The 2020

Asia Jinan Regional Contest

Contest Session

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Problem A. Matrix Equation

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

We call a matrix "01 Square" if and only if it's a $N \times N$ matrix and its elements are all 0 or 1.

For two 01 Squares X,Y, we define two operators $X \times Y$ and $X \odot Y$. The value of them are also 01 Square matrices and calculated below(we use Z to abbreviate $X \times Y$ and D to abbreviate $X \odot Y$):

$Z_{i,j} = (\sum_{k=1}^{N} X_{i,k}Y_{k,j})\ mod\ 2$

$D_{i,j} = X_{i,j}Y_{i,j}$

Now MianKing has two 01 Squares A, B, he wants to solve the matrix equation below:

$A \times C = B \odot C$

You need to help MainKing solve this problem by calculating how many 01 Squares C satisfy this equation.

The answer may be very large, so you only need to output the answer module 998244353.

Input

The first line has one integer N

Then there are N lines and each line has N integers, the j-th integer of the i-th line denotes $A_{i,j}$

Then there are N lines and each line has N integers, the j-th integer of the i-th line denotes $B_{i,j}$

$1 \le N \le 200$, $A_{i,j}, B_{i,j} \in \{0, 1\}$

Output

Output the answer module 998244353.

Examples

standard input	standard output
2 0 1 1 1 1 0 0 1	2
3 1 0 0 0 1 0 0 0 1 1 1 1 1 1 1 1 1 1	512
4 0 1 0 1 0 1 1 0 0 1 1 1 1 0 0 1 1 0 1 1 0 1 1 1 1 0 0 1 1 1 1 0	8

Problem B. Number Game

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

MianKing and GreenKing are playing a game. Initially there are K integers on the blackboard and a set S.

MianKing and GreenKing take turns to operate and MianKing will operate first.

In each operation the player can choose an integer x on the blackboard which is not a Bad Number(Will be defined below), then choose an integer y in S.

The player should guaranteed that $y \le x$ and if there is no y that satisfies $y \le x$ in the set S, the player cannot choose this x.

Then the player will replace x with $x - y$ on the blackboard.

If a player cannot do any operations, the player loses this game.

GreenKing is a bad woman, she wants to choose a subset of size K from $\{1...n\}$ to ensure that she can win the game(Assuming that both players are smart enough). Now you need to help her calculate how many subset of $\{1...n\}$ satisfies the above conditions.

The answer may be very large, so you only need to output answer mod 998244353.

We call a number is a Bad Number, if and only if it has an even number of 1 in the binary representation.

For example, $0, 3, 996$ are all Bad Numbers and $1, 7$ are not Bad Numbers.

Input

The first line has three integers $n, K, |S|$

The second line has $|S|$ distinct integers denotes the set S.

$1 \le n \le 10^{18}$

$1 \le K \le min(n, 100)$

$\forall x \in S, 1 \le x \le 20$

$|S| > 0$

Output

Output the answer mod 998244353.

Examples

standard input	standard output
5 2 1 2	6
1000 100 10 1 2 3 4 5 6 7 8 10 11	896262428

Problem C. Stone Game

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

MianKing has n piles of stones and each pile has at most 3 stones, now he wants to merge all of these stones into one pile.

In order to achieve his goal, each time MianKing can choose two piles of stones and merge them into a new pile, and the number of stones in the new pile is the sum of these two piles.

Because it takes manpower to move stones, in each operation if the numbers of these two piles of stones are x and y respectively, MianKing should pay $(x \ mod \ 3)(y \ mod \ 3)$ coins for it.

Now MianKing wants to know the minimum amount of coins he need to pay to merge all of these stones into one pile.

Input

The first line has 3 integers a_1, a_2, a_3. And a_i denotes the number of piles which have i stones.

$0 \le a_i \le 10^9$

$\sum_{i=1}^{3} a_i > 0$

Output

Output one integer: the minimum amount of coins MianKing need to pay for his goal.

Examples

standard input	standard output
1 1 1	2
99 66 55	165

Problem D. Fight against involution

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

MianKing chose a course in this semester. There are n students in this course, and everyone needs to write a final paper. Let w_i denote the word count of the i-th student's final paper.

