Codeforces Round #743 (Div. 1)

A. Book

time limit per test: 1.5 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

You are given a book with n chapters.

Each chapter has a specified list of other chapters that need to be understood in order to understand this chapter. To understand a chapter, you must read it after you understand every chapter on its required list.

Currently you don't understand any of the chapters. You are going to read the book from the beginning till the end repeatedly until you understand the whole book. Note that if you read a chapter at a moment when you don't understand some of the required chapters, you don't understand this chapter.

Determine how many times you will read the book to understand every chapter, or determine that you will never understand every chapter no matter how many times you read the book.

Input

Each test contains multiple test cases. The first line contains the number of test cases t ($1 \le t \le 2 \cdot 10^4$).

The first line of each test case contains a single integer n ($1 \le n \le 2 \cdot 10^5$) — number of chapters.

Then n lines follow. The i-th line begins with an integer k_i ($0 \le k_i \le n-1$) — number of chapters required to understand the i-th chapter. Then k_i integers $a_{i,1}, a_{i,2}, \ldots, a_{i,k_i}$ ($1 \le a_{i,j} \le n, a_{i,j} \ne i, a_{i,j} \ne a_{i,l}$ for $j \ne l$) follow — the chapters required to understand the i-th chapter.

It is guaranteed that the sum of n and sum of k_i over all testcases do not exceed $2 \cdot 10^5$.

Output

For each test case, if the entire book can be understood, print how many times you will read it, otherwise print -1.

Example

input
5 4 1 2 0 2 1 4 1 2 5 1 5 1 1 1 2 1 3 1 4 5 0 0 2 1 2 1 2 2 2 1 4 2 2 3 0 0 2 3 2 5 1 2 1 3 1 4 1 5 0

output
2 -1 1 2 5

Note

In the first example, we will understand chapters $\{2, 4\}$ in the first reading and chapters $\{1, 3\}$ in the second reading of the book.

In the second example, every chapter requires the understanding of some other chapter, so it is impossible to understand the book.

In the third example, every chapter requires only chapters that appear earlier in the book, so we can understand everything in one go.

In the fourth example, we will understand chapters $\{2, 3, 4\}$ in the first reading and chapter 1 in the second reading of the book.

In the fifth example, we will understand one chapter in every reading from 5 to 1.

B. Xor of 3

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

You are given a sequence a of length n consisting of 0s and 1s.

You can perform the following operation on this sequence:

- Pick an index i from 1 to $n-2$ (inclusive).
- Change all of a_i, a_{i+1}, a_{i+2} to $a_i \oplus a_{i+1} \oplus a_{i+2}$ simultaneously, where $\oplus$ denotes the bitwise XOR operation

Find a sequence of **at most** n operations that changes all elements of a to 0s or report that it's impossible.
We can prove that if there exists a sequence of operations of any length that changes all elements of a to 0s, then there is also such a sequence of length not greater than n.

Input

Each test contains multiple test cases. The first line contains the number of test cases t ($1 \le t \le 10^4$).

The first line of each test case contains a single integer n ($3 \le n \le 2 \cdot 10^5$) — the length of a.

The second line of each test case contains n integers $a_1, a_2, \ldots, a_n$ ($a_i = 0$ or $a_i = 1$) — elements of a.

It is guaranteed that the sum of n over all test cases does not exceed $2 \cdot 10^5$.

Output

For each test case, do the following:

- if there is no way of making all the elements of a equal to 0 after performing the above operation some number of times, print "NO".
- otherwise, in the first line print "YES", in the second line print k ($0 \le k \le n$) — the number of operations that you want to perform on a, and in the third line print a sequence $b_1, b_2, \ldots, b_k$ ($1 \le b_i \le n-2$) — the indices on which the operation should be applied.

If there are multiple solutions, you may print any.

Example

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

Note

In the first example, the sequence contains only 0s so we don't need to change anything.

In the second example, we can transform $[1, 1, 1, 1, 0]$ to $[1, 1, 0, 0, 0]$ and then to $[0, 0, 0, 0, 0]$ by performing the operation on the third element of a and then on the first element of a.

In the third example, no matter whether we first perform the operation on the first or on the second element of a we will get $[1, 1, 1, 1]$, which cannot be transformed to $[0, 0, 0, 0]$.

C. Paint

time limit per test: 1 second
memory limit per test: 256 megabytes

input: standard input
output: standard output

You are given a 1 by n pixel image. The i-th pixel of the image has color a_i. For each color, the number of pixels of that color is **at most** 20.

You can perform the following operation, which works like the bucket tool in paint programs, on this image:

- pick a color — an integer from 1 to n;
- choose a pixel in the image;
- for all pixels connected to the selected pixel, change their colors to the selected color (two pixels of the same color are considered connected if all the pixels between them have the same color as those two pixels).

