0_Hello World

(30 points)

Introduction

YTP Contest has started!

Let's verify everything first.

Is the internet setting correct?

Is the source code submission working well?

Do you use STDOUT output for program solutions?

Everything is ready! Go get 30 points now!! Go! Go! Go!

Description

Please write a program to output Hello World!

Input Format

This problem requires no input.

Output Format

[A~Z][a~z], space, and common English punctuation.

Constraints

[A~Z][a~z], space, and exclamation mark "!".

Input Example 1

(no input)

Output Example 1

Hello World!

Example Explanation

Input Example 1 has no input, simply output Hello World!

1_On Our Way

(5 points)

Description

Jiajia and Wayne used to be best friends before. They practiced problem solving together, ate ramen together, and enjoyed their lives as a CSIE student. Once, they turned against each other over an argument and vowed to go their own way, but soon patched up their friendship with the support from Yee. Today, they're going to play a table game "The 3rd Territory Crisis" together.

The game board is a table of size $N \times M$. We will consider the table rows numbered from top to bottom from 1 to N, and the columns numbered from left to right from 1 to M. We will denote a cell that is in the x -th row and in the y-th column as (x, y). At the beginning of the game, Jiajia is at the cell (x_A, y_A), Wayne is at the cell (x_C, y_C). The target of the game is to move to their own destinations: Jiajia's is at (x_B, y_B), Wayne's is at (x_D, y_D).

From the cell (a, b), they can move to one of the cells $(a + 1, b)$, $(a - 1, b)$, $(a, b + 1)$, or $(a, b - 1)$, if it exists.

Jiajia and Wayne always plan for their future, and so do they for the game. They're going to decide their own paths together before the game starts. Jiajia's path will be $J_1, J_2, \ldots, J_k$, Wayne's path will be $W_1, W_2, \ldots, W_l$. J_1 and W_1 are the cells where they started at the beginning of the game, J_k and W_l are their destinations.

After their first try of the game, they found that there are many traps on the game board, therefore they decide to make their paths as short as possible this time. Besides, they want to maximize the number of cells which belong to both of their paths. More formally, they want to maximize the number of cells (a, b) that satisfy $(a, b) \in J$ and $(a, b) \in W$.

Jiajia and Wayne both messed up their data structure and algorithm exams, so they would like to ask for your help to calculate the maximal possible number of cells which belong to both of their paths if they make their paths as short as possible.

Input Format

The first line contains a single integer T - the number of test cases. The description of test cases follows. A single line for each test contains ten integers $N, M, x_A, y_A, x_B, y_B, x_C, y_C, x_D, y_D$ - the size of the maps, the cells where they started, and their destinations.

Output Format

For each test case output a single integer - the maximal possible number of cells which belong to both of their paths if they make their paths as short as possible.

Constraints

- $1 \leq T \leq 10^5$

- $1 \leq N, M \leq 10^5$
- $1 \leq x_A, x_B, x_C, x_D \leq N$
- $1 \leq y_A, y_B, y_C, y_D \leq M$
- (x_A, y_A), (x_B, y_B), (x_C, y_C), (x_D, y_D) are pairwise different

Input Example 1

```
2
4 5 1 2 4 4 2 1 3 5
4 5 3 5 2 1 4 4 1 2
```

Output Example 1

```
4
4
```

Input Example 2

```
1
4 5 3 1 1 3 4 5 1 1
```

Output Example 2

```
3
```

Input Example 3

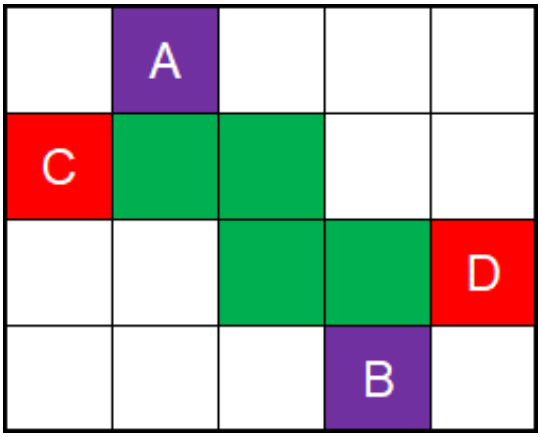
```
1
4 5 1 1 1 2 4 4 4 5
```

Output Example 3

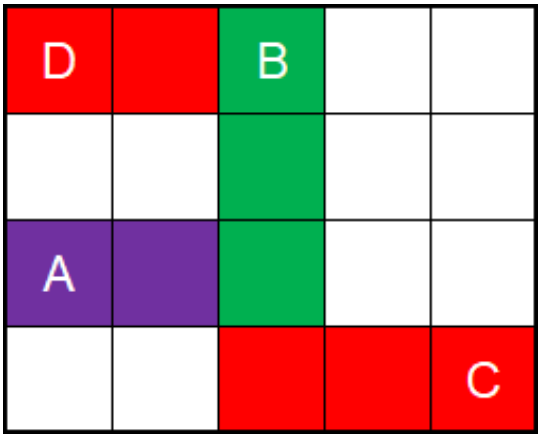
```
0
```

Example Explanation

The figure below shows one of the possible paths in sample test case 1. Jiajia's path consists of purple and green cells, Wayne's path consists of red and green cells.



The figure below shows one of the possible paths in sample test case 2. Jiajia's path consists of purple and green cells, Wayne's path consists of red and green cells.



In sample test case 3, Jiajia and Wayne only need to move one step to their destinations.

2_UR Bubble Shield

(10 points)

Description

Mr. PP launched a full-scale invasion of U Country and made thousands of people dead.

To avoid risk of war, and based on previous time traveler described, there will have a bubble shield in AD. 3000. You are assigned to do some research to invent an Ozone-Oil based Halo Protection System to generate bubble shield in the current complex international environment. As early stage, it is required to build a molecular model simulation system of Bi-Layer Curved Structure to find the chemical composition.

In particular, the program must find the root of a given equation via Newton-Raphson method.

- $x_{n+1} = x_n - f(x_n)/f'(x_n)$
  - $f(x)$ is a polynomials and $f(x) = a_n x^n + a_{n-1}x^{n-1} + \ldots a_0$
  - $f'(x)$ is a differential for $f(x)$, That is, $f^{'}(x) = n \times a_n x^{n-1} + (n-1) \times a_{n-1}x^{n-2} + \ldots a_1$
- Set $x_0 = 0$, loop through till $|f(x_m)| \leq 0.0001, (1 < m < 100)$, and then x_m is the root of $f(x)$, that is $f(x_m) \cong 0$
  (assume infinite and no solution, or $f^{'}(x_i) = 0$ situation are excluded).

You are requested to write a program to find the solution of a polynomial equal to zero by referring to Newton Raphson's method.

Input Format

$\mathbf{a_n}$ $\mathbf{a_{n-1}}$ $\ldots$ $\mathbf{a_0}$.

Output Format

A float number with precision to 0.01.

Constraints

- $n \leq 10$
- $\mathbf{a_i}, \forall i = 1..n$ is an integer, $abs(i) \leq 10, abs(a_i) \leq 10$

Example 1 Input

```
2 3 -1 -2
```

Example 1 Output

```
-1.28
```

Example 2 Input

```
1 0 3 -2
```

Example 2 Output

```
0.60
```

Example 3 Input

```
3 -2 -3 5
```

Example 3 Output

```
-1.24
```

Example Explaination

Example 2.

- $x_1 = 0.666667$ and $f(x_1) = 0.296296$
- $x_2 = 0.598291$ and $f(x_2) = 0.009031$
- $x_3 = 0.596074$ and $f(x_3) = 0.000009$,
- $f(x_3) < 0.0001$, so round (0.596) to 0.01 as 0.60.

3_Strange Sheep

(10 points)

Problem Statement

Given an array A with N positive integer $(a_1, a_2, \cdots, a_N)$, you should find the longest subinterval $[l, r]$ such that there exists another array B while every b_i in $[l, r]$ satisfy the condition below:

- $1 \leq b_i \leq a_i$
- $b_i < b_{i+1}$
  Please output the length of such longest interval.

Three-mouthed Sheep, who has fallen head over heels in love with treeeeap, claims that she can solve this problem by treeeeap, but smart as you know that she will fail on this problem because of the running time. Can you help Three-mouthed Sheep to solve this problem with a better algorithm?

Input Format

The first line of the input contains one integer N — the number of elements in the array A.

The second line of the input contains N integers $a_1, a_2, \cdots, a_N$ — elements of the array A.

- $0 < N \leq 10^6$
- $0 < a_i \leq 10^9$

Output Format

Print the length of the longest interval which satisfy the condition above.

Sample Input 1

```
5
5 2 3 1 4
```

Sample Output 1

```
3
```

Sample Input 2

```
10
1 5 3 4 3 5 9 6 3 6
```

Sample Output 2

```
6
```

Sample Input 3

```
20
3 1 4 1 5 9 2 6 5 3 5 8 9 7 9 3 2 3 8 4
```

Sample Output 3

```
8
```

Example Explanation

- [1,3] is the longest interval in the first sample test case.
- [3,8] is the longest interval in the second sample test case.
- [8,15] is the longest interval in the third sample test case.

4_Stage Design

(10 points)

Description

"In A.D. 234, Zhuge Kongming died in the Battle of Wuzhang Plains. On Halloween 2022, Kongming reincarnated in Shibuya, Tokyo..."