The i-th student has a lower bound L_i and an upper bound R_i on the number of words in his final paper so that $L_i \le w_i \le R_i$

The grade rule of this course is very amazing. The grade of the i-th student g_i is $n - K_i$, K_i is the number of $j \in [1, n]$ satisfies that $w_j > w_i$.

Every student wants to achieve the highest possible grade, so under the optimal decision w_i will equal to R_i for the i-th student.

But MianKing found an interesting thing: let's assume that $\forall i \in [1, n], L_i = 1000, R_i = 10000$. Under the optimal decision w_i are all equal to 10000 and the grades of the students are all n. But if everyone only writes 1000 words in their final papers, their grades are still all n and they can use the time they save to play games.

Now to fight against involution, MianKing wants to decide w_i for each student, and his plan has to satisfy the following conditions:

1. For each student, his grade cannot be less than that in the original plan.

2. Minimize the sum of w_i.

You need help MianKing calculate the minimum value of $\sum_{i=1}^{n} w_i$

Input

The first line has one integer n.

Then there are n lines, the i-th line has two integers L_i, R_i.

$1 \le n \le 10^5$

$1 \le L_i \le R_i \le 10^9$

Output

Output the minimum value of $\sum_{i=1}^{n} w_i$.

Examples

standard input	standard output
3 1 10000 1 10000 1 10000	3
4 1 2 2 2 2 4 3 4	10

Problem E. Tree Transform

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

MianKing has two labeled unrooted trees S,T with n nodes and he wants to transform S to T by some operations.

In each operation, MianKing can select four distinct nodes x, y, z, w which forms a path $\{(x, y), (y, z), (z, w)\}$ in the tree S. Then he removes edges $\{(x, y), (y, z), (z, w)\}$ from S , chooses three new edges whose endpoints $\in \{x, y, z, w\}$ and adds these new edges to S. MianKing has to guarantee that S is still a tree after this operation.

Now you need to help MianKing to transform S to T within 10^4 operations.

Input

The first line has one integer n.

Then there are $n - 1$ lines, each lines has two integers (x, y) which denotes an edge in S.

Then there are $n - 1$ lines, each lines has two integers (x, y) which denotes an edge in T.

$4 \leq n \leq 100$

It's guaranteed that S and T are both trees.

Output

The first line has one string "YES"if there exists a solution to transform S to T within 10^4 operations, otherwise "NO". (both without quotation)

If there exists a solution, then:

The first line has one integers m which denotes the number of operations of your solution.

Then for each operations, there are two lines which represent this operations. The first line has four integers (x, y, z, w) and the second line has six integers $a_1, b_1, a_2, b_2, a_3, b_3$ which (a_i, b_i) denotes the i-th new edge you choose in this operation.

For each operation, you should guarantee these conditions:

1. $1 \leq x, y, z, w, a_i, b_i \leq n$

2. x, y, z, w are distinct and form a path $\{(x, y), (y, z), (z, w)\}$ in the tree S at that time.

3. $a_i, b_i \in \{x, y, z, w\}$

4. After removing edges $\{(x, y), (y, z), (z, w)\}$ and add new edges $(a_1, b_1), (a_2, b_2), (a_3, b_3)$, S is still a tree at that time.

5. After all of the operations, S should be the same as T.

6. $0 \leq m \leq 10^4$

Two labeled tree are same if and only if $[(x, y) \in S] \leftrightarrow [(x, y) \in T]$ for all edge (x, y)

Examples

standard input	standard output
5 1 2 2 3 3 4 2 5 1 2 2 3 3 4 1 5	YES 2 5 2 3 4 2 3 3 5 3 4 1 2 3 5 1 5 1 2 2 3
4 1 2 1 3 1 4 1 2 2 3 3 4	NO
4 1 2 1 3 1 4 1 2 1 3 1 4	YES 0

Problem F. Gcd Product

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

Give you $n, A_{1...n}, B_{1...n}$, you need to calculate:

$$C_k = \sum_{i=1}^{k} A_{gcd(i,k)} B_{gcd(k+1-i,k)}$$

Because the output may be too large, let Ans_i denote $C_i \ mod \ 998244353$, you only need to output $Ans_1 \ xor \ Ans_2 \ xor \ ... \ xor \ Ans_n$

Input

The first line has one integer n.

