A - Sort Left and Right

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score: 300 points

Problem Statement

You are given a permutation $P=(P_1,P_2,\ldots,P_N)$ of $(1,2,\ldots,N)$.

You want to satisfy $P_i=i$ for all $i=1,2,\ldots,N$ by performing the following operation zero or more times:

• Choose an integer k such that $1 \leq k \leq N$. If $k \geq 2$, sort the 1-st through (k-1)-th terms of P in ascending order. Then, if $k \leq N-1$, sort the (k+1)-th through N-th terms of P in ascending order.

It can be proved that under the constraints of this problem, it is possible to satisfy $P_i=i$ for all $i=1,2,\ldots,N$ with a finite number of operations for any P. Find the minimum number of operations required.

You have T test cases to solve.

Constraints

- $1 < T < 10^5$
- $3 < N < 2 \times 10^5$
- P is a permutation of $(1, 2, \ldots, N)$.
- All input values are integers.
- The sum of N across the test cases in a single input is at most $2 imes 10^5$.

Input

The input is given from Standard Input in the following format:

Each case is given in the following format:

```
egin{bmatrix} N \ P_1 & P_2 & \dots & P_N \end{bmatrix}
```

Output

Print T lines. The i-th line should contain the answer for the i-th test case.

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

1 0 2

For the first test case,

- Performing the operation with k=1 results in P becoming (2,1,3,4,5).
- Performing the operation with k=2 results in P becoming (2,1,3,4,5).
- Performing the operation with k=3 results in P becoming (1,2,3,4,5).
- ullet Performing the operation with k=4 results in P becoming (1,2,3,5,4).
- Performing the operation with k=5 results in P becoming (1,2,3,5,4).

Specifically, performing the operation with k=3 results in P satisfying $P_i=i$ for all $i=1,2,\ldots,5$. Therefore, the minimum number of operations required is 1.

For the third test case, performing the operation with k=4 followed by k=3 results in P changing as (3,2,1,7,5,6,4) o (1,2,3,7,4,5,6) o (1,2,3,4,5,6,7).

B - Annoying String Problem

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score: 600 points

Problem Statement

For strings S and T consisting of lowercase English letters, and a string X consisting of 0 and 1, define the string f(S,T,X) consisting of lowercase English letters as follows:

• Starting with an empty string, for each $i=1,2,\ldots,|X|$, append S to the end if the i-th character of X is 0, and append T to the end if it is 1.

You are given a string S consisting of lowercase English letters, and strings X and Y consisting of 0 and 1.

Determine if there exists a string T (which can be empty) such that f(S,T,X)=f(S,T,Y).

You have t test cases to solve.

Constraints

- $1 < t < 5 \times 10^5$
- $1 \le |S| \le 5 \times 10^5$
- $1 \le |X|, |Y| \le 5 \times 10^5$
- $\bullet \;\; S$ is a string consisting of lowercase English letters.
- X and Y are strings consisting of 0 and 1.
- ullet The sum of |S| across all test cases in a single input is at most $5 imes 10^5.$
- The sum of |X| across all test cases in a single input is at most $5 imes 10^5$.
- The sum of |Y| across all test cases in a single input is at most $5 imes 10^5$.

Input

The input is given from Standard Input in the following format:

```
egin{array}{c} t \ \operatorname{case}_1 \ dots \ \operatorname{case}_t \end{array}
```

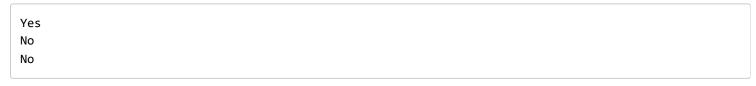
Each case is given in the following format:

```
egin{array}{c} S \ X \ Y \end{array}
```

Output

Print t lines. The i-th line should contain Yes if there exists a T that satisfies the condition for the i-th test case, and No otherwise.

```
3
araara
01
111
araaaa
100100
0010111
abacabac
0
```



Below, string concatenation is represented using +.

For the 1st test case, if T= ara, then f(S,T,X)=S+T= araaraara and f(S,T,Y)=T+T+ T= araaraara, so f(S,T,X)=f(S,T,Y).

For the 2nd and 3rd test cases, there is no T that satisfies the condition.

Sample Input 2

```
2
empty
10101
00
empty
11111
111
```

Sample Output 2

Yes Yes

T can be empty.

C - Row and Column Order

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score: 600 points

Problem Statement

You are given two permutations $P=(P_1,P_2,\ldots,P_N)$ and $Q=(Q_1,Q_2,\ldots,Q_N)$ of $(1,2,\ldots,N)$.

Write one of the characters 0 and 1 in each cell of an N-by-N grid so that all of the following conditions are satisfied:

- Let S_i be the string obtained by concatenating the characters in the i-th row from the 1-st to the N-th column. Then, $S_{P_1} < S_{P_2} < \cdots < S_{P_N}$ in lexicographical order.
- Let T_i be the string obtained by concatenating the characters in the i-th column from the 1-st to the N-th row. Then, $T_{Q_1} < T_{Q_2} < \cdots < T_{Q_N}$ in lexicographical order.