Reincarnated in the present, Kongming became a manager through serendipity and was determined to assist EIKO, a singer-songwriter, with her concert dream. A journey of a thousand miles begins with a single step! Aiming to step on Budokan, he also has to start from a little pub. Thus EIKO is going to perform in CS pub tonight. In order to introduce the beauty of EIKO's voice to more people, Kongming decided to put his hands on stage design. He asked someone to investigate N listeners' habits, finding out that everyone's activity range can be described as a rectangle on a plain. The i-th listener's activity rectangle is notated as $(x1_i,\ y1_i)$ being the left-bottom corner, and $(x2_i,\ y2_i)$ being the right-top corner.

The stage for EIKO tonight is a circle. According to Kongming's precise calculation, as long as the stage has any intersection with a listener's activity rectangle, even if there is only one point of tangency, the lucky listener will be charmed by EIKO's infectious singings and become a devoted fan. The shopkeeper of CS pub, Kobayashi, provided M stage designing plans. Each plan consists of three parameters, $x_j,\ y_j,\ r_j$, with the first two numbers representing the center coordinate of the j-th stage plan and the last number representing the radius of the stage.

Since Kongming is busy adjusting the arrangement and traffic flow of the pub, he has no time to deal with the stage designing problem. Therefore he asks your help to finish this task, by telling him how many listeners can be charmed for each plan, and then he can make the best decision.

Input Format

The first line contains two positive integers $N,\ M$ — the number of listeners and stage plans.
The next N lines contain four integers each $x1_i,\ y1_i,\ x2_i,\ y2_i$ — the activity rectangle of the i-th listener.
The next M lines contain three integers each $x_j,\ y_j,\ r_j$ — the center coordinate and radius of the j-th stage plan.

Output Format

For each stage plan, please print one nonnegative integer — the number of listeners whom can be charmed.

Constraints

- $1 \leq N,\ M \leq 1000$
- $-10^9 \leq x1_i < x2_i \leq 10^9$
- $-10^9 \leq y1_i < y2_i \leq 10^9$
- $-10^9 \leq x_j,\ y_j \leq 10^9$
- $1 \leq r_j \leq 10^9$

Input Example 1

```
2 3
1 0 3 3
4 3 5 4
3 1 1
3 5 3
6 1 1
```

Output Example 1

```
1
2
0
```

Input Example 2

```
3 2
1 1 4 3
3 0 8 2
2 4 3 5
6 5 3
3 1 1
```

Output Example 2

```
3
2
```

Input Example 3

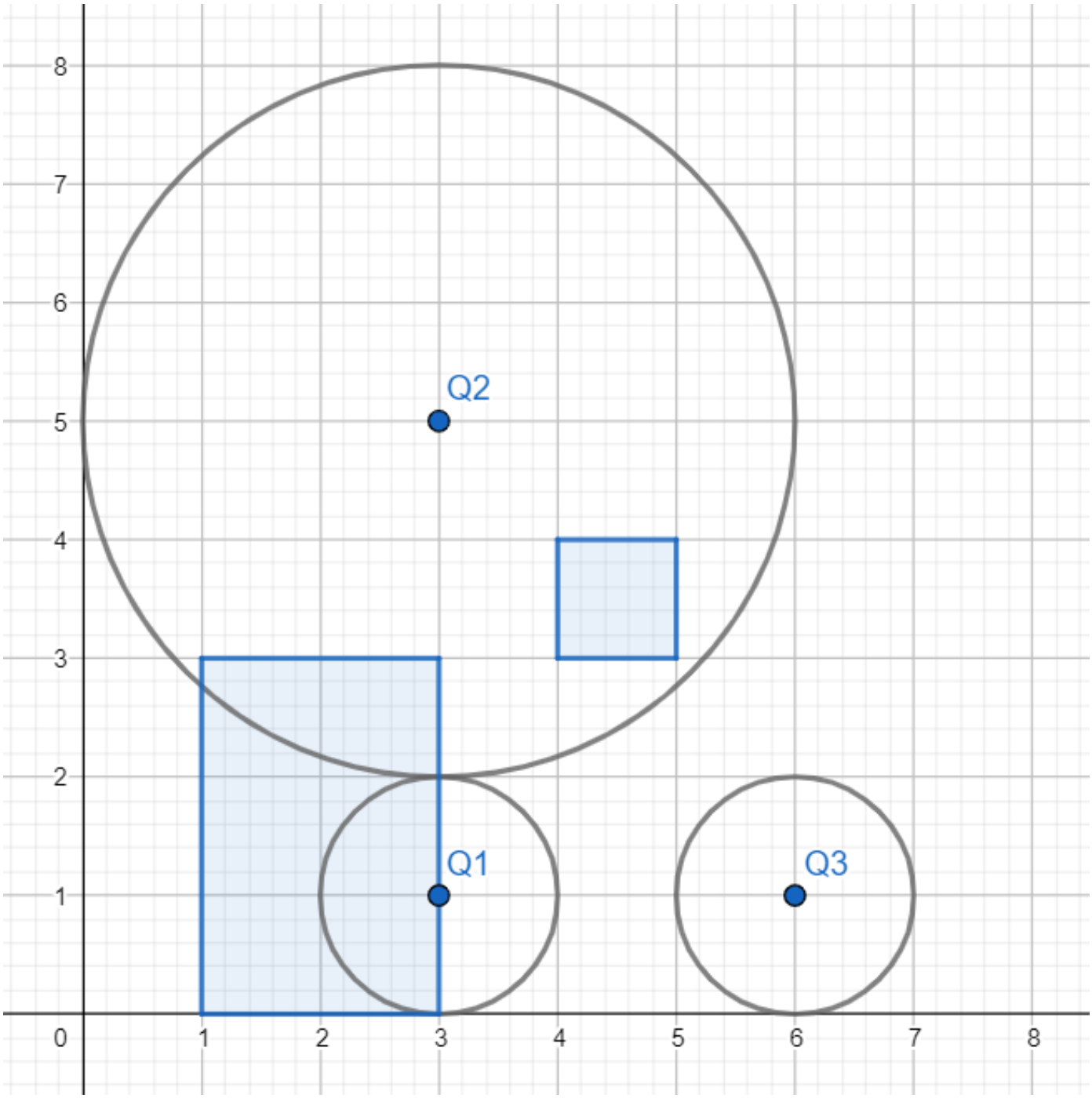
```
3 2
1 1 8 7
5 2 9 5
6 3 7 4
3 5 1
5 2 2
```

Output Example 3

```
1
3
```

Example Explanation

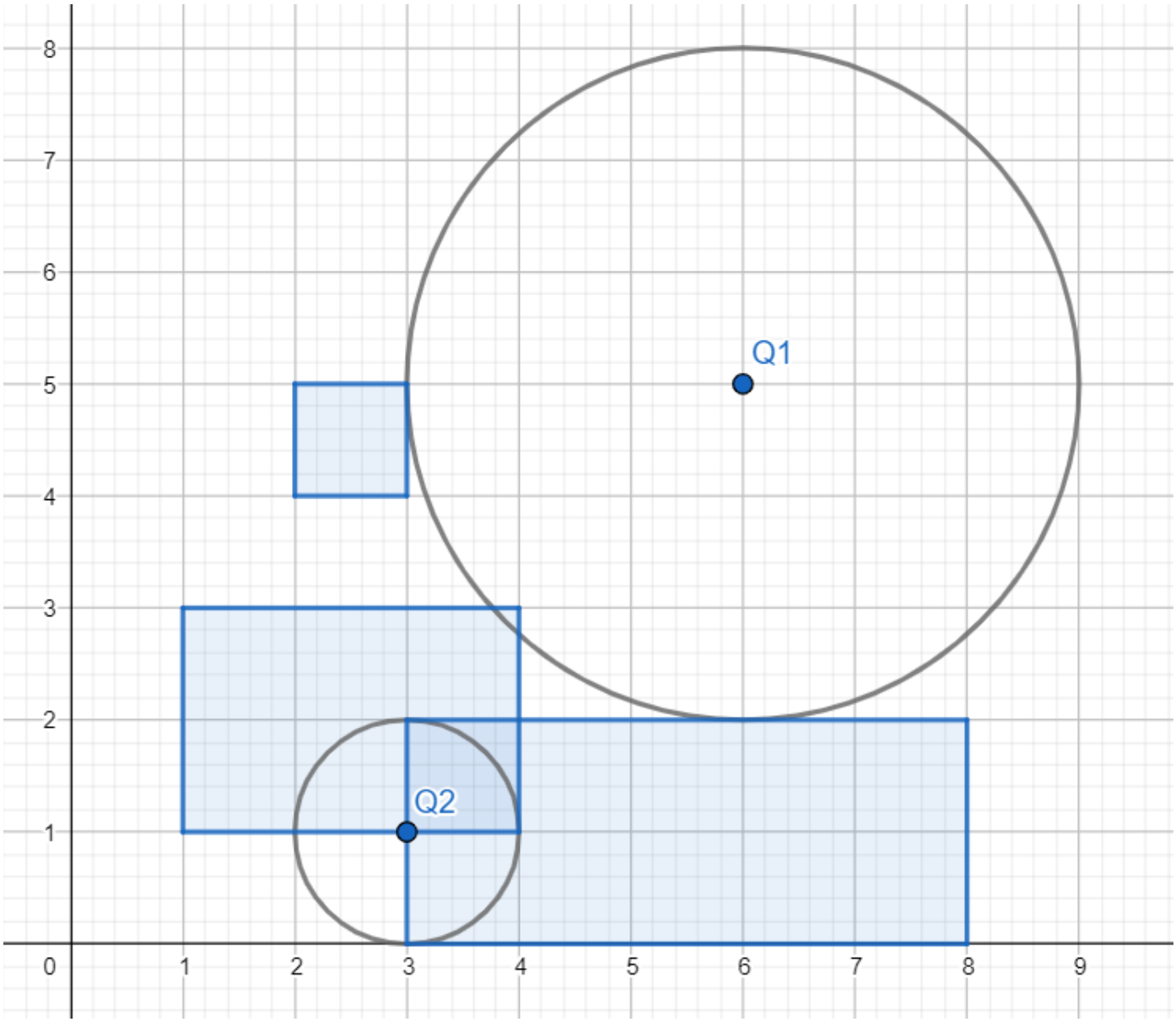
Example 1



The blue areas in the graph represent a person's activity rectangle, and the j th circle represents the stage of the j th plan.