The second line has n integers $a_{1...n}$.

The third line has n integers $b_{1...n}$.

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

$0 \leq a_i, b_i < 998244353$

Output

Output the answer.

Example

standard input	standard output
6 1 2 3 4 5 6 6 5 4 3 2 1	88

Problem G. Xor Transformation

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

MianKing has one integer X, he wants to perform some operations to transform X to Y $(Y < X)$.

In each operation, MianKing can choose one integer $0 \le A < X$ and let $X = X \ xor \ A$.

It's noticed that after an operation, the upper bound of A will change because X has changed.

Now you need to help MianKing to find a way to transform X to Y by doing at most 5 operations.

Input

The first line has two integers X, Y.

$1 \le Y < X \le 10^{18}$.

Output

The first line has one integer d denotes the number of operations you did.

Then there are d integers $A_{1...d}$ denotes the A you choose in each operations.

$0 \le d \le 5$.

Example

standard input	standard output
5 3	3 1 2 5

Problem H. Path Killer

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

MainKing has a rooted tree with n nodes, and m paths on it. And the root of this tree is 1.

The endpoints of the i-th path are a_i, b_i. All of these paths satisfy a special condition: a_i is on the path from b_i to the root.

Now MianKing wants to delete all of these paths. He will do the following operation until all of the paths are deleted: choose an integer x from $[1, n]$ randomly and delete all of the paths where x is on.

MianKing wants you to calculate the expected number of operations he need to do.

It's guaranteed that the answer will converge to some rational number.

If the answer is irreducible fraction $\frac{x}{y}$, you need to output an integer d in $[0, 998244352]$ which satisfies $d \times y \ mod\ 998244353 = x \ mod\ 998244353$. It's guaranteed that $y \ mod\ 998244353 \neq 0$

Input

The first line has two integers n, m.

The second line has $n-1$ integers, the i-th integer denotes the father node of node $i+1$

Then there are m lines, the i-th line has two integers a_i, b_i.

$1 \leq n, m \leq 300$

Let fa_i denote the father node of node i. Then $0 < fa_i < i$ for $i \in [2, n]$

$1 \leq a_i \leq b_i \leq n$. It's guaranteed that a_i is on the path from b_i to the root.

Output

Output the answer.

Example

standard input	standard output
3 3 1 1 1 2 3 3 1 1	499122181

Problem I. Random Walk On Tree

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

MianKing has a tree with n nodes. And he has one black chess and one white chess, both of the chess are initially on some nodes of the tree.

Now MianKing will do the following operation until the black chess and the white chess are on the same node: If the black chess is on node x, let S denote the set of nodes which connect to x directly. Then MainKing will choose a node of S randomly and move the black chess to it.

Let Len denote the number of operations MianKing did, now let $f(S,T)$ denote the expectation of Len^2 when the black chess is on node S and the white chess is on node T initially.

Let $Sub(x)$ denote the set of all of the nodes in the subtree of x when the root is node 1. Now MainKing wants you to answer Q questions, each question formed by two integers A,B and you need to answer $\sum_{S\in Sub(A)}\sum_{T\in Sub(B)} f(S,T)$

It's guaranteed that $Sub(x)\cap Sub(y)=\emptyset$ for each questions.

If the answer is irreducible fraction $\frac{x}{y}$, you need to output an integer d in $[0,998244352]$ which satisfies $d\times y\ mod\ 998244353 = x\ mod\ 998244353$. It's guaranteed that $y\ mod\ 998244353 \neq 0$

Input

The first line has two integers n,Q.

Then there are $n-1$ lines, each line has two integers (x,y) denotes an edge of the tree.

Then there are Q lines, the i-th line has two integers (A,B) denotes the i-th questions.

$1\le n,Q\le 10^5$

It's guaranteed that $Sub(A)\cap Sub(B)=\emptyset$ for each questions.

