3 2 3 1 4 2 4 1 5 3 5	7 4 1 3 2 4 3 1 3 2 3 1 3 5 4 1 3 2 4 3 1 3 2 2 1 3 1 1
4 3 1 2 1 4 2 3 1 4 2 4 3 4	-1

Problem I. Suffix Sort

Input file:	`standard input`
Output file:	`standard output`
Time limit:	4 seconds
Memory limit:	1024 megabytes

Grammy has a string S of length n containing only lowercase letters.

For a string s, if we record the first occurrence of each type of character in order as $t_1, t_2, t_3, \ldots, t_k$, then the minimal representation of s can be obtained by replacing all occurrence of t_1 in s by the first character of the character set (**a**), replacing all occurrence of t_2 in s by the second character of the character set (**b**), and so on.

For example, when the character set is lowercase, the minimal representation of "edcca" is "abccd", and "xy" and "zt" are essentially the same in terms of minimal representation.

Your task is sorting all suffixes of S with a special regularity.

For two suffixes $S[i:]$ and $S[j:]$, if the minimal representation of $S[i:]$ is less than the minimal representation of $S[j:]$ in the lexicographic order, then $S[i:]$ is less than $S[j:]$ in the special regularity.

Please output the result array $sa[i]$ of the suffix sort with the special regularity. The i-th element of $sa[i]$ is the position of the first character in the i-th smallest suffix of S with the special regularity.

Input

The first line contains one integers n ($1 \le n \le 200\,000$).

The next line contains a string S of length n. It is guaranteed that S only consists of lowercase English alphabets.

Output

Output n integers representing the answer.

Example

standard input	standard output
6 aadead	6 1 5 4 3 2

Problem J. Melborp Elcissalc

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

Grammy has a favorite number k. She thinks that all the numbers divisible by k are good.

For each array containing only numbers from 0 to $k-1$, Grammy define its goodness as the number of non-empty consecutive subarrays that sums to a good number.

Please count the number of arrays of length n such that its goodness is t. Since the answer can be enormous, output the answer modulo $998\,244\,353$.

Input

A single line contains three integers n, k, t $(1 \le n, k \le 64, 0 \le t \le \frac{n(n+1)}{2})$.

Output

Output a single number, denoting the answer modulo $998\,244\,353$.

Examples

standard input	standard output
`2 5 1`	`12`
`7 10 15`	`2016`
`46 50 171`	`645560469`

Problem K. Great Party

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

Grammy joined a great party.

There is an interesting game at the party. There are n piles of stones on the table. The i-th pile has a_i stones in it. Two players participate in the game and operate the stones in turn.

In each player's turn, the player will do the following two steps:

1. Select a **non-empty** pile of stones, select a positive amount of stones to remove from it.
2. Keep the remaining stones in the pile still **or** merge them all into another **non-empty** pile of stones.

Those who cannot operate lose the game.

Now, Grammy has q questions. For each question, she asks you how many sub-segments of $[l, r]$ satisfy that if the piles in the segment are taken out alone for the game, the first player will win.

Input

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

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

The i-th of the next q lines contains two integers l_i, r_i ($1 \le l_i \le r_i \le n$).

Output

The output contains q lines. Each line contains a single integer, denoting the answer to the question.

Examples

standard input	standard output
4 5 1 2 2 4 1 2 2 3 3 4 1 3 2 4	3 2 3 5 5
4 5 5 6 7 8 1 2 2 3 3 4 1 3 2 4	3 3 3 6 6

Problem L. Maximum Range

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

Grammy has a simple connected undirected graph. Each of the edges has a value written on it. Please choose a simple cycle for her such that the values written on the cycle has maximum range.

The range of a cycle is the difference between the maximum value and the minimum value written on it.

A cycle $i_1 - e_1 - i_2 - e_2 - \cdots - i_k - e_k - i_1$ (e_j is some edge connecting vertices i_j and $i_{j \bmod k+1}$ in the graph) is simple if and only if each **edge** appears at most once in it.

To prove that you really found the cycle, you need to output the vertices on the cycle in order.

It is guaranteed that there is at least one cycle in the graph.

Input

The first line contains 2 integers n, m ($3 \le n \le m \le 10^5$), denoting the number of vertices and the number of edges in the graph. It is guaranteed that there is at most one edge between each pair of vertices.

In each of the next m lines, there are 3 integers u, v, w ($1 \le u, v \le n, -10^9 \le w \le 10^9, u \ne v$), indicating that there is an edge between vertex u and vertex v having value w written on it.

Output

In the first line, output a single integer, denoting the maximum range of a simple cycle in the graph.

In the second line, output a single integer k, denoting the number of edges in the cycle. It is not hard to find out that the number of edges is equal to the number of vertices in the cycle.

In the last line, output k integers, denoting the vertices on the cycle in order. Note that these vertices can be repeated since only edges cannot be visited multiple times.

If there are multiple solutions, output any.

Example

standard input	standard output
5 7 1 2 1 1 3 -2 2 3 1 3 4 3 4 5 1 1 5 -1 2 5 2	5 5 1 2 5 4 3

Note

In the first sample, the cycle 1-2-5-4-3-1 has the maximum range of 5, since the maximum value on the cycle is 3, and the minimum value on the cycle is -2, so the maximum range of a cycle is $3 - (-2) = 5$. It can be shown that there are no cycles with a range larger than 5.