

2022 Canadian Computing Olympiad

Day 1, Problem 1

Alternating Heights

Time Limit: 2 seconds

Problem Description

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, \dots, 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}, \dots, 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 $h[1], h[2], \dots, h[K]$ such that $h[A_x] > h[A_{x+1}] < h[A_{x+2}] > h[A_{x+3}] < \dots < h[A_y]$, 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, \dots, 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 | $2 \leq N \leq 3000$ | $K = 2$ | $1 \leq Q \leq 10^6$ |
| 6 marks | $2 \leq N \leq 500$ | $2 \leq K \leq \min(N, 5)$ | $1 \leq Q \leq 10^6$ |
| 7 marks | $2 \leq N \leq 3000$ | $2 \leq K \leq N$ | $1 \leq Q \leq 2000$ |
| 8 marks | $2 \leq N \leq 3000$ | $2 \leq K \leq N$ | $1 \leq Q \leq 10^6$ |

Output Specification

Output Q lines. On the i th line, output the answer to Troy's i th query. Note that the answer will be 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 $h[1] = 160\text{cm}$, $h[2] = 140\text{cm}$, $h[3] = 180\text{cm}$. Another solution could be $h[1] = 1.55\text{m}$, $h[2] = 1.473\text{m}$, $h[3] = 1.81\text{m}$.

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