

# Team Up!

## Problem ID: teamup

Life of the undercity can be boring sometimes. There are  $N$  children in the undercity, and they have decided to play a new game — Team Up! Each player is on a team, and each turn, a team is selected uniformly at random. Two players,  $i$  and  $j$ , can use their team's turn to "team up" on player  $k$ , if and only if  $i < k < j$ . After this, player  $k$  joins  $i$  and  $j$ 's team. A team may choose to pass (do nothing) on any given turn.

1 3 2 2 4 3 4 → 1 3 2 2 3 3 4

Figure 1: Players 2 and 6 team up on player 5.

A team with one player remaining is considered eliminated, as that team can never make a turn again. When only one team is not eliminated, that team is the winner. A team is the *effective winner* if the probability that they will win, with perfect play, is 1.

1 3 2 3 3 3 4

Figure 2: Team 3 has won.

1 3 2 2 3 3 4

Figure 3: Team 3 is the effective winner; no amount of random luck or perfect play from opposing teams will prevent team 3 from eventually winning.

Note that some games may not have a winner. In the following example, neither team can ever win, and the game ends in a draw:

3 3 4 4

Figure 4: Neither team can make any progress.

The children want to keep track of who is winning. You are given  $Q$  queries, of the form:

- 1  $t$   $i$ : Player  $i$  joins team  $t$ . This turn may not necessarily be valid by the rules of the game (children of the undercity don't always play fair); there are no restrictions on when a player might change teams.
- 2  $t$ : Output the number of *consecutive turns* a team needs to have *effectively won*, assuming the children play perfectly and follow all rules, or  $-1$  if they cannot win, even with unlimited consecutive turns.

Here, a team having  $k$  *consecutive turns* means that team is selected and gets to make a move for the next  $k$  consecutive turns. Can you help the children keep track of who is winning?

## Input

The first line contains two integers,  $N$  ( $2 \leq N \leq 3 \cdot 10^5$ ) and  $Q$  ( $1 \leq Q \leq 3 \cdot 10^5$ ).

The second line contains  $N$  integers,  $a_1, a_2, \dots, a_N$ , where  $1 \leq a_i \leq N$  denotes the initial team of the  $i$ -th player.

Each of the following  $Q$  lines contains one query in one of the following formats:

- 1  $t$   $i$ : Here,  $t$  is a team identifier ( $1 \leq t \leq N$ ) and  $i$  is a player index ( $1 \leq i \leq N$ ).
- 2  $t$ : Here,  $t$  is a team identifier ( $1 \leq t \leq N$ ).

It is guaranteed that there is at least one query of the second type.

## Output

For each query of the form  $2 \times t$ , output a single line containing one integer — the number of consecutive turns a team needs to have effectively won, or  $-1$  if the team cannot win even with unlimited consecutive turns.

### Sample Input 1

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

### Sample Output 1

```
1
1
0
-1
```

### Sample Input 2

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

### Sample Output 2

```
0
-1
```

### Sample Input 3

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

### Sample Output 3

```
-1
-1
```

### Sample Input 4

```
6 8
2 3 2 1 3 1
2 3
2 1
1 3 3
2 3
2 1
1 1 5
2 3
2 1
```

### Sample Output 4

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