CCO '22 P1 - Alternating Heights

Time limit: 2.0s **Memory limit:** 1G

Canadian Computing Olympiad: 2022 Day 1, Problem 1

Troy is planning to take a group photo of the students at CCO and has asked you for help.

There are K students, numbered from 1 to K. Troy has forgotten the students' heights but remembers that no two students have the same height.

Troy has prepared a sequence $A_1, A_2, \ldots, A_N$ representing the order of students in the group photo, from left to right. It is possible for a student to appear multiple times in A. You aren't sure how this group photo would be taken, but you're unwilling to assume that Troy made a mistake.

Troy will ask you Q queries of the form `x y`, which is a compact way of asking "Given the sequence of students, $A_x, A_{x+1}, \ldots, A_y$, can their heights form an alternating sequence?" More precisely, we denote the height of the i^{th} student as $h[i]$. If there exists an assignment of heights $h[1], h[2], \ldots, h[K]$ such that $h[A_x] > h[A_{x+1}] < h[A_{x+2}] > h[A_{x+3}] < \ldots h[A_y]$, answer `YES`; otherwise, answer `NO`.

Note that each of the Q queries will be independent: that is, the assignment of heights for query i is independent of the assignment of heights for query j so long as $i \neq j$.

Input Specification

The first line of input will contain three space-separated integers N, K, and Q.

The second line of input will contain the array $A_1, A_2, \ldots, A_N$ $(1 \leq A_i \leq K)$.

The next Q lines will each contain a query of the form of two space-separated integers x and y $(1 \leq x < y \leq N)$.

Marks Awarded	Bounds on N	Bounds on K	Bounds on Q
4 marks	$2 \leq N \leq 3\,000$	$K = 2$	$1 \leq Q \leq 10^6$
6 marks	$2 \leq N \leq 500$	$2 \leq K \leq \min(N, 5)$	$1 \leq Q \leq 10^6$
7 marks	$2 \leq N \leq 3\,000$	$2 \leq K \leq N$	$1 \leq Q \leq 2\,000$
8 marks	$2 \leq N \leq 3\,000$	$2 \leq K \leq N$	$1 \leq Q \leq 10^6$

Output Specification

Output Q lines. On the i^{th} line, output the answer to Troy's i^{th} query. Note that the answer is either `YES` or `NO`.

Sample Input

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

Output for Sample Input

```
NO
YES
NO
```

Explanation of Output for Sample Input

For the first query, we will never have $h[1] > h[1]$, so the answer is no.

For the second query, one solution to $h[1] > h[2] < h[3] > h[1]$ is $h[1] = 160cm, h[2] = 140cm, h[3] = 180cm$. Another solution could be $h[1] = 1.55m, h[2] = 1.473m, h[3] = 1.81m$.

For the third query, we cannot have both $h[1] > h[2]$ and $h[1] < h[2]$.