Output

There are Q lines, thee i-th line has one integer denotes the answer. If the answer is irreducible fraction $\frac{x}{y}$, you need to output an integer d in $[0,998244352]$ which satisfies $d\times y\ mod\ 998244353 = x\ mod\ 998244353$. It's guaranteed that $y\ mod\ 998244353 \neq 0$

Examples

standard input	standard output
3 1 1 2 1 3 2 3	24
7 4 1 2 1 3 2 4 2 5 3 6 3 7 2 3 4 5 2 7 4 7	6508 408 2833 960

Problem J. Tree Constructer

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

MianKing has a Graph Constructer : The input of it is a sequence $a_{1...n}$ $(0 \leq a_i < 2^{60})$ and the output of it is an undirected graph with n nodes, edge (x, y) is in this graph if and only if $(a_x \ or \ a_y) = 2^{60} - 1$

For example, if the input is $a_{1...3} = \{2^{60} - 1, 2^{60} - 2, 1\}$, the output is the graph $\{(1,1),(1,2),(1,3),(2,3)\}$

Now GreenKing has a tree with n nodes, MianKing wants to find a sequence as input to get this tree. You need to help him find a sequence satisfy the condition.

Input

The first line has one integer n.

Then there are $n - 1$ lines, each line has two integers (x, y) denotes an edge in the tree.

$1 \leq n \leq 100$.

Output

Output n integers $a_{1...n}$ denotes the sequence you find.

You should guaranteed that $0 \leq a_i < 2^{60}$

It's guaranteed that the solution always exists.

Example

standard input	standard output
3 1 2 2 3	1 1152921504606846974 1

Problem K. Kth Query

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

MianKing has a sequence $a_{1...n}$ and he wants to answer Q queries about it.

Let $f(a, S, K)$ denote the K-th smallest number of sequence $b_{1...n}$ which satisfies that $\forall i \in [1, n], b_i = a_i\ xor\ S$.

Now for each query, give you L, R, K, you need to answer $Min_{S=L}^{R} f(a, S, K)$.

Input

The first line has two integers n, Q.

The second line has n integers which denote $a_{1...n}$.

Then there are Q lines, the i-th line has three integers L, R, K which represents the i-th query.

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

$0 \leq a_i < 2^{30}$

$0 \leq L \leq R < 2^{30}$

$1 \leq K \leq n$

Output

There are Q lines, the i-th line has one integer which denotes $Min_{S=L}^{R} f(a, S, K)$.

Examples

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

Problem L. Bit Sequence

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

Let $f(x)$ denote the number of 1s in the binary representation of x.

Now MianKing has a sequence $a_{0...m-1}$ and he wants to know the number of integer $x \in [0, L]$ satisfies that: $\forall i \in [0, m-1], f(x+i)\ mod\ 2 = a_i$

You need to help him calculate the answer.

Input

There are T testcases in this problem.

The first line has one integer T.

Then for each testcase, the first line has two integer m, L. The second line has m integers denote $a_{0...m-1}$

$1 \le T \le 1000$

$1 \le m \le 100$

$0 \le L \le 10^{18}$

$a_i \in \{0, 1\}$

Output

For each testcase, output the answer in one line.

Example

standard input	standard output
3 3 10 0 1 0 1 1000 0 9 1000000 1 0 1 1 0 1 0 0 1	2 501 41667

Problem M. Cook Pancakes!

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

In China, there is a very famous problem about pancakes: You have a pan and you can fry two pancakes at the same time each time. For a pancake, its front and back sides need to be cooked, and it takes one hour for each side to be cooked.

So how long does it take at least to cook 3 pancakes? The answer is three hours:

In the first hour, fry the front of No.1 pancake and the front of No.2 pancake.

In the second hour, fry the back of No.2 pancake and the front of No.3 pancake.

In the third hour, fry the back of No.1 pancake and the back of No.3 pancake.

Now you have a pan and you can fry K pancakes at the same time each time. How many hours does it takes at least to cook N pancakes?

It's noticed that you have to fry some side of the pancake until fully cooked every time, it means that you can't fry some side of the pancake half-cooked and taking it out. So the answers are always integers.

Input

The first line has two integers N, K.

$1 \le N, K \le 100$

Output

Output the answer.

Example

standard input	standard output
3 2	3