- Plan 1 can only charm the left person: 1 in total.
- Plan 2 can charm every people: 2 in total.
- Plan 3 can not charm any one: 0 in total.

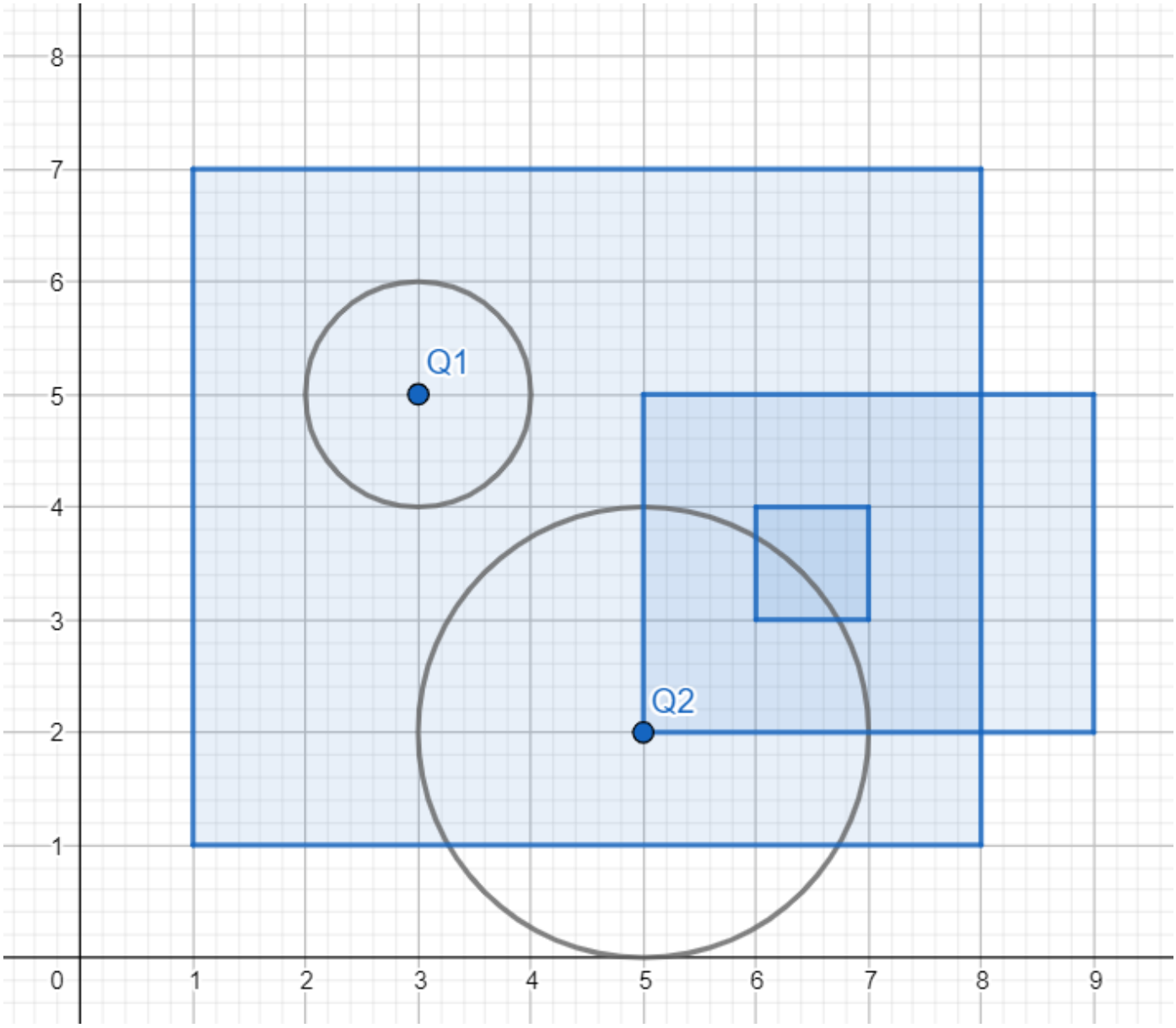
Example 2



The blue areas in the graph represent a person's activity rectangle, and the j th circle represents the stage of the j th plan.

- Plan 1 can charm every people: 3 in total.
- Plan 2 can only charm the two people at the bottom: 2 in total.

Example 3



The blue areas in the graph represent a person's activity rectangle, and the j th circle represents the stage of the j th plan.

- Plan 1 can only charm the person completely covered: 1 in total.
- Plan 2 can charm every people: 3 in total.

5_Where to Eat Pork I

(10 points)

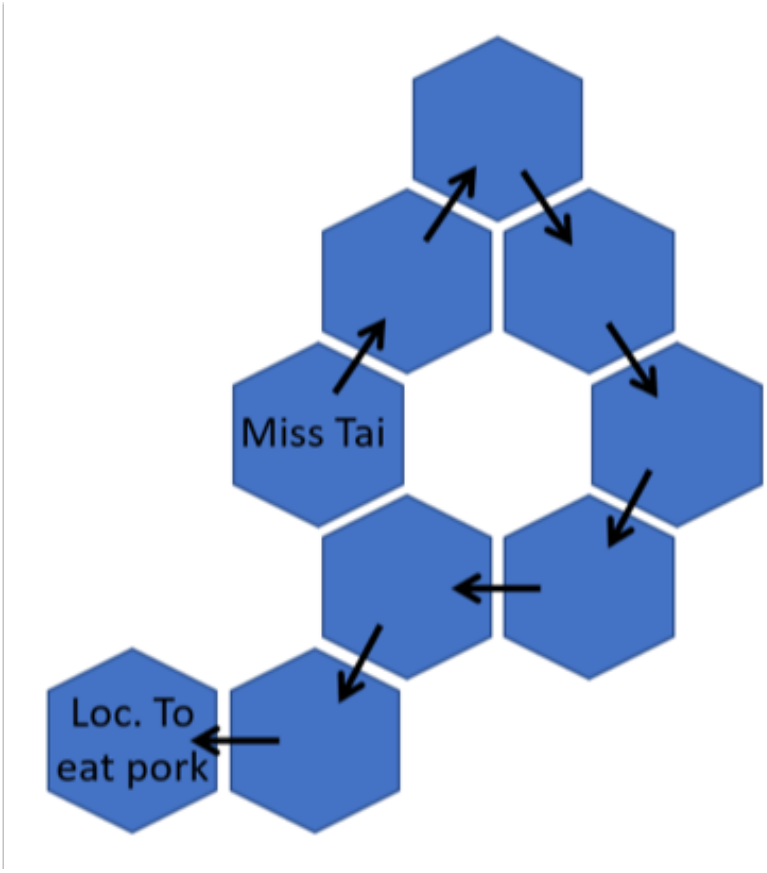
Description

Miss. Tai asked Miss Mei how to get to the place to eat pork. Miss Mei gives the instruction similar as flight pilot with the odd numbers in a clock. Such as,

- center toward 1 o'clock named as "A" direction,
- center toward 3 o'clock as "B" direction,
- center toward 5 o'clock as "C" direction,
- center toward 7 o'clock as "D" direction,
- center toward 9 o'clock as "E" direction,
- center toward 11 o'clock as "F" direction.

Miss Mei gives messy and long instructions intentionally to waste Miss Tai's time finding the place.

For example, from "AACCDEDE" instruction, Miss Tai can go to final location by shortened as "DD" – 2 steps.



So, Miss Tai requests your help find a shortest path to eat pork. Please write a program for him!

Input Format

a string; composed of "A" to "F", representing the original path in between Miss Tai and the location to eat pork.

Output Format

an integer indicates the length of shortest path

Constraints

The characters in the input string is in between “A” to “F”. The length of the input string is less or equal to 1000 characters. The output number is less or equal to 1000.

Example 1 Input

```
AACCDEDE
```

Example 1 Output

```
2
```

Description:

As in the example of the question, input "AACCDEDE", can be simplified to "DD" (2 steps), so the output is 2.

Example 2 Input

```
AACC
```

Example 2 Output

```
2
```

Description:

From “AACC” instruction, the instruction to final location can be shortened as “BB” – 2 steps.

