Problem A. Tree

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

For a rootless tree with n vertices and $n-1$ edges, each edge has edge weights. In the beginning, each vertex has a color (black or white), you can choose to reverse the color of a vertex, but this will pay the cost.

For a tree, we define its earnings as $\sum_{x \in V_1} \sum_{y \in V_2} val(x, y)$, where V_1 is the set of white vertices and V_2 is the set of black vertices.

Where $val(x, y)$ is the maximum edge weight in the shortest path from x to y.

You need to reverse some vertices (or not) so that the earnings-cost is maximum? You need to calculate the answer.

Input

The first line contains a positive integer n ($1 \le n \le 3000$), representing the number of vertices in the tree.

The second line contains a row of n integers a_i ($0 \le a_i \le 1$), representing the initial color of the i-th vertex (0 for white, 1 for black).

The third line contains a row of n integers $cost_i$ ($1 \le cost_i \le 10^9$), representing the cost of changing the i-th vertex.

The next $n-1$ line, each line contains three positive integers u_j, v_j, w_j ($1 \le u_j, v_j, w_j \le n$) represents an undirected edge and edge weight. It is guaranteed that the input is a tree.

Output

A line of output with an integer represents the maximum earnings-cost.

Examples

standard input	standard output
3 0 0 0 1 2 3 1 2 1 2 3 2	2
8 1 0 0 0 0 1 0 0 3 9 8 9 5 9 9 4 1 2 2 1 3 8 1 4 5 1 5 5 5 6 7 2 7 3 3 8 3	100

Problem B. Distance

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

For the two multisets A and B , In an operation, we can choose one between the following two operations:

1. Update an element a_i in the multiset A, to $a_i = a_i + 1$

2. Update an element b_i in the multiset B, to $b_i = b_i - 1$

We define $C(A, B)$ as the minimum number of operations to make the sets A and B identical,meaning that both sets have the same elements, If there is no way to transform multisets A and B into the same set, then $C(A, B) = 0$.

Now you have two multisets S and T, and calc the value of $\sum_{A \in S} \sum_{B \in T} C(A, B)$ modulo 998244353.

Note: Subsets in the multiset are allowed to duplicate values, that is, the number of solutions selected from each of the two sets S and T is $(2^{|S|} - 1)(2^{|T|} - 1)$.

Input

The first line contains a positive integer n $(1 \le n \le 2 \times 10^3)$,representing the size of the multiset S and the multiset T .

The second line contains a line of n positive integers s_i $(1 \le s_i \le 10^5)$, representing the multiset S .

The third line contains a line of n positive integers t_i $(1 \le t_i \le 10^5)$, representing the multiset T.

Output

Output a line with a integer representing the answer, modulo 998244353.

Examples

standard input	standard output
2 1 2 1 1	3
3 1 2 2 1 1 3	22

Problem C. Idol

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

Akuya has finally obtained Shinki Hikari's iPhone. Now, he needs to crack the password to gather evidence!

Blindly attempting to crack the password won't work, so Akuya found a note inside Shinki Hikari's phone case. On it was a puzzle! He believes the solution to this puzzle is the phone's password. The puzzle is as follows:

Given a positive integer n, **the double factorial** of n is the product of all positive integers with the same odd/even parity as n and not exceeding n. It is denoted as $n!!$, for example, $5!! = 1 \times 3 \times 5, 6!! = 2 \times 4 \times 6$.

Find the number of trailing zeros in the decimal representation of the product $1!! \times 2!! \times 3!! \times \cdots \times n!!$.

Akuya is just one step away from achieving his revenge. Can you help him?

Input

Input one line containing a positive integer $n (1 \leq n \leq 10^{18})$.

Output

Only one line, containing a positive integer, represents the answer.

Example

standard input	standard output
11	5

Note

$1!! \times 2!! \times 3!! \times \cdots \times 11!! = 52563198423859200000$

Problem D. Grid

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

Given a $n \times n$ grid, with each point having a value $a_{i,j}$ (coordinate is from $1 \sim n$).

Now you need to select m points, one of which is considered as a good point $[i, j]$ if it satisfy one of the conditions, otherwise it's a bad point.

- $i = 1$
- $[i-1,\ j-1]$ and $[i-1,\ j+1](1 <\ i,\ j\ < n)$ are both selected.

A selection is legal if and only if the number of bad points is less than or equal to k.

For $m = 1 \sim n^2$, print the maximum value of the sum of all the points selected.

If there is no solution, output -1.

Input

The first line contains two integers $n,\ k\ (2 \le n \le 140, 0 \le k \le 1)$.