Compute the minimum number of operations needed to make all the pixels in the image have the same color.

Input
Each test contains multiple test cases. The first line contains the number of test cases t ($1 \le t \le 10^3$).

The first line of each test case contains a single integer n ($1 \le n \le 3 \cdot 10^3$) — the number of pixels in the image.

The second line of each test case contains n integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le n$) — the colors of the pixels in the image.

Note: for each color, the number of pixels of that color is **at most** 20.

It is guaranteed that the sum of n over all test cases does not exceed $3 \cdot 10^3$.

Output
For each test case, print one integer: the minimum number of operations needed to make all the pixels in the image have the same color.

Example

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

Note
In the first example, the optimal solution is to apply the operation on the third pixel changing its color to 2 and then to apply the operation on any pixel that has color 2 changing its color and the color of all pixels connected to it to 1. The sequence of operations is then: $[1, 2, 3, 2, 1] \to [1, 2, 2, 2, 1] \to [1, 1, 1, 1, 1]$.

In the second example, we can either change the 1s to 2s in one operation or change the 2s to 1s also in one operation.

In the third example, one possible way to make all the pixels have the same color is to apply the operation on the first, third and the fourth pixel each time changing its color to 2.

D. Bridge Club

time limit per test: 2.5 seconds
memory limit per test: 512 megabytes
input: standard input
output: standard output

There are currently n hot topics numbered from 0 to $n - 1$ at your local bridge club and 2^n players numbered from 0 to $2^n - 1$. Each player holds a different set of views on those n topics, more specifically, the i-th player holds a positive view on the j-th topic if $i \,\&\, 2^j > 0$, and a negative view otherwise. Here $\&$ denotes the bitwise AND operation.

You are going to organize a bridge tournament capable of accommodating at most k pairs of players (bridge is played in teams of two people). You can select teams arbitrarily while each player is in at most one team, but there is one catch: two players cannot be in the same pair if they disagree on 2 or more of those n topics, as they would argue too much during the play.

You know that the i-th player will pay you a_i dollars if they play in this tournament. Compute the maximum amount of money that you can earn if you pair the players in your club optimally.

Input
The first line contains two integers n, k ($1 \le n \le 20$, $1 \le k \le 200$) — the number of hot topics and the number of pairs of players that your tournament can accommodate.

The second line contains 2^n integers $a_0, a_1, \ldots, a_{2^n-1}$ ($0 \le a_i \le 10^6$) — the amounts of money that the players will pay to play in

the tournament.

Output
Print one integer: the maximum amount of money that you can earn if you pair the players in your club optimally under the above conditions.

Examples

input
3 1 8 3 5 7 1 10 3 2
output
13

input
2 3 7 4 5 7
output
23

input
3 2 1 9 1 5 7 8 1 1
output
29

Note
In the first example, the best we can do is to pair together the 0-th player and the 2-nd player resulting in earnings of $8 + 5 = 13$ dollars. Although pairing the 0-th player with the 5-th player would give us $8 + 10 = 18$ dollars, we cannot do this because those two players disagree on 2 of the 3 hot topics.

In the second example, we can pair the 0-th player with the 1-st player and pair the 2-nd player with the 3-rd player resulting in earnings of $7 + 4 + 5 + 7 = 23$ dollars.

E. Polygon

time limit per test: 3 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

You are given a strictly convex polygon with n vertices.

You will make k cuts that meet the following conditions:

- each cut is a segment that connects two different nonadjacent vertices;
- two cuts can intersect only at vertices of the polygon.

Your task is to maximize the area of the smallest region that will be formed by the polygon and those k cuts.

Input
The first line contains two integers n, k ($3 \le n \le 200$, $0 \le k \le n - 3$).

The following n lines describe vertices of the polygon in anticlockwise direction. The i-th line contains two integers x_i, y_i ($|x_i|, |y_i| \le 10^8$) — the coordinates of the i-th vertex.

It is guaranteed that the polygon is convex and that no two adjacent sides are parallel.

Output
Print one integer: the maximum possible area of the smallest region after making k cuts **multiplied by** 2.