Example 3 Input

```
AACCACBAFED
```

Example 3 Output

```
3
```

6_Where to Eat Pork II

(15 points)

Description

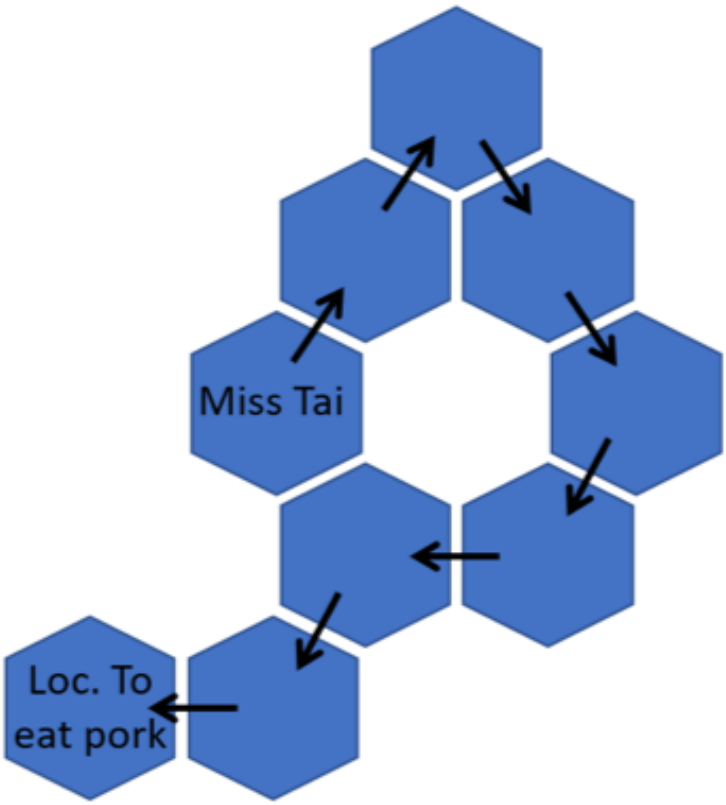
Miss. Tai asked Miss Mei how to get to the place to eat pork. Miss Mei gives the instruction similar as flight pilot with the odd numbers in a clock. Such as,

- center toward 1 o'clock as "A" direction,
- center toward 3 o'clock as "B" direction,
- center toward 5 o'clock as "C" direction,
- center toward 7 o'clock as "D" direction,
- center toward 9 o'clock as "E" direction,
- center toward 11 o'clock as "F" direction.

Miss Mei gives messy and long instructions intentionally to waste Miss Tai's time finding the place.

Somehow, Miss Tai can only go thru exist node; which Mei ever mentioned in the instruction.

For example, from "AACCDEDE" instruction, Miss Tai can go to final location by shortened as "CDE" – 3 steps.



So, Mr. Tai requests your help find a shortest path to eat pork. (The solution can only go thru exist node; which has ever mentioned in the instruction)

Input Format

a string; composed of “A” to “F”, representing the original path in between Mr. Tai and the location to eat pork

Output Format

an integer indicates the length of shortest path

Constraints

The characters in the input string is in between “A” to “F”

The length of the input string is less or equal to 1000 characters.

The output number is less or equal to 1000.

Example 1 Input

```
AACCDEDE
```

Example 1 Output

```
3
```

Description:

As in the example of the question, input "AACCDEDE", can be simplified to “CDE” – 3 steps (The solution can only go thru exist node; which has ever mentioned in the instruction).

Example 2 Input

```
AACC
```

Example 2 Output

```
3
```

Description:

From “AACC” instruction, the instruction to final location can be shortened as “ABC” or “CBA”. Both are 3 steps.

Example 3 Input

```
AACCACBAFED
```

Example 3 Output

```
3
```

7_Flipping Coins

(15 points)

Problem Description

Alice and Bob are playing a game. Alice arranges a series of coins on the table, with a total amount of N coins. Each coin has a head and tail. To give Alice a trial, Bob gives Q questions to Alice, which Alice should answer in order. Each question has one of the following forms:

- `1 l r`: Bob asks Alice to flip the coins from l^{th} coin to r^{th} coin.
- `2 l r`: Bob asks Alice to answer how many pairs of coins among l^{th} coin to r^{th} coin such that they have the different sides facing upwards.

However, Alice is indolent. Please help Alice to finish these questions.

Input

The first line of input contains two positive integers N, Q ($1 \leq N, Q \leq 10^5$), representing the number of coins and the number of question, respectively.

The second line contains a string s with length N ($s_i \in \{0, 1\}$), describing the initial state of each coin. s_i is 0 if it has heads facing upwards, and vice versa.

In the following Q lines, each line is the form of either $1\ l\ r$ or $2\ l\ r$, describing the questions in order.

Output

For each question of the form $2\ l\ r$, please output an integer in a line, representing the answer.

Sample Input 1

```
5 5
01001
2 3 5
1 3 5
1 2 3
2 4 5
2 1 3
```

Sample Output 1

```
2
1
0
```

Sample Input 2

```
5 5
01011
1 3 5
2 2 2
1 3 4
1 1 5
2 3 5
```

Sample Output 2

```
0
2
```

Sample Input 3

```
10 5
0001000110
1 1 10
1 5 5
1 3 10
2 1 7
2 1 9
```

Sample Output 3

```
12
18
```

Hints

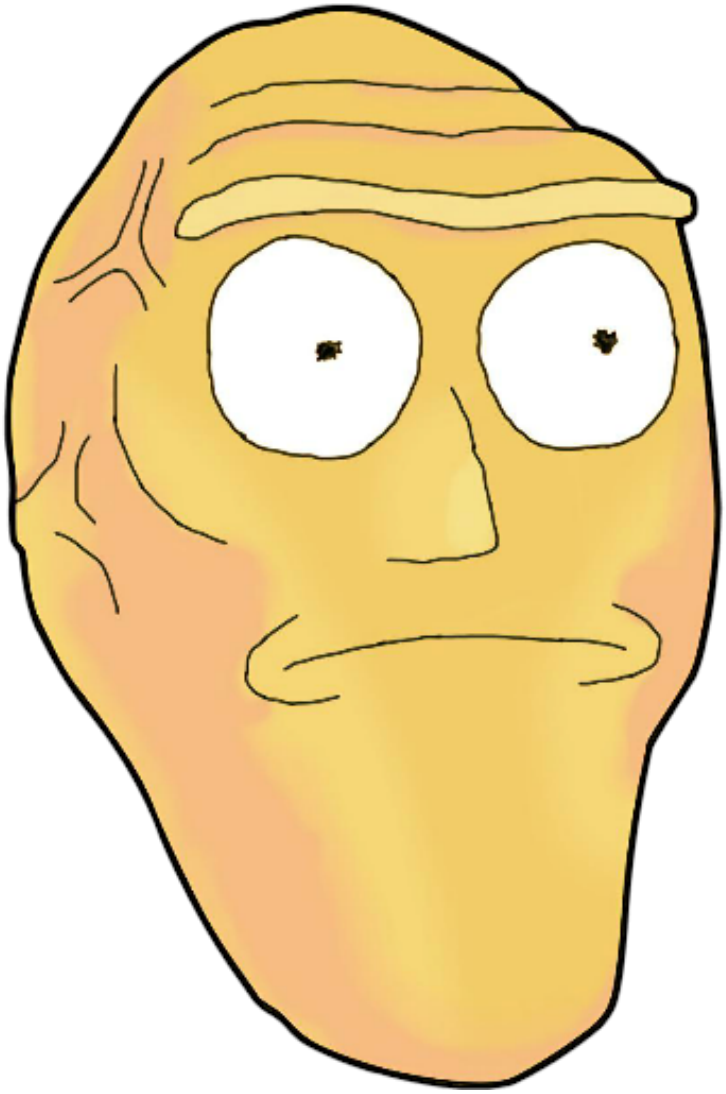
In Sample Input 1. For the first question, there are two pairs of coins $(3, 5), (4, 5)$ which has different sides facing upwards. After two operations $1\ 3\ 5$ and $1\ 2\ 3$, the state of coins become 00010. Therefore, for the fourth question, only one pair of coins $(4, 5)$ has different sides facing upwards.
In Sample Input 2, the final sequence of coins is 10101.
In Sample Input 3, the final sequence of coins is 1101100110.

8_Show Me What You Got

(5 points / 10 points)

Description

"Cromulons" are a species of planet-sized beings shaped as giant human heads, and are native to the Cygnus-5 expanse. According to a scientist named Rick Sanchez, the Cromulons "feed on the talent and showmanship of less-evolved lifeforms". They do this by capturing planets with intelligent lifeforms on them, teleporting these planets to the expanse of the universe they inhabit, and run a reality television named *Planet Music*, in which these planets compete to perform music which satisfies them. Planets that lose or are disqualified are disintegrated by a massive plasma ray cannon.



Now, there're N planets which have been teleported to the expanse the Cromulons inhabit. These N planets were arranged in a row from left to right.
Moreover, each planet has a score a_i representing the value of its music.
To get the winner of *Planet Music*, Cromulons use their massive plasma ray cannon to destroy the planet with the minimum value at the end of each episode until there's only one planet left(if there're multiple planets with the minimum value, they'd destroy the leftmost one)

At the beginning of each episode, suppose there are k continuous segments of planets which is still alive, and the ith segment is $[l_i, r_i]$, the rating of this episode is given by the formula below:

$$\sum_{i=1}^{k}(r_i - l_i + 1) \min_{l_i \le j \le r_i} a_j$$

Notice that if there's only one planet left, there'd be an award ceremony episode, whose rating is the score of the planet's value.