The next n lines contain n space separated integers $a_{i,j}\ (0 \le a_{i,j} \le 10^9)$ — the values of each cell of the grid.

Output

The output contains n^2 lines.

The i-th line represents the answer when $m\ =\ i$.

Examples

standard input	standard output
2 0 2 3 4 5	3 5 -1 -1
4 0 2 1 0 8 0 10 1 0 0 0 0 0 0 0 0 0	8 10 12 20 21 22 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1

Problem E. Sequence

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

You have an array of n elements $a_1, a_2, \ldots, a_n$.

For each task, you have three integers l, r, k.

Ask whether you can find an array b of $k-1$ integers satisfy:

- $l \leq b_1 < b_2 < b_3 < \cdots < b_{k-1} < r$
- $sum(l, b_1), sum(b_1+1, b_2), \ldots, sum(b_{k-1}+1, r)$ are the multiplies of 2

We define $sum(l, r) = \sum_{i=l}^{r} a_i$ $(l \leq r)$.

If possible, print "YES". Otherwise print "NO".

Input

Each test contains multiple test cases. The first line contains the number of test cases $T(1 \leq T \leq 10000)$. The description of the test cases follows.

The first line of each test case contains two integers $n,\ q$ $(1 \leq n,\ q \leq 10^5)$.

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

Each of the next q lines contains three integers $l,\ r,\ k$ $(1 \leq l \leq r \leq n, 1 \leq k \leq 10^5)$

It's guaranteed that $\sum n,\ \sum q \leq 5 \times 10^5$

Output

For each test case, output "YES"or "NO".

Example

standard input	standard output
2 3 3 1 2 3 1 2 1 1 3 1 2 3 1 3 3 2 2 2 1 2 1 1 2 2 1 2 3	NO YES NO YES YES NO

Problem F. Calculate sum

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

You are given an array of integers $a_1,\ a_2,\ \ldots,\ a_n$.

Define $b_{i,j}(1 \le i < j \le n) = a_1,\ a_2,\ \ldots\ ,\ a_{i-1},\ a_j,\ a_{j-1},\ \ldots\ ,\ a_{i+1},\ a_i,\ a_{j+1},\ \ldots\ ,\ a_n$. Which means you choose two indexes i and j, then reverse $a_i,\ a_{i+1},\ \ldots\ a_{j-1},\ a_j$.

You should calculate for $k = 2$ to $2 \times n$, $(\sum_{i=1}^{n} \sum_{j=i+1}^{n} \sum_{1 \le x,y \le n,\ x+y=k} (b_{i,j})_x \times (b_{i,j})_y)$ modulo 998244353.

Input

The first line contains one integers n ($2 \le\ n\ \le 10^5$).

The second line contains n integers $a_1, a_2, \ldots, a_n$ ($0 \le\ a_i\ \le 10^8$).

Output

Output $2 \times n - 1$ lines, each of which contains a single integer , denoting the answer taken modulo 998244353—the i-th number is for the answer of $k = i + 1 (1 \le i \le 2 \times n - 1)$.

Example

standard input	standard output
5 2 4 8 7 5	178 390 707 1022 1341 1232 995 612 283

Problem G. Gcd

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

Initially, you have a set $S = \{x, y\}$ $(x \neq y)$. Then you have two operations:

- 1. Choose two elements $a, b (a \neq b)$ from set S, insert $a - b$ to the set.
- 2. Choose two elements $a, b (a \neq b)$ from set S, insert $\gcd(|a|, |b|)$ to the set.

We define $|a|$ as the absolute value of a.

We define $\gcd(a,\ b)$ as the greatest common divisor of a and b.

Specially, $\gcd(a,\ 0) = \gcd(0,\ a) = a$.

You task is making $z \in S$ after several operations.

If possible, print "YES". Otherwise print "NO".

Input

Each test contains multiple test cases. The first line contains the number of test cases T $(1 \leq T \leq 10^5)$. The description of the test cases follows.

One line contains three integers $x,\ y,\ z$ ($0 \leq x, y, z \leq 10^9,\ x \neq y$).

Output

For each test case, output "YES" or "NO".

Example

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

Problem H. Traffic

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

Alice's country has n cities, and these n cities are connected by $n+1$ channels. If a channel is opened, residents on one end can reach the other end through this channel. There are a total of $T+1$ days (from day 0 to day T), and the cost of opening the j-th channel on the i-th day is given by the expression $a_i \times j + b_i$. The total cost for a specific day is the sum of costs of all the channels opened on that day.