It can be proved that for any P and Q, there is at least one way to write the characters that satisfies all the conditions.

lacktriangle What does "X < Y in lexicographical order" mean?

Constraints

- 2 < N < 500
- P and Q are permutations of $(1, 2, \ldots, N)$.
- All input values are integers.

Input

The input is given from Standard Input in the following format:

Output

Print a way to fill the grid that satisfies the conditions in the following format, where A_{ij} is the character written at the i-th row and j-th column:

```
A_{11}A_{12}\dots A_{1N}
\vdots
A_{N1}A_{N2}\dots A_{NN}
```

If there are multiple ways to satisfy the conditions, any of them will be accepted.

Sample Input 1

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

Sample Output 1

```
001
101
110
```

In this sample, $S_1=$ 001, $S_2=$ 101, $S_3=$ 110, and $T_1=$ 011, $T_2=$ 001, $T_3=$ 110. Therefore, $S_1< S_2< S_3$ and $T_2< T_1< T_3$ hold, satisfying the conditions.

```
15
8 15 10 2 4 3 1 13 5 12 9 6 14 11 7
4 1 5 14 3 12 13 7 11 8 6 2 9 15 10
```

010001111110101	
001000000101001	
010001001100010	
010000011110010	
010011101101101	
100101110100000	
111100011001000	
000001001100000	
100011011000101	
000111101011110	
101010101010101	
011010101011110	
010011000010011	
100110010110101	
000101101100100	

D - Prefix Bubble Sort

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score: 700 points

Problem Statement

You are given a permutation $P=(P_1,P_2,\ldots,P_N)$ of $(1,2,\ldots,N)$.

Consider the following operations $k\ (k=2,3,\ldots,N)$ on this permutation.

• Operation k: For $i=1,2,\ldots,k-1$ in this order, if $P_i>P_{i+1}$, swap the values of the i-th and (i+1)-th elements of P.

You are also given a **non-decreasing** sequence $A=(A_1,A_2,\ldots,A_M)\ (2\leq A_i\leq N)$ of length M.

For each $i=1,2,\ldots,M$, find the inversion number of P after applying the operations A_1,A_2,\ldots,A_i in this order.

▶ What is the inversion number of a sequence?

Constraints

- $2 < N < 2 \times 10^5$
- $1 < M < 2 \times 10^5$
- $2 \leq A_i \leq N$
- P is a permutation of $(1, 2, \ldots, N)$.
- $A_i \leq A_{i+1}$ for $i=1,2,\ldots,M-1$.
- All input values are integers.

Input

The input is given from Standard Input in the following format:

Output

Print M lines. The k-th line should contain the answer to the problem for i=k.

Sample Input 1

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

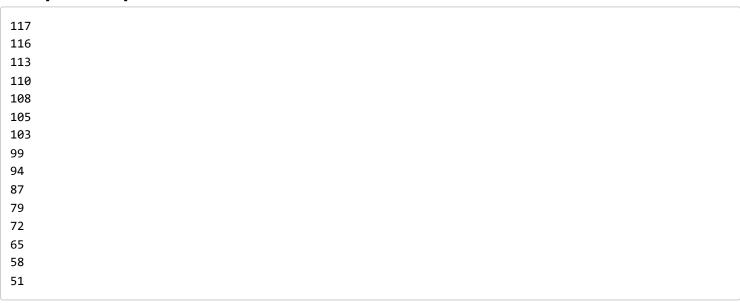
Sample Output 1

```
3
1
```

First, operation 4 is performed. During this, P changes as follows: $(3,2,4,1,6,5) \to (2,3,4,1,6,5) \to (2,3$

Next, operation 6 is performed, where P eventually becomes (2,1,3,4,5,6), whose inversion number is 1.

```
20
12 14 16 8 7 15 19 6 18 5 13 9 10 17 4 1 11 20 2 3
15
3 4 6 8 8 9 10 12 13 15 18 18 19 19 20
```



E - Min and Max at the edge

Time Limit: 3 sec / Memory Limit: 1024 MiB

Score: 1000 points

Problem Statement

An undirected graph with numbered vertices is called a **good graph** if it has a spanning tree T that satisfies the following condition. Here, an edge connecting two vertices u and v (u < v) is denoted as edge (u, v).

• For every edge (u, v) (u < v) in the graph, the minimum and maximum vertex numbers on the unique simple path connecting vertices u and v in T are u and v, respectively.

You are given a simple connected undirected graph G with N vertices numbered from 1 to N. The graph G has M edges, and the i-th edge connects vertices A_i and B_i ($A_i < B_i$).

For each $i=1,2,\ldots,M$, determine whether the graph obtained by removing the i-th edge from G is a good graph.

Constraints

- $2 < N < 2 \times 10^5$
- $N-1 \le M \le 2 imes 10^5$
- $1 \le A_i < B_i \le N$
- All input values are integers.
- The given graph is a simple connected undirected graph.