As the director of *Planet Music*, you want to know what's the highest rating among all episodes.

Input Format

First line contains an integer N.
Second line contains N integers, the ith one represents a_i

Output Format

Print the highest rating among all episodes in one line.

Constraints

- $1 \le N \le 200000$
- $1 \le a_i \le 10^9$

Subtasks

For a subtask worth 5 points, $1 \le N \le 3000$

Input Example 1

```
3
1 2 3
```

Output Example 1

```
4
```

Input Example 2

```
3
1 100 1
```

Output Example 2

```
100
```

Input Example 3

```
10
100 2 6 2 10 56 50 40 36 90
```

Output Example 3

```
310
```

Example Explanation

Input Example 1:
episode 2 has the highest rating 4.
In episode 2, [2, 3] is the only segment, and the minimum number in [2, 3] is 2, the length of [2, 3] is 2, so the rating is 2*2 = 4.

Input Example 2:
episode 3, which is the award ceremony has the highest rating 100.
In episode 3, [2, 2] is the only segment, and the minimum number in [2, 2] is 100, the length of [2, 2] is 1, so the rating is 100*1 = 100.

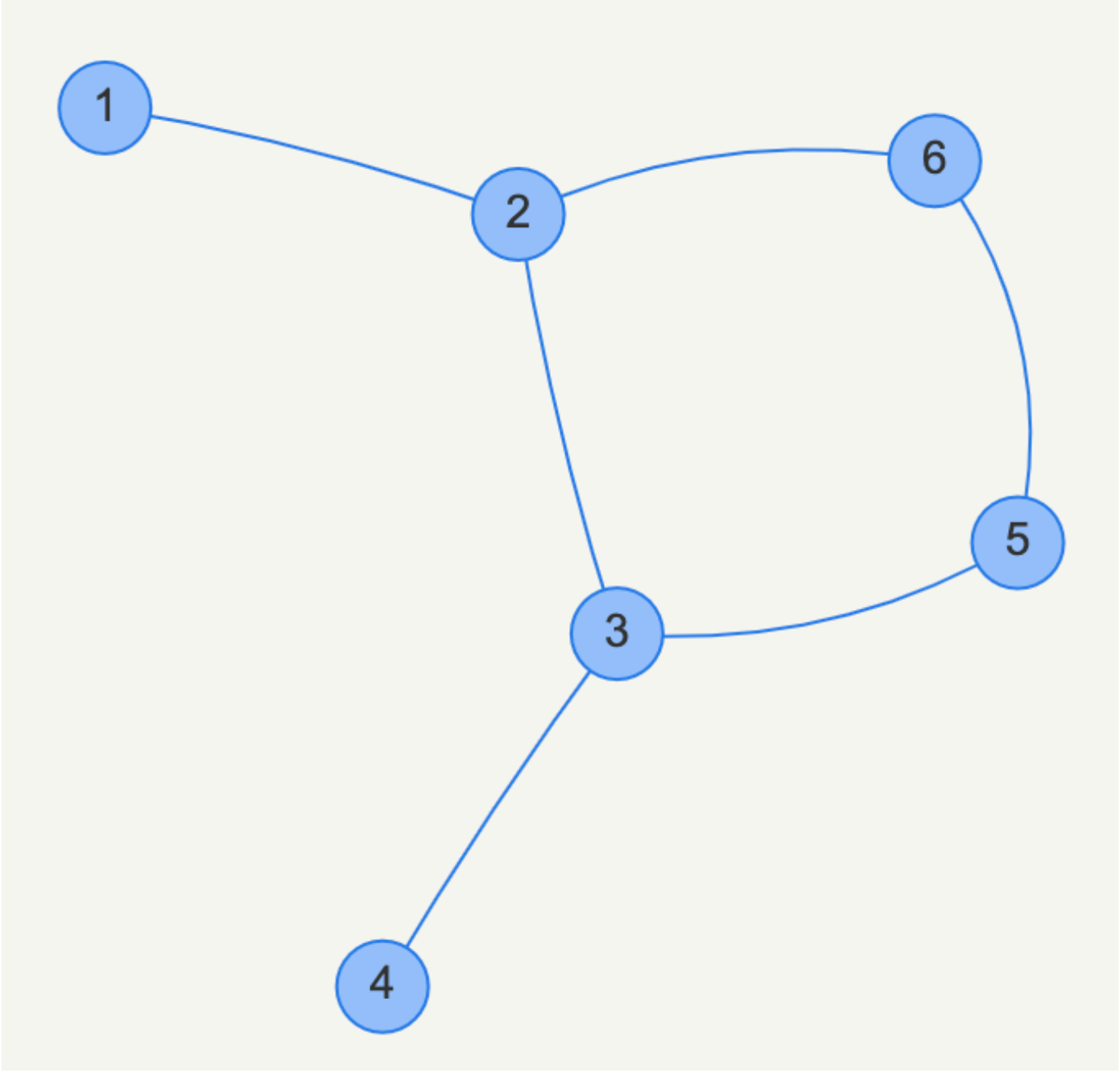
Input Example 3:
episode 6, 100 + 40*3+90 = 310
In episode 6, there're 3 segment [1, 1], [6, 8], [10, 10].
The miniumum number of each segments is 100, 40, 90, multiply each of them with the length of the segment and sum up, the rating is 310.

9_Opuntia dillenii

(6 points /9 points)

Problem Statement

An independent set of a graph is a set of vertices in a graph with no two of which are adjacent. The sum of an independent set is the sum of the value of the vertices in the set. We can then define "Maximum independent set" for a graph as the independent set we can find in the graph with the maximum sum.



For example, $\{2, 4, 5\}$ is a valid independent set of the graph.

Given a simple connected graph with N vertices and M edges, while each vertex in the graph will be in at most one cycle. Please find the sum of the maximum independent set.

Input Format

The first line of the input contains two integers N, M -— the number of vertices and the number of edges in the graph.

The second line of the input contains N integers $v_1, v_2, \cdots, v_N$ —- the value of the i-th vertex.

The following M line of the input each contains two integers a_i, b_i -- there is an edge between vertex a_i and b_i in the graph

- $N \leq 10^5$
- $M \leq 2 \cdot 10^5$
- $v_i \leq 10^3$

Output Format

Print the sum of the maximum independent set.

Subtasks

- Subtask 1 satisfy that $M = N - 1$ (6 points).
- Subtask 2 has no other constraint (9 points).

Sample Input 1

```
10 9
3 9 6 4 7 3 1 2 4 5
10 1
10 4
9 6
3 7
5 8
2 5
3 9
2 3
2 10
```

Sample Output 1

```
23
```

Sample description 1

$\{1, 3, 4, 5, 6\}$ is the maximum independent set.

Sample Input 2

```
12 15
1 9 2 1 6 8 9 2 3 4 7 10
1 5
5 6
6 1
2 7
7 8
8 2
5 7
3 9
9 10
10 3
8 9
4 11
11 12
12 4
8 4
```

Sample Output 2

```
31
```

Sample description 2

$\{2, 6, 10, 12\}$ is the maximum independent set.

Sample Input 3

```
9 11
145 851 174 670 571 747 238 391 689
1 4
4 5
5 1
2 6
6 7
7 2
1 7
3 8
8 9
9 3
7 9
```

Sample Output 3

```
2210
```

Sample description 3

$\{2, 4, 9\}$ is the maximum independent set.

10_How to Play

(20 points)

Description

Bridge, a kind of well-known poker game in the world, is popular for the complex rules and competitiveness. Today, SYSTEX is holding a Bridge tournament. In this game, we use special poker, which has N denomination suits and every suit has M numbers. Each player will have $\frac{N\times M}{4}$ cards in their hands. During the Bridge game, if the cards satisfies one of the following two conditions, the player will get a high score. Please calculate the probability that satisfies at least y conditions in all x conditions.

Following are the two conditions

1. In one suit the card satisfies an exactly distributed.
   EX: In the $N = 4, M = 13$ game. In suit 1, you and your partner have 9 cards and you want both of your opposites to have 2 cards in this suit.
2. One exact card is at the left or right opposite.

Input Format

There are two integers N, M in the first line. The meaning has been explained in the description.

There are N integer a_i in the second line. Which is the number of cards in the ith suit you have. The sum of a_i is equal to $\frac{N\times M}{2}$.

There are two integers x, y in the third line. The meaning has been explained in the description.

There are x lines below, every line is one condition.

In every next x line, it will begin with an integer t_j.

- If $t_j = 1$, it will follows with two intger c_j, d_j ,which means the left opposite must have d_j cards in suit c_j.
- Else if $t_j = 2$ ，it will follows with two intger e_j, f_j ,which means one exact card with suit e_j must be at the left(when $f_j = 1$)or right(when $f_j = 2$) opposite.

You can assume that every $t_j = 2$'s card is different, and the sum of suit i will not overflow the number of opposites have in that suit i.

