

457. Circular Array Loop

You are playing a game involving a circular array of non-zero integers $nums$. Each $nums[i]$ denotes the number of indices forward/backward you must move if you are located at index i :

- If $nums[i]$ is positive, move $nums[i]$ steps forward, and
- If $nums[i]$ is negative, move $nums[i]$ steps backward.

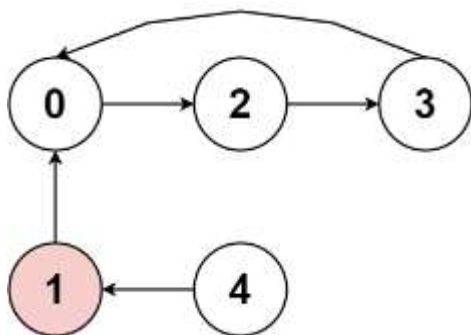
Since the array is circular, you may assume that moving forward from the last element puts you on the first element, and moving backwards from the first element puts you on the last element.

A cycle in the array consists of a sequence of indices seq of length k where:

- Following the movement rules above results in the repeating index sequence $seq[0] \rightarrow seq[1] \rightarrow \dots \rightarrow seq[k-1] \rightarrow seq[0] \rightarrow \dots$
- Every $nums[seq[j]]$ is either all positive or all negative.
- $k > 1$

Return true if there is a cycle in $nums$, or false otherwise.