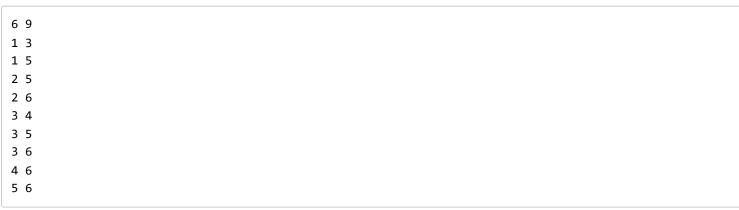
Input

The input is given from Standard Input in the following format:

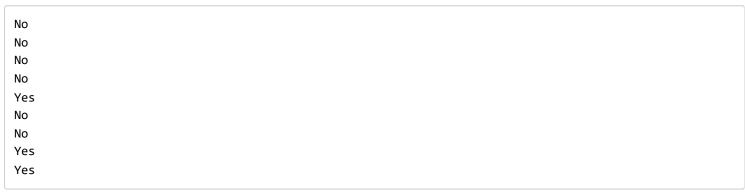
Output

Print M lines. The i-th line should contain Yes if the graph obtained by removing the i-th edge from G is a good graph, and No otherwise.

Sample Input 1



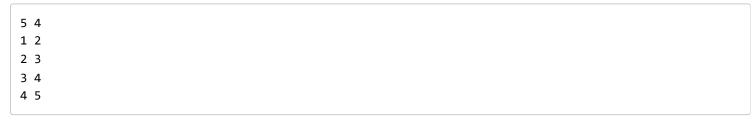
Sample Output 1



Consider the case where edge (4,6) is removed. A spanning tree formed by edges (1,3),(2,5),(3,4),(3,5),(5,6) satisfies the condition. For example, for edge (3,6), the simple path connecting vertices 3 and 6 traverses vertices 3,5,6 in this order, and the minimum and maximum vertex numbers on the path are 3 and 6, respectively, thus satisfying the condition. By verifying the other edges similarly, it can be seen that this spanning tree satisfies the condition, so the answer is Yes.

On the other hand, consider the case where edge (1,5) is removed. The same spanning tree does not satisfy the condition. For edge (4,6), the simple path connecting vertices 4 and 6 traverses vertices 4,3,5,6 in this order, and the minimum and maximum vertex numbers on the path are 3 and 6, respectively, thus not satisfying the condition. It can also be shown that no other spanning tree satisfies the condition, so the answer is No.

Sample Input 2



Sample Output 2

```
No
No
No
```

Removing an edge may disconnect the graph.

```
15 20
12 13
7 8
5 7
8 10
9 12
4 5
11 12
2 4
6 8
4 14
1 2
14 15
2 9
3 8
2 15
10 11
13 14
8 9
7 14
5 13
```

No			
No			
No			
Yes			
Yes			
No			
Yes			
No			
Yes			
No			

F - Colorful Reversi

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score: 1100 points

Problem Statement

You are given an integer sequence $A=(A_1,A_2,\dots,A_N)$ of length N. On this sequence, the following operation can be performed:

• Choose l and r $(1 \leq l < r \leq N)$ such that $A_l = A_r, A_{l+1} = A_{l+2} = \cdots = A_{r-1}$, and $A_{l+1} \neq A_l$. Replace each of $A_{l+1}, A_{l+2}, \ldots, A_{r-1}$ with A_l . The cost of this operation is r-l-1.

You will repeat this operation until there is no l and r $(1 \le l < r \le N)$ such that $A_l = A_r, A_{l+1} = A_{l+2} = \cdots = A_{r-1}$, and $A_{l+1} \ne A_l$. Find the minimum total cost of such a series of operations.

Constraints

- $3 \le N \le 5 \times 10^5$
- $1 \leq A_i \leq N$
- All input values are integers.

Input

The input is given from Standard Input in the following format:

Output

Print the answer.

7

For example, if you perform the operation with (l,r)=(3,5),(2,6),(1,7) in this order, A changes as follows: (1,2,3,2,3,2,1) o (1,2,3,3,3,2,1) o (1,2,2,2,2,2,1) o (1,1,1,1,1,1,1), after which there is no l and r with the said property. The total cost of this series of operations is 1+3+5=9.

On the other hand, if you perform the operation with (l,r)=(2,4),(4,6),(1,7) in this order, A changes as follows: (1,2,3,2,3,2,1) o (1,2,2,2,3,2,1) o (1,2,2,2,2,2,1) o (1,1,1,1,1,1). The total cost of this series of operations is 1+1+5=7.

Sample Input 2

5 1 2 3 4 5

Sample Output 2

0

Sample Input 3

40 1 2 3 4 5 6 7 8 7 6 5 6 7 8 7 6 5 4 3 2 2 1 2 3 4 5 4 5 6 7 8 7 7 6 5 6 6 7 8 8

Sample Output 3

44