Output Format

If the probability is $\frac{P}{Q}$.Please output $P \times Q^{-1}(MOD\ 998244353)$
We call $Q' = Q^{-1}(MOD\ 998244353)$,if $Q \times Q' = 1(MOD\ 998244353)$。

Constraints

- $1 \leq N \leq 20, 1 \leq M \leq 10^5$, and $N \times M = 0(MOD\ 4)$
- $1 \leq a_i \leq M$

- $0 \leq y \leq x \leq 15$
- $1 \leq t_j \leq 2$
- $1 \leq c_j \leq N$
- $0 \leq d_j \leq M - a_{c_j}$
- $1 \leq e_j \leq N$
- $1 \leq f_j \leq 2$

Sample Input 1

```
4 13
7 7 6 6
1 1
2 1 1
```

Sample Output 1

```
499122177
```

Sample1 Explanation

The probability with that card on left opposite is $\frac{1}{2}$:$1 \times 2^{-1} (MOD\ 998244353)$

Sample Input 2

```
4 13
7 7 6 6
1 0
2 1 1
```

Sample Output 2

```
1
```

Sample2 Explanation

You can always finish.

Sample Input 3

```
4 13
7 7 6 6
2 2
1 1 5
1 1 4
```

Sample Output 3

```
0
```

Sample3 Explanation

you can't finish this 2 conditions at the sametime.

11_I Want to Play a Game

(20 points)

Description

MM and TT have invented a new game. In this game, two players take turns modifying the game state with MM moving first. Initially, the game is set up so that there are N piles of stones, with the ith pile containing a_i stones. During each player's turn, the player do either:

1. Remove a single stone from a chosen pile that contains **more than one stone**.
2. Choose a pile of stones with size equal to $k(k+1)/2$ for some integer $k > 1$, and replace it with k piles of stones, the ith pile containing i stones. i.e. Add piles of stones with size $1, 2, 3, \ldots, k$ into the game.

The player who cannot remove any stone loses.
Now, MM and TT would like to play this game for T times, each time given N and a sequence a_i.
Suppose both MM and TT play optimally, who'll be the winner?

Input Format

First line contains an integer T, represents the times that TT and MM would play.
After that, there'll be T sets of N and a sequence a.
In each set, first line contains an integer N.
The second line contains N integers, the ith one represents a_i

Output Format

Print T line, each represents the result of that game.
If MM wins, print "MM", otherwise print "TT" (without quotes).

Constraints

- $1 \leq T \leq 20$
- $1 \leq N \leq 200000$
- $1 \leq a_i \leq 10^9$
- $1 \leq \sum N \leq 200000$

Input Example 1

```
1
3
1 2 3
```

Output Example 1

```
MM
```

Input Example 2

```
1
3
1 1 1
```

Output Example 2

```
TT
```

Input Example 3

```
1
5
1 2 3 4 5
```

Output Example 3

```
TT
```

Example Explanation

In Input Example 1, MM would replace 3 with 2 first. In TT's turn, TT can only replace a 2 with a 1, and MM will replace the last 2 with 1. After that, TT will have no operation to do.

In Input Example 2, MM has no operations to do at the beginning, so TT wins.

In Input Example 3, a possible process of the game is given below:

MM: 5 -> 4, the state becomes : 1 2 3 4 4

TT: 3 -> 2, the state becomes : 1 2 2 4 4

MM: 4 -> 3, the state becomes : 1 2 2 3 4

TT: 4 -> 3, the state becomes : 1 2 2 3 3

MM: 2 -> 1, the state becomes : 1 1 2 3 3

TT: 2 -> 1, the state becomes : 1 1 1 3 3

MM: 3 -> 2, the state becomes : 1 1 1 2 3

TT: 3 -> 2, the state becomes : 1 1 1 2 2

MM: 2 -> 1, the state becomes : 1 1 1 1 2

TT: 2 -> 1, the state becomes : 1 1 1 1 1

MM have no operations to do, so TT wins.

12_Coffee Stains

(4 points /6 points /10 points)

Time limit: 5 seconds

Memory limit: 512 MB

Description

Team Numeros is hard at work training for this year's YTP programming competition! The three team members, Hito, Futa, and Mi often come to Cafe Bene to practice. They always order a drink each and then start a session.

One day, after a session, they found that they had left coffee stains on the table! Instead of cleaning the mess up, the trio started to wonder if they could reconstruct the positions and sizes of their coffee mugs just from the coffee stains...

The table can be thought of as a Cartesian plane, centered at $(0, 0)$. There are N ($1 \leq N \leq 10^5$) coffee stains represented as points, the i'th of which is located at (x_i, y_i) ($0 \leq x_i, y_i \leq 10^6$). All points have distinct coordinates. Please find three circles such that all the points lie on at least one circle. Of course, it's entirely possible for a mug to not leave any stains, and have no points lie on it.

Hint: Given three points $A(x_1, y_1), B(x_2, y_2), C(x_3, y_3)$, the circumcentre $O(x, y)$ of triangle $\triangle ABC$ can be given by

$$x = \frac{(y_3 - y_2) \times d_1 - (y_2 - y_1) \times d_2}{K}$$
$$y = \frac{(x_2 - x_1) \times d_2 - (x_3 - x_2) \times d_1}{K}$$

, where

$d_1 = \left(x_2^2 + y_2^2\right) - \left(x_1^2 + y_1^2\right)$, $d_2 = \left(x_3^2 + y_3^2\right) - \left(x_2^2 + y_2^2\right)$, and
$K = 2\left((y_3 - y_2)(x_2 - x_1) - (y_2 - y_1)(x_3 - x_2)\right)$.

Input Format

On the first line, there will be an integer N, the number of coffee stains. Then, for the next N lines that follow, the i'th line will contain two numbers x_i, y_i, the coordinates of the i'th coffee stain.

It's guaranteed that a solution exists for all of the test data.

Output Format

In the first three lines, please output three numbers on each line: X_k, Y_k, R_k, meaning that the k'th ($1 \leq k \leq 3$) circle is centered at (X_k, Y_k), and that its radius is R_k. **In addition, you must have $0 \leq X_k, Y_k, R_k \leq 2 \times 10^6$.**

In the fourth line, please output a string S of length N consisting of the characters `1`, `2`, and `3`. The i'th character of this string S_i is the circle that the i'th point lies on.

To pass the test case, your output must satisfy

$$\frac{(x_i-X_{S_i})^2+(y_i-Y_{S_i})^2-R_{S_i}^2}{\max(1,R_{S_i}^2)} < 10^{-6}$$

for all $1 \leq i \leq N$.

Please note: Regardless of whether you use three circles, please still output the full three circles, otherwise you will receive a WA verdict.

You may output any set of solutions that satisfies the given constraints.

Constraints

- $1 \leq N \leq 10^5$
- $0 \leq x_i, y_i < 10^6$

Subtasks

In addition, there are subtasks which can be solved for partial credit. Do these first!

Additional Constraints	Score
At most one cup caused stains	4
At most two cups caused stains	6
No additional constraints	10

Sample Input 1

```
10
2.0 1.0
4.0 1.0
3.0 2.0
3.0 0.0
5.0 10.0
11.0 10.0
8.0 13.0
8.0 7.0
0.0 1.0
0.0 0.0
```

Sample Output 1

```
3 1 1
8 10 3
0 0.5 0.5
1111222233
```

Sample Input 2

```
6
0.5 0.5
1.0 1.0
2.0 2.0
3.0 3.0
4.0 4.0
5.0 5.0
```

Sample Output 2

```
0.75 0.75 0.353553
2.5 2.5 0.707106
4.50 4.5 0.707106
112233
```

Sample Input 3

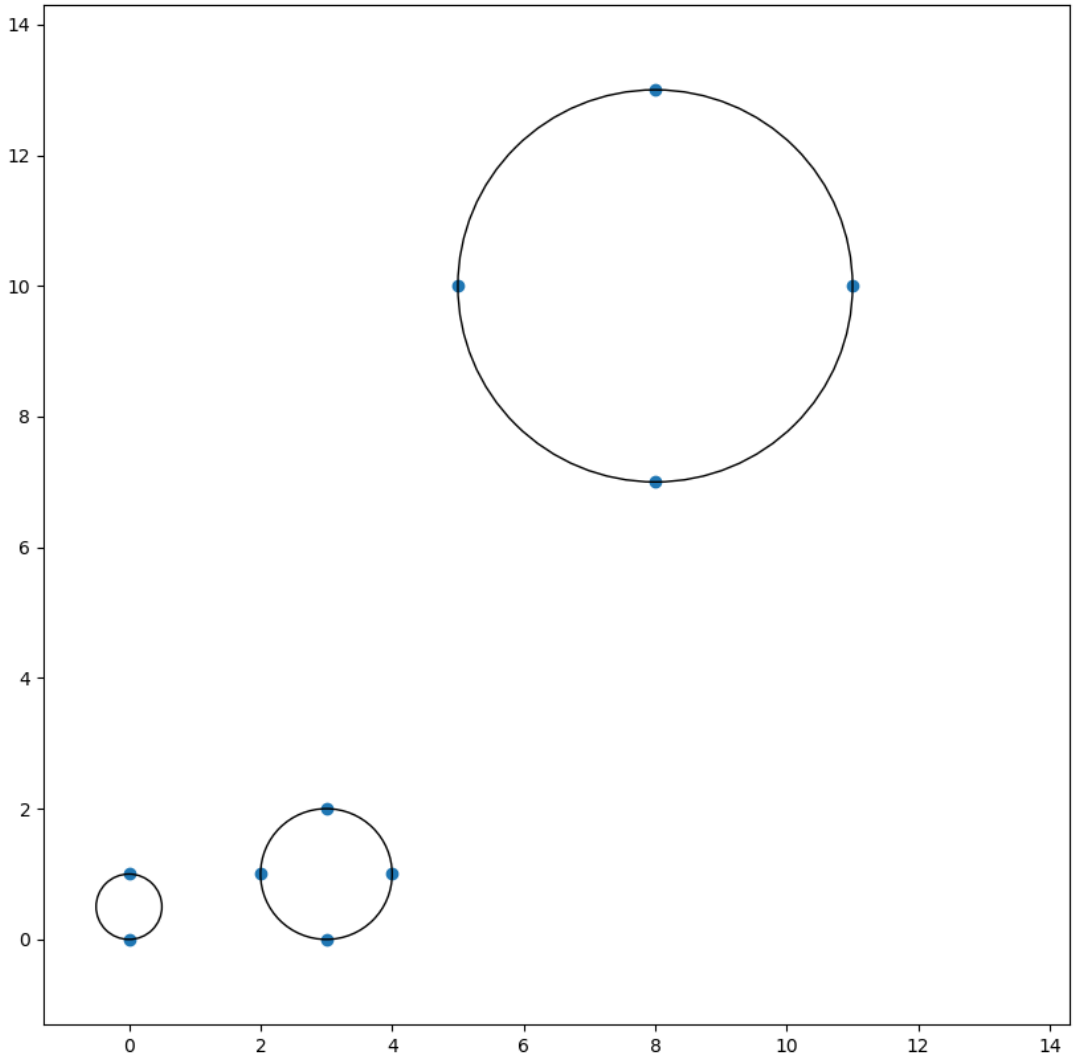
```
1
0.7 1.2
```

Sample Output 3

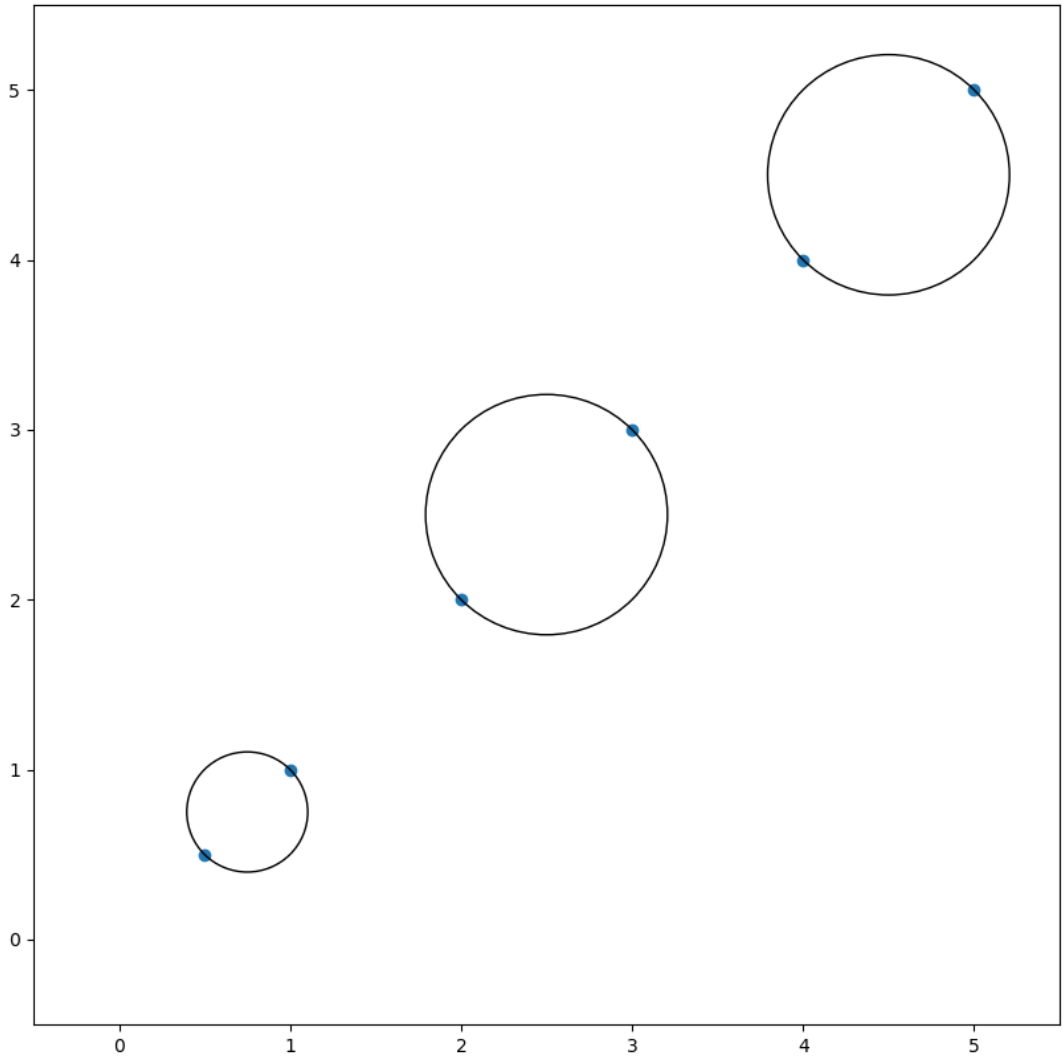
```
0.7 1.2 0.0
0.0 0.0 0.0
0.0 0.0 0.0
1
```

Sample Explanation

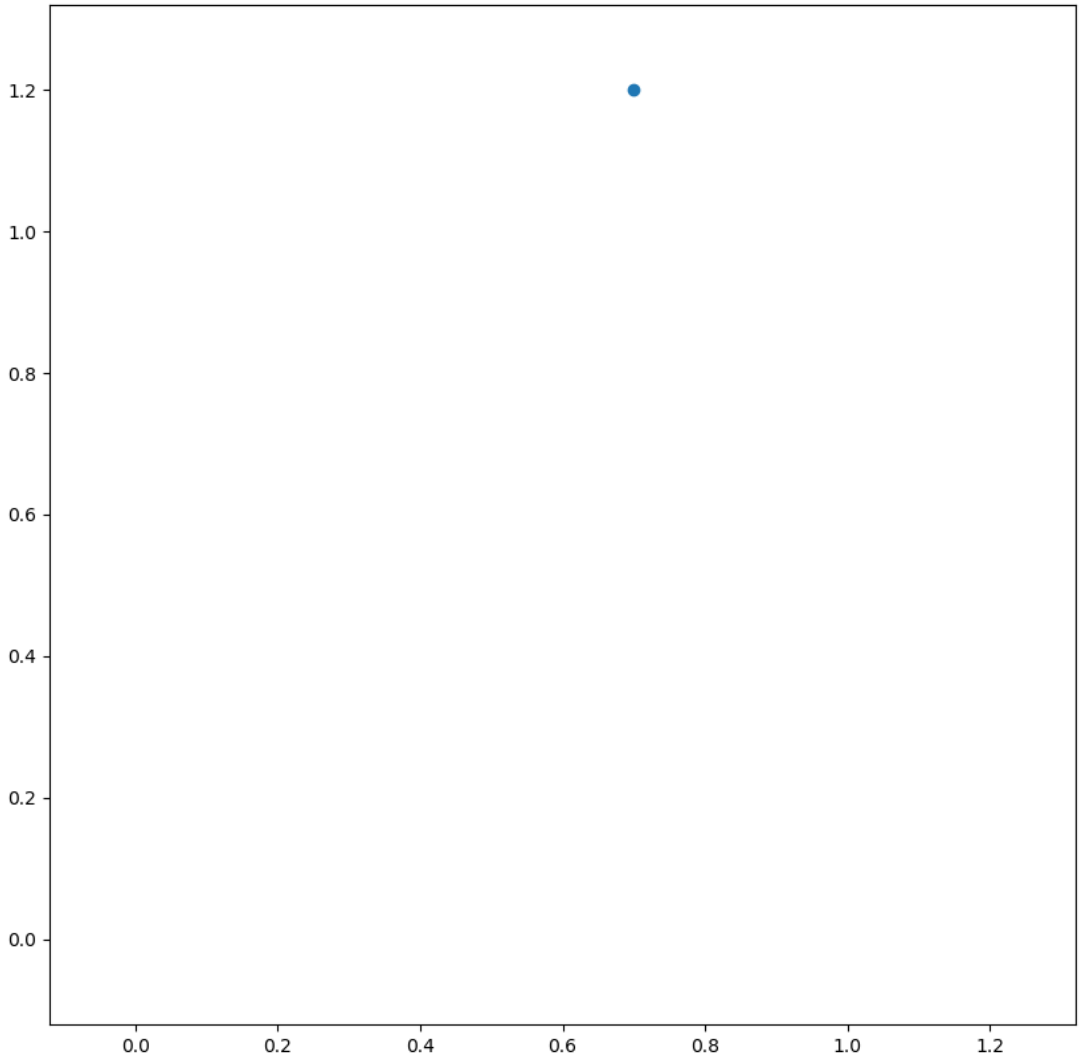
- The diagram of the output of the first sample test:



- the second sample test:



- the third sample test:


1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
1.2

13_Giveaway

(3 points /17 points)

Time limit: 1 second

Memory limit: 512 MB

Description

Omelet works in YTP Convenience Store, which is hosting a buy-one-get-one-free campaign. As everyone knows, buy-one-get-one-free includes buying one item and getting another one for free, but if there is a large gap in price or nature, it can not attract customers to buy them. Now, there are N product in the store, numbered from 1 to N. Some of them exist in "collocation relation", which means that they can be sold in a buy-one-get-one-free relation. All the collocation ralation form a "promotion proposal". Because there is only one item for each product, it is impossible to buy one and get the same one for free. There is also no duplicate collocation ralation because it is unnecessary. Based on the promotion proposal, when a customer is going to buy a series of products, YTP Convenience Store will choose some collocation relation for the customer sush that all the products can be sold in the buy-one-get-one-free way to help customers to purchase these products in the lowest price. The way to choose the collocation relations is called a "sale plan". Of course, one product can not be include by two collocation relation, it is a loss to the store.