Alice needs to determine which channels to open each day to ensure that residents can reach any other city through the opened channels every day while minimizing the total cost. Can you help her?

Input

The first line contains two integers n and $T(1 \leq n, T \leq 10^5)$, representing the number of cities and the total number of days.

The next $n+1$ lines (from 2nd to $(n+2)$-th) each contain four integers $u_i, v_i, a_i, b_i (1 \leq u_i, v_i \leq n, 0 \leq a_i, b_i \leq 10^8)$, representing a channel between cities u_i and v_i. The cost of opening this channel on the j-th day is $a_i \times j + b_i$.

It is guaranteed that there are no self-loops, but there may be multiple edges between the same pair of vertices.

Output

Output $T+1$ lines, each containing an integer, representing the minimum cost for each of the days from 0 to T.

Example

standard input	standard output
5 3 1 2 3 1 1 3 1 2 2 3 1 3 3 4 1 1 3 5 1 2 4 5 1 3	6 12 16 20

Problem I. Journey

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

Alice is a young girl who enjoys adventure and solving puzzles. One day, she finds herself in a mysterious and ancient forest, where a magical maze called the "Colorful Maze"is hidden.

The Colorful Maze is an undirected connected graph consisting of n rooms and m corridors. Each room is colored either red or blue, and the corridors form various connections between the rooms.

Initially, Alice is teleported to the starting point of the maze, which is room number 1. Her goal is to find a path that leads to the endpoint of the maze, which is room number n.

However, the maze's magical rules perplex Alice. Whenever she moves from one room to another through a corridor, the color of the destination room changes to the opposite color of the original color. For example, if the room was originally red, it will turn blue after Alice moves to it.

The challenge is for Alice to find a path starting from the starting point, passing through a series of rooms, and finally reaching the endpoint while ensuring that all rooms have either all red or all blue colors.

Alice seeks your assistance in solving this problem and finding a path that meets the requirements. She wants to know if such a path exists. If there is a solution, she would like you to provide a path that consists of no more than 5×10^5 corridors.

Now, please help Alice solve this puzzle and provide a valid path if it exists. If it is not possible to find such a path, please inform Alice that it is currently impossible to reach the endpoint. May you aid Alice successfully navigate through the adventure in the Colorful Maze!

Input

The first line of input contains two positive integers n and $m(1 < n \leq 10^5, 1 \leq m \leq 10^6)$, representing the number of rooms and corridors in the undirected graph.

The next line contains n integers $color_i(0 \leq color_i \leq 1)$, representing the colors of each room, 0 indicates blue, and 1 indicates red.

The next m lines each contain two integers u and $v(1 \leq u, v \leq n)$, representing an undirected corridor between rooms u and v. It is guaranteed that there are no self-loops.

Output

The first line of output should be either "YES"if the problem has a solution, or "NO"if there is no solution.

If the problem has a solution, the second line should contain an integer ans, representing the number of corridors in the constructed path. The third line should contain $ans+1$ integers, representing the sequence of rooms visited in the path,and the path must start at room 1 and end at room n.

If there is no solution, there is no need to output the second and third lines.

Examples

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

Problem J. Even

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

You have an array of n elements $a_1, a_2, \ldots, a_n$.

You need to answer q queries. Every query will give you $l,\ r,\ k$, each query is independent with others.

Each operation can be completed by the following code:

```
a[0] = 0;
bool have_even = 0;
for(int i = l; i <= r; i++)if (a[i] % 2 == 0 && a[i] > 0 ) have_even = 1;
if (have_even)
{
        index = 0;
        for(int i = l; i <= r; i++)
        {
                if (a[index] < a[i] && a[i] % 2 == 0) index = i;
        }
        a[index] /= 2;
}else
{
        index = l;
        for(int i = l; i <= r; i++)
        {
                if (a[index] < a[i]) index = i;
        }
        if (a[index] > 0) a[index] = (a[index] - 1) / 2;
}
```

You want to know the maximum value of interval $[l,\ r]$ after k operations.

Input

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

The second line contains n integers $a_1,\ a_2, \ldots,\ a_n (1 \le a_i \le 10^9)$.

Each of the next q lines contains three integers $l,\ r,\ k$ $(1 \le l \le r \le n, 1 \le k \le 10^9)$

Output

For each test case, output the maximum number.

Examples

standard input	standard output
3 2 1 2 3 1 2 1 1 3 3	1 1
5 5 33 15 22 9 7 3 5 5 2 4 7 1 1 6 2 4 10 1 5 5	7 5 0 1 15