Examples

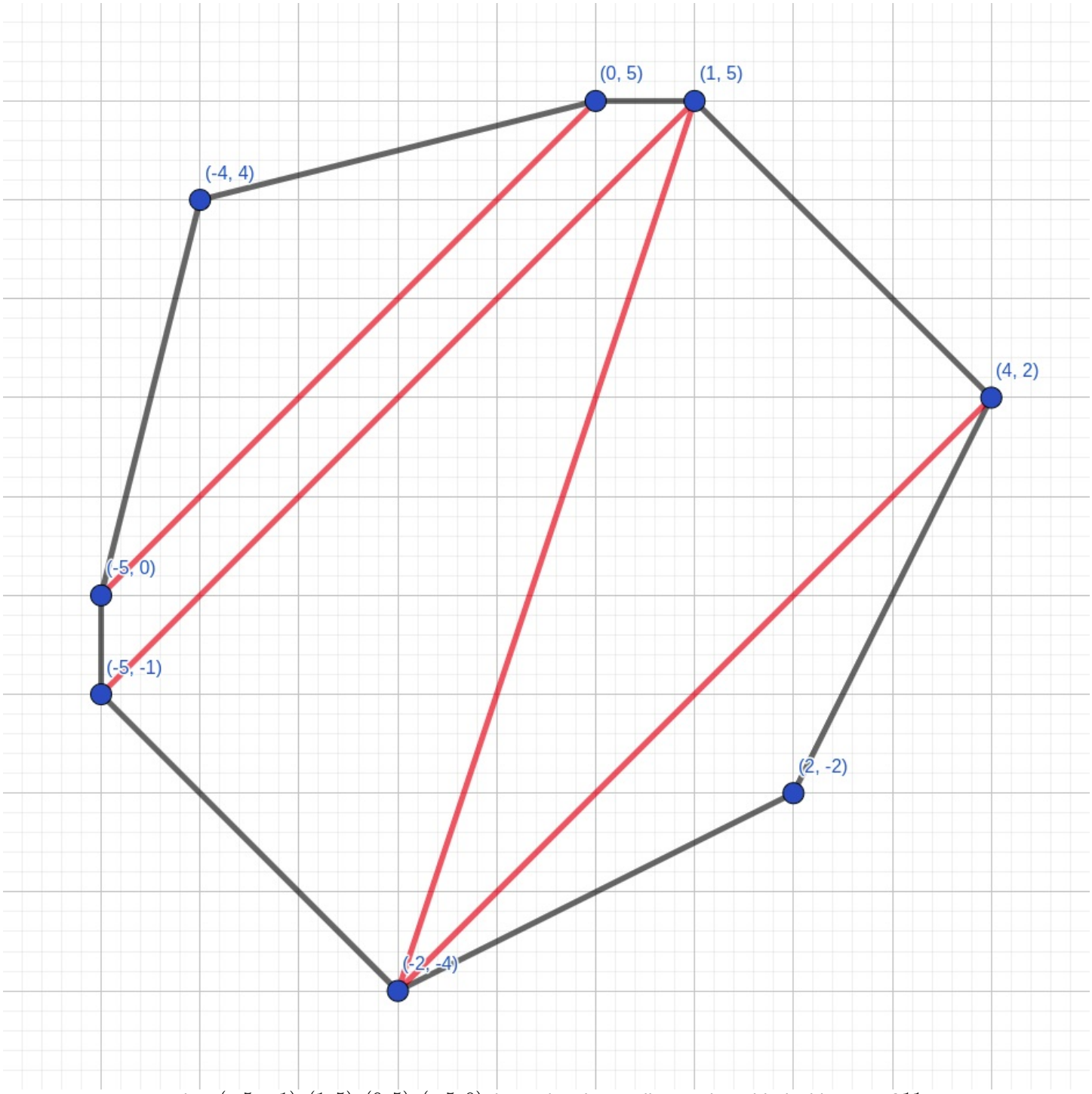
input
8 4 -2 -4 2 -2 4 2 1 5 0 5 -4 4 -5 0 -5 -1
output
11

input
6 3 2 -2 2 -1 1 2 0 2 -2 1 -1 0
output
3

Note

In the first example, it's optimal to make cuts between the following pairs of vertices:

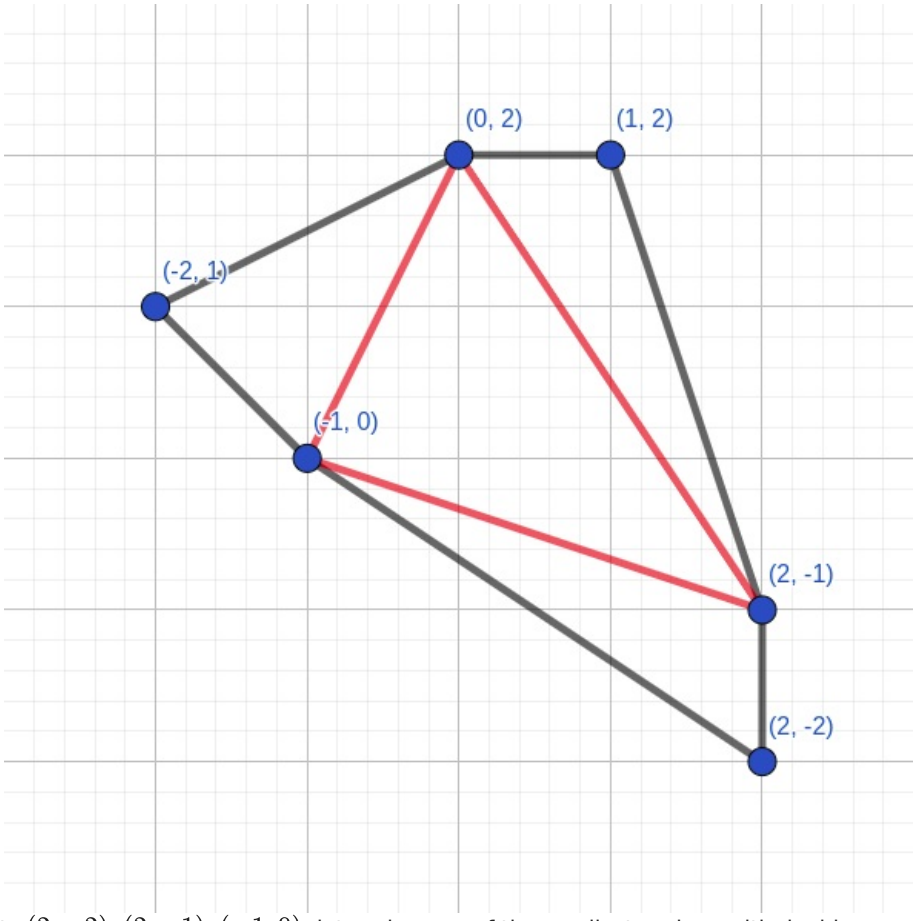
- $(-2, -4)$ and $(4, 2)$,
- $(-2, -4)$ and $(1, 5)$,
- $(-5, -1)$ and $(1, 5)$,
- $(-5, 0)$ and $(0, 5)$.



Points $(-5, -1)$, $(1, 5)$, $(0, 5)$, $(-5, 0)$ determine the smallest region with double area of 11.

In the second example, it's optimal to make cuts between the following pairs of vertices:

- $(2, -1)$ and $(0, 2)$,
- $(2, -1)$ and $(1, 0)$,
- $(-1, 0)$ and $(0, 2)$.



Points $(2, -2)$, $(2, -1)$, $(-1, 0)$ determine one of the smallest regions with double area of 3.

F. Stations

time limit per test: 2.5 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

There are n cities in a row numbered from 1 to n.

The cities will be building broadcasting stations. The station in the i-th city has height h_i and range w_i. It can broadcast information to city j if the following constraints are met:

- $i \leq j \leq w_i$, and
- for each k such that $i < k \leq j$, the following condition holds: $h_k < h_i$.

In other words, the station in city i can broadcast information to city j if $j \geq i$, j is in the range of i-th station, and i is strictly highest on the range from i to j (including city j).
At the beginning, for every city i, $h_i = 0$ and $w_i = i$.

Then q events will take place. During i-th event one of the following will happen:

- City c_i will rebuild its station so that its height will be strictly highest among all stations and w_{c_i} will be set to g_i.
- Let b_j be the number of stations that can broadcast information to city j. Print the sum of b_j over all j satisfying $l_i \leq j \leq r_i$.

Your task is to react to all events and print answers to all queries.

Input

The first line contains two integers n and q ($1 \leq n, q \leq 2 \cdot 10^5$) — number of cities and number of events.

Then q lines follow. The i-th line begins with an integer p_i ($p_i = 1$ or $p_i = 2$).

If $p_i = 1$ a station will be rebuilt. Then two integers c_i and g_i ($1 \leq c_i \leq g_i \leq n$) follow — the city in which the station is rebuilt and its new broadcasting range.

If $p_i = 2$ you are given a query. Then two integers l_i and r_i ($1 \leq l_i \leq r_i \leq n$) follow — the range of cities in the query.

Output

For each query, print in a single line the sum of b_j over the given interval.

Examples

input
1 3 2 1 1

1 1 1
2 1 1

output

1
1

input

5 10
1 3 4
2 3 5
1 1 5
2 1 5
1 4 5
2 2 4
1 2 3
2 1 3
1 5 5
2 2 5

output

4
10
5
4
5

Note

In the first test case, only station 1 reaches city 1 before and after it is rebuilt.

In the second test case, after each rebuild, the array b looks as follows:

1. $[1, 1, 1, 2, 1]$;
2. $[1, 2, 2, 3, 2]$;
3. $[1, 2, 2, 1, 2]$;
4. $[1, 1, 2, 1, 2]$;
5. $[1, 1, 2, 1, 1]$.