Omelet finds out that the promotion proposal in the store makes that there is only one sale plan to sell all the products out in one time, and the promotion proposal in the store includes the most collocation relations among all possible ones.

Unfortunately, Omelet sold all the product but forgot how the sale plan distributed, so he could not keep accounts correctly. Please help Omelet reproduce a promotion proposal according the above condition he remembers. If there are multiple promotion proposal that match his memory, you can print any of them. If the promotion proposal does not exists, please tell Omelet that he misremembered.

Input Format

The input includes a positive integer N, indicating the number of product in the store.

Output Format

If the promotion proposal does not exists, print a line `-1`, indicating that Omelet misremembered.

Otherwise, print a non-negative integer M in the first line, indicating the number of collocation relation(s). Then, print M line(s), each contains two positive integer a_i, b_i, indicating there is a collocation relation between product a_i and b_i.

Constraints

- $1 \leq N \leq 500$

Subtasks

- Subtask 1 satisfies that $N \leq 10$. (3 points)
- Subtask 2 has no additional constraint. (17 points)

Input Example 1

```
2
```

Output Example 1

```
1
1 2
```

Input Example 2

```
3
```

Output Example 2

```
-1
```

Input Example 3

```
4
```

Output Example 3

```
4
1 2
2 3
2 4
3 4
```

Example Explanation

In the first example, it can be proved that there is only one sale plan.

In the second example, it is trivial that there is no sale plan satisfying the condition.

In the third example, the only sale plan is to sell product 1 with product 2, product 3 with product 4. It can be proved that there is no promotion proposal containing more collocation relations. Moreover, the following promotion proposal can also get Accepted:

```
4
1 2
1 3
1 4
2 3
```

The only legal sale plan of the above promotion proposal is:

```
1 4
2 3
```

The following promotion proposal will get Wrong Answer:

```
4
1 2
2 3
3 4
1 4
```

The reason is that it contain:

```
1 2
3 4
```

and

```
2 3
1 4
```

these two sale plans, which violates the condition in the description.

14_RGB Coloring Game

(4 points /8 points /13 points)

Time limit: 3 seconds

Memory limit: 512 MB

Description

One day, Iofi, a painter, received a gift from Yofi, a half-colored graph formed by N vertices and M edges. After Iofi received her gift, she found all of the edges were colored red(`R`), green(`G`), or blue(`B`) by Yofi, respectively. But the graph remained non-colored for all vertices.

Therefore, as a painter, Iofi wants to color red, green, or blue for all the vertices just as the edges. But for beauty, Iofi decides to define some rules to prevent these colors from being applied too casually.

1. If an edge is colored **red**, then the two vertices connected by it cannot be colored "blue, blue" or "blue, green", respectively.
2. If an edge is colored **blue**, then the two vertices connected by it cannot be colored "red, red" or "red, green", respectively.
3. If an edge is colored **green**, then the two vertices connected by it cannot be colored "blue, red", respectively.

Notice that there isn't any order of the vertices in the above rules. Take the third rule as an example, as long as one side is blue and the other side is red, it does not meet the requirements of Iofi.

Besides, in order to prevent the whole graph from turning green everywhere, Iofi also gives some special restrictions that we **cannot color green** on some vertices. Can you give a coloring under her constraint? Please write a program that outputs a coloring that fits her rules after reading the graph Iofi received and her constraint. Or tell Iofi that there isn't any coloring that works to her rules.

Input Format

The first line of the input contains two positive integers N, M, indicating the number of vertices and edges.

The second line of the input contains a string S, indicating the constraint about green given by Iofi. If the i-th character of S is `1`, then the i-th vertex cannot be colored green; or `0` for no constraint.

Then, following by M lines, each line contains two positive integers and one character, indicating that there is an edge with color c_i that connects vertices u_i and v_i.

Among them, `R` represents red, `G` represents green, and `B` represents blue.

Output Format

If there isn't any coloring that works to Iofi's rules, output `NO` in a single line.

Otherwise, output `Yes` in the first line, and then output a string with length N, which compose of characters `R`, `G`, `B`, indicating a coloring that fit the rules. The i-th characters represent that you want to color the i-th vertex into that color.

Among them, `R` represents red, `G` represents green, and `B` represents blue.

If there are multiple possible coloring that fit the rules, output any of them.

Constraints

- $1 \leq N \leq 2 \times 10^5$
- $1 \leq M \leq 5 \times 10^5$
- S is a `01` string with length N
- $1 \leq u_i, v_i \leq N, u_i \neq v_i$
- c_i belongs to one of the characters `R`, `G`, `B`

Subtasks

- Subtask 1 satisfies that $N \leq 10, M \leq 50$. (4 points)
- Subtask 2 satisfies that all of the characters of S are `1`. That is, none of the vertices can be colored green. (8 points)
- Subtask 3 has no additional constraint. (13 points)

Input Example 1

```
3 4
110
1 2 B
1 2 R
1 3 G
2 3 G
```

Output Example 1

```
Yes
BRG
```

Input Example 2

```
5 7
11001
1 3 B
1 4 R
2 3 B
2 4 G
2 5 G
3 5 R
4 5 B
```

Output Example 2

```
No
```

Input Example 3

```
5 6
11111
1 2 B
1 4 R
1 3 R
1 5 B
2 3 B
3 5 G
```

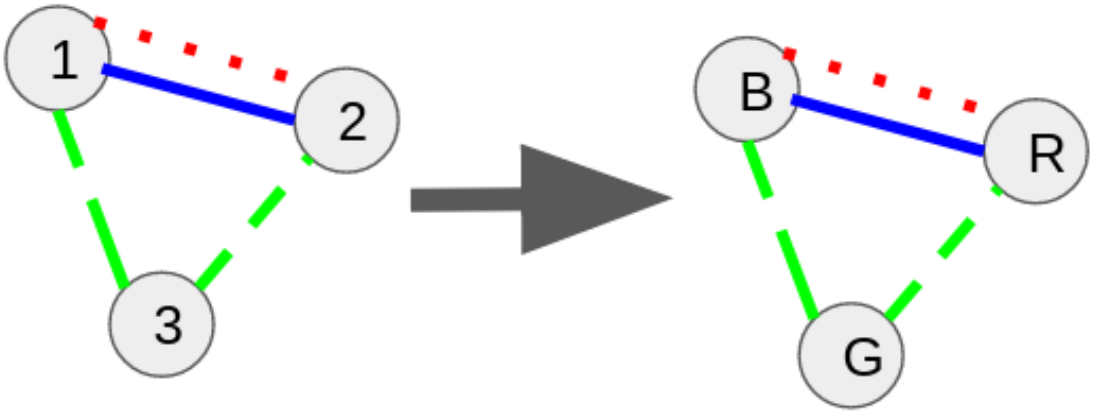
Output Example 3

```
Yes
BBRRR
```

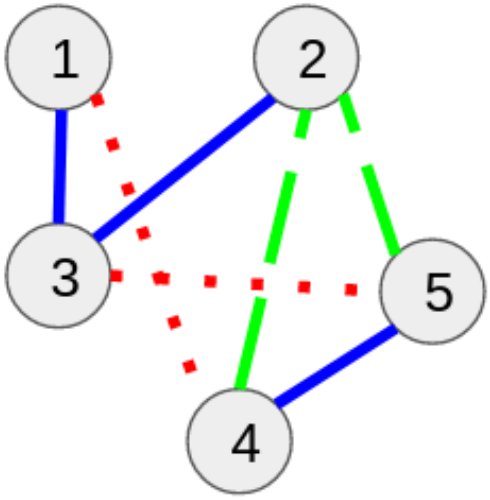
Example Explanation

- In order to prevent the image from being grayscaled, in addition to using color to indicate the edges, we also use solid lines to represent blue, long dotted lines to represent green, short dotted lines to represent red, and the color of the vertices is directly represented by text.

The figure of the first example is shown below, notice that both `BRG` and `RBG` are correct answers.



The figure of the second example is shown below, but no matter how Iofi paints, she can't find a coloring that fit the rules, so you have to output `No`.



The figure of the third example is shown below, notice that because $S =$ `11111`, this means that all vertices cannot be painted with `G`, which fits the constraint of subtask 1.