1

Stone Arranging 2

JOI-kun has N go stones. The stones are numbered from 1 to N. The color of each stone is an integer between 1 and 10^9, inclusive. In the beginning, the color of Stone i ($1 \leq i \leq N$) is A_i.

From now, JOI-kun will perform N operations. He will put the stones on the table in a line. The operation i ($1 \leq i \leq N$) will be performed as follows:

1. JOI-kun will put Stone i on the immediate right of Stone $i - 1$. However, when $i = 1$, JOI-kun will put Stone 1 on the table.
2. If there is a stone among Stones $1, 2, \ldots, i - 1$ whose current color is the same as Stone i, let j be the maximum index of such stones, and JOI-kun will paint all of Stones $j + 1, j + 2, \ldots, i - 1$ with the color A_i.

In order to confirm whether the operations are correctly performed, JOI-kun wants to know in advance the colors of the stones after all the operations are performed.

Given information of the go stones, write a program which determines the colors of the stones after the N operations are performed.

Input

Read the following data from the standard input.

N
A_1
A_2
$\vdots$
A_N

Output

Write N lines to the standard output. The i-th line ($1 \leq i \leq N$) should contain the color of Stone i after the N operations are performed.

Constraints

- $1 \leq N \leq 200\,000$.
- $1 \leq A_i \leq 10^9$ $(1 \leq i \leq N)$.
- Given values are all integers.

Subtasks

1. (25 points) $N \leq 2\,000$.
2. (35 points) $A_i \leq 2$ $(1 \leq i \leq N)$.
3. (40 points) No additional constraints.

Sample Input and Output

Sample Input 1	Sample Output 1
6 1 2 1 2 3 2	1 1 1 2 2 2

The operations are performed as in the following table.

Operation	The colors of the stones on the table	Explanation
1	1	Stone 1 is put on the table.
2	1, 2	Stone 2 is put on the immediate right of Stone 1.
3	1, 2, 1	Stone 3 is put on the immediate right of Stone 2.
	1, 1, 1	Stone 2 is painted in color 1.
4	1, 1, 1, 2	Stone 4 is put on the immediate right of Stone 3.
5	1, 1, 1, 2, 3	Stone 5 is put on the immediate right of Stone 4.
6	1, 1, 1, 2, 3, 2	Stone 6 is put on the immediate right of Stone 5.
	1, 1, 1, 2, 2, 2	Stone 5 is painted in color 2.

Finally, the colors of Stones 1, 2, 3, 4, 5, 6 will be 1, 1, 1, 2, 2, 2, respectively.
This sample input satisfies the constraints of Subtasks 1, 3.

Sample Input 2	Sample Output 2
10	1
1	1
1	1
2	1
2	1
1	1
2	1
2	1
1	1
1	2
2	

This sample input satisfies the constraints of all the subtasks.

2

Advertisement 2

There are N residents in JOI Kingdom, numbered from 1 to N. Resident i $(1 \leq i \leq N)$ lives at the coordinate X_i on the real line, and its **power of influence** is E_i. It may be the case that more than one residents live at the same coordinate. A resident with a large power of influence has a high advertising potential. But such a resident is careful in buying books.

Rie published a book on informatics. In order to encourage many people to buy copies of the book, she can donate copies of the book to some residents. If she donates a copy of the book to Resident i $(1 \leq i \leq N)$, Resident i will get a copy of Rie's book. Moreover, among the residents who did not yet get copies of the book, every resident j $(1 \leq j \leq N)$ satisfying the following condition will buy a copy of the book and get it.

> The distance between Resident i and Resident j on the real line is less than or equal to $E_i - E_j$. In other words, $|X_i - X_j| \leq E_i - E_j$ is satisfied.

If all the residents read Rie's book, the Olympiads in Informatics will be greatly recognized. Write a program which calculates the minimum number of residents who will be donated copies of Rie's book so that all the residents in JOI Kingdom will get copies of Rie's book.

Input

Read the following data from the standard input.

N
X_1 E_1
X_2 E_2
$\vdots$
X_N E_N

Output

Write one line to the standard output. The output should contain the minimum number of residents who will be donated copies of Rie's book.

Constraints

- $1 \le N \le 500\,000$.
- $1 \le X_i \le 10^9$ $(1 \le i \le N)$.
- $1 \le E_i \le 10^9$ $(1 \le i \le N)$.
- Given values are all integers.

Subtasks

1. (10 points) $E_1 = E_2 = \cdots = E_N$.
2. (23 points) $N \le 16$.
3. (36 points) $N \le 1\,000$.
4. (31 points) No additional constraints.

Sample Input and Output

Sample Input 1	Sample Output 1
4 4 2 2 3 3 4 6 5	2

For example, if Rie donates copies of the book in the following way, all the residents in JOI Kingdom will get copies of Rie's book.

- Rie donates a copy of the book to Resident 3.
  - Since $|X_3 - X_1| = 1$ and $E_3 - E_1 = 2$, Resident 1 will buy a copy of Rie's book and get it.
  - Since $|X_3 - X_2| = 1$ and $E_3 - E_2 = 1$, Resident 2 will buy a copy of Rie's book and get it.
  - Since $|X_3 - X_4| = 3$ and $E_3 - E_4 = -1$, Resident 4 will not buy a copy of Rie's book.

  Therefore, Residents 1, 2, 3 will get copies of Rie's book.
- Rie donates a copy of the book to Resident 4. Since all the residents except Resident 4 already got copies of Rie's book, all the residents in JOI Kingdom finally get copies of Rie's book.

Since it is impossible to donate copies of the book to less than two residents so that all the residents in JOI Kingdom will get copies of Rie's book, output 2.

This sample input satisfies the constraints of Subtasks 2, 3, 4.

Sample Input 2	Sample Output 2
3 7 10 10 10 7 10	2

This sample input satisfies the constraints of all the subtasks.

Sample Input 3	Sample Output 3
10 31447678 204745778 430226982 292647686 327782937 367372305 843320852 822224390 687565054 738216211 970840050 766211141 563662348 742939240 103739645 854320982 294864525 601612333 375952316 469655019	5

This sample input satisfies the constraints of Subtasks 2, 3, 4.

3

Maze

President K loves solving mazes. He found cells from which he may create a maze. The cells are rectangular grid with R horizontal rows and C vertical columns. Each cell is colored either white or black. The cell in the i-th row ($1 \leq i \leq R$) from the top and the j-th column ($1 \leq j \leq C$) from the left is called Cell (i, j)

President K will solve the maze under the condition that he can pass the white cells, but he cannot pass the black cells. More precisely, he will solve the maze in the following way.

1. Among the white cells, he will choose Cell (S_r, S_c), which is the starting cell of the maze, and Cell (G_r, G_c), which is the goal cell of the maze.
2. It is possible to move from one cell to another white cell which is adjacent to the current cell in one of the four directions (top, bottom, left, or right). By repeating this, he will find a path from the starting cell to the goal cell.

President K already fixed the starting cell and the goal cell. However, he noticed that in some situations of the colors of the cells, there might not be a path from the starting cell to the goal cell consisting of white cells only. He has a stamp of size $N \times N$. He will perform the following **Operations** several times so that there will be a path from the starting cell to the goal cell consisting of white cells only.

Operation He chooses a square region of $N \times N$ cells, and paint the cells in the region white. More precisely, he chooses integers a, b satisfying $1 \leq a \leq R - N + 1$ and $1 \leq b \leq C - N + 1$, and for every pair (i, j) of integers satisfying $a \leq i \leq a + N - 1$ and $b \leq j \leq b + N - 1$, he paints Cell (i, j) white.

Since his hands becomes dirty if he uses the stamp, he wants to minimize the number of operations. Given information of the colors of the cells, the size of the stamp, and the locations of the starting cell and the goal cell, write a program which calculates the minimum number of operations he has to perform so that there will be a path from the starting cell to the goal cell consisting of white cells only.

Input

Read the following data from the standard input.

R C N
S_r S_c
G_r G_c
A_1
A_2
$\vdots$
A_R

A_i ($1 \leq i \leq R$) is a string of length C consisting of `.` or `#`. The j-th character ($1 \leq j \leq C$) of A_i represents the color of Cell (i, j). Its color is white if the character is `.`, and its color is black if the character is `#`.

Output

Write one line to the standard output. The output should contain the minimum number of operations President K has to perform so that there will be a path from the starting cell to the goal cell consisting of white cells only.

Constraints

- $1 \leq N \leq R \leq C$.
- $R \times C \leq 6\,000\,000$.
- $1 \leq S_r \leq R$.
- $1 \leq S_c \leq C$.
- $1 \leq G_r \leq R$.
- $1 \leq G_c \leq C$.
- $(S_r, S_c) \neq (G_r, G_c)$.
- A_i ($1 \leq i \leq R$) is a string of length C consisting of `.` or `#`.
- The color of Cell (S_r, S_c) is white.
- The color of Cell (G_r, G_c) is white.
- $R, C, N, S_r, S_c, G_r, G_c$ are integers.

Subtasks

1. (8 points) $N = 1$, $R \times C \leq 1\,500\,000$.
2. (19 points) $R \times C \leq 1\,000$.
3. (16 points) The answer is less than or equal to 10, and $R \times C \leq 1\,500\,000$.
4. (19 points) $R \times C \leq 60\,000$.
5. (5 points) $R \times C \leq 150\,000$.
6. (19 points) $R \times C \leq 1\,500\,000$.
7. (8 points) $R \times C \leq 3\,000\,000$.
8. (6 points) No additional constraints.

Sample Input and Output

Sample Input 1	Sample Output 1
2 4 2 1 1 2 4 .### ###.	1

If he chooses $(a, b) = (1, 2)$ and perform an operation, Cells $(1, 2), (1, 3), (2, 2), (2, 3)$ become white. Then there will be a path from the starting cell to the goal cell consisting of white cells only. For example, the path $(1, 1) \to (1, 2) \to (1, 3) \to (2, 3) \to (2, 4)$ satisfies the condition.

If he does not perform an operation, there is no path from the starting cell to the goal cell consisting of white cells only. Therefore, output 1.

This sample input satisfies the constraints of Subtasks 2, 3, 4, 5, 6, 7, 8.

Sample Input 2	Sample Output 2
6 6 1 1 6 6 1 ..#.#. ##.### ####.# ...### ##.##. .#.###	4

This sample input satisfies the constraints of all the subtasks.

Sample Input 3	Sample Output 3
6 7 6 6 4 3 1 ..#.#.# ##.##.. .###### #..#.#. .###### ..#.##.	1

This sample input satisfies the constraints of Subtasks 2, 3, 4, 5, 6, 7, 8.

Sample Input 4	Sample Output 4
1 15 1 1 15 1 1	0

Even if he does not perform an operation, there might be a path from the starting cell to the goal cell consisting of white cells only.

This sample input satisfies the constraints of all the subtasks.

4

Cat Exercise

There are N cat towers, numbered from 1 to N. The height of Tower i ($1 \leq i \leq N$) is P_i. The heights of the towers are distinct integers between 1 and N, inclusive. There are $N - 1$ adjacent pairs of towers. For each j ($1 \leq j \leq N - 1$), Tower A_j and Tower B_j are adjacent to each other. In the beginning, it is possible to travel from a tower to any other tower by repeating moves from towers to adjacent towers.

In the beginning, a cat stays in a tower of height N.

Then we perform **cat exercises**. In cat exercises, we repeatedly choose a tower and put an obstacle on it. However, we cannot put an obstacle on a tower where we already put an obstacle on it. During the process, the following will happen.

- If the cat does not stay in the chosen tower, nothing will happen.
- If the cat stays in the chosen tower and there is an obstacle on every tower which is adjacent to the chosen tower, the cat exercises will finish.
- Otherwise, among the towers where the cat can arrive by repeating moves from towers to adjacent towers without obstacles, the cat will move to the highest tower except for the current tower by repeating moves from towers to adjacent towers. In this process, the cat takes the route where the number of moves from towers to adjacent towers becomes minimum.

Given information of the heights of the towers and pairs of adjacent towers, write a program which calculates the maximum possible sum of the number of moves of the cat from towers to adjacent towers if we put obstacles suitably.

Input

Read the following data from the standard input.

N
$P_1\ P_2 \cdots P_N$
$A_1\ B_1$
$A_2\ B_2$
$\vdots$
$A_{N-1}\ B_{N-1}$

Output

Write one line to the standard output. The output should contain the maximum possible sum of the number of moves of the cat from towers to adjacent towers.

Constraints

- $2 \leq N \leq 200\,000$.
- $1 \leq P_i \leq N$ $(1 \leq i \leq N)$.
- $P_i \neq P_j$ $(1 \leq i < j \leq N)$.
- $1 \leq A_j < B_j \leq N$ $(1 \leq j \leq N-1)$.
- In the beginning, it is possible to travel from a tower to any other tower by repeating moves from towers to adjacent towers.
- Given values are all integers.

Subtasks

1. (7 points) $A_i = i, \quad B_i = i+1$ $(1 \leq i \leq N-1), \quad N \leq 16$.
2. (7 points) $A_i = i, \quad B_i = i+1$ $(1 \leq i \leq N-1), \quad N \leq 300$.
3. (7 points) $A_i = i, \quad B_i = i+1$ $(1 \leq i \leq N-1), \quad N \leq 5\,000$.
4. (10 points) $N \leq 5\,000$.
5. (20 points) $A_i = i, \quad B_i = i+1$ $(1 \leq i \leq N-1)$.
6. (23 points) $A_i = \left\lfloor \frac{i+1}{2} \right\rfloor, \quad B_i = i+1$ $(1 \leq i \leq N-1)$. Here $\lfloor x \rfloor$ is the largest integer which is smaller than or equal to x.
7. (26 点) No additional constraints.

Sample Input and Output

Sample Input 1	Sample Output 1
4 3 4 1 2 1 2 2 3 3 4	3

If we perform the cat exercises in the following way, the cat moves 3 times in total.

- We put an obstacle on Tower 1. The cat does not move.
- We put an obstacle on Tower 2. The cat moves from Tower 2 to Tower 3. Then, the cat moves from Tower 3 to Tower 4.
- We put an obstacle on Tower 4. The cat moves from Tower 4 to Tower 3.
- We put an obstacle on Tower 3. Then the cat exercises finish.

Since there is no way to perform cat exercises where the cat moves more than or equal to 4 times from towers to adjacent towers, output 3.

This sample input satisfies the constraints of Subtasks 1, 2, 3, 4, 5, 7.

Sample Input 2	Sample Output 2
7 3 2 7 1 5 4 6 1 2 1 3 2 4 2 5 3 6 3 7	7

This sample input satisfies the constraints of Subtasks 4, 6, 7.

5

Modern Machine

Bitaro is given JOI machine as a birthday present. JOI machine consists of one **ball**, N **light tiles**, and M **buttons**. The light tiles are numbered from 1 to N. When Bitaro turns the power on, Light tile i ($1 \leq i \leq N$) emit light of color C_i (blue (`B`) or red (`R`)). The buttons are numbered from 1 to M. If Bitaro pushes Button j ($1 \leq j \leq M$), the following happen.

1. The ball is placed on Light tile A_j.
2. Light tile A_j becomes red (regardless of its original color).
3. The following operations are performed until the ball is removed.

   Let p be the index of the light tile where the ball is currently placed.

   If Light tile p is blue,

   Light tile p becomes red. After that, if $p = 1$, the ball is removed. Otherwise, the ball moves to Light tile $p - 1$.

   If Light tile p is red,

   Light tile p becomes blue. After that, if $p = N$, the ball is removed. Otherwise, the ball moves to Light tile $p + 1$.

Bitaro is interested in JOI machine. He plans to perform Q experiments. In the k-th experiment ($1 \leq k \leq Q$), after Bitaro turns the power on, Bitaro pushes Buttons $L_k, L_k + 1, \ldots, R_k$ in this order. After Bitaro pushes a button, he will not push the next button and wait until the ball is removed.

Given information of JOI machine and the experiments, write a program which calculates, for each experiment, the number of light tiles whose colors are red when the experiment finishes.

Input

Read the following data from the standard input.

N M
$C_1 C_2 \cdots C_N$
A_1 A_2 $\cdots$ A_M
Q
L_1 R_1
L_2 R_2
$\vdots$
L_Q R_Q

Output

Write Q lines to the standard output. In the k-th line ($1 \leq k \leq Q$), the output should contain the number of light tiles whose colors are red when the k-th experiment finishes.

Constraints

- $3 \leq N \leq 120\,000$.
- $1 \leq M \leq 120\,000$.
- C_i ($1 \leq i \leq N$) is either B or R.
- $1 \leq A_j \leq N$ ($1 \leq j \leq M$).
- $1 \leq Q \leq 120\,000$.
- $1 \leq L_k \leq R_k \leq M$ ($1 \leq k \leq Q$).
- N, M, A_j, Q, L_k, R_k are integers.

Subtasks

1. (3 points) $N \leq 300$, $M \leq 300$, $Q = 1$.
2. (12 points) $N \leq 7\,000$, $M \leq 7\,000$, $Q = 1$.
3. (10 points) $Q \leq 5$.
4. (11 points) $N = 10$, and C_i is R ($1 \leq i \leq N$).
5. (26 points) There exists an integer t ($0 \leq t \leq N$) such that C_i is R for every $i \leq t$, and C_i is B for every $i > t$.
6. (17 points) $A_j \leq 20$ or $A_j > N - 20$ ($1 \leq j \leq M$).
7. (21 points) No additional constraints.

Sample Input and Output

Sample Input 1	Sample Output 1
5 1 RBRRB 4 1 1 1	1

The first experiment proceeds as follows.

1. Bitaro pushes Button 1, and ball is placed on Light tile 4.
2. Light tile 4 becomes red. Since the original color of Light tile 4 is red, the color of Light tile 4 does not change.
3. After that, the following operations are performed.
   (1) Since the current color of Light tile 4 is red, Light tile 4 becomes blue, and the ball moves to Light tile 5.
   (2) Since the current color of Light tile 5 is blue, Light tile 5 becomes red, and the ball moves to Light tile 4.
   (3) Since the current color of Light tile 4 is blue, Light tile 4 becomes red, and the ball moves to Light tile 3.
   (4) Since the current color of Light tile 3 is red, Light tile 3 becomes blue, and the ball moves to Light tile 4.
   (5) Since the current color of Light tile 4 is red, the color of Light tile 4 becomes blue, and the ball moves to Light tile 5.
   (6) Since the current color of Light tile 5 is red, the color of Light tile 5 becomes blue, and the ball is removed.

After the experiment, Light tile 1 is the only light tile whose current color is red. Therefore, output 1.
This sample input satisfies the constraints of Subtasks 1, 2, 3, 6, 7.

Sample Input 2	Sample Output 2
5 3 RBRBR 1 3 4 2 2 3 1 3	5 0

For the first experiment, Light tiles 1, 2, 3, 4, 5 are the light tiles whose current colors are red after the experiment. Since there are five such light tiles, output 5.

For the second experiment, there is no light tile whose current color is red after the experiment. Therefore, output 0.

This sample input satisfies the constraints of Subtasks 3, 6, 7.

Sample Input 3	Sample Output 3
10 3 BBRRBRBRRB 2 10 5 1 1 3	2

This sample input satisfies the constraints of Subtasks 1, 2, 3, 6, 7.

Sample Input 4	Sample Output 4
10 10 RRRRRRRRRR 3 1 4 1 5 9 2 6 5 3 5 1 7 2 8 3 9 4 10 1 10	4 8 10 0 9

This sample input satisfies the constraints of Subtasks 3, 4, 5, 6, 7.

Sample Input 5	Sample Output 5
10 10 RRRBBBBBBB 3 1 4 1 5 9 2 6 5 3 5 1 10 2 9 3 8 4 7 5 6	2 6 0 10 7

This sample input satisfies the constraints of Subtasks 3, 5, 6, 7.

Sample Input 6	Sample Output 6
30 10 RRRBBRBBBRBBBRBRBRRRRRBBBBRBRR 3 28 2 29 1 30 6 14 7 7 10 1 10 2 3 2 5 2 8 3 3 3 6 4 5 4 7 5 9 10 10	21 15 15 4 17 16 14 20 12 23

This sample input satisfies the constraints of Subtasks 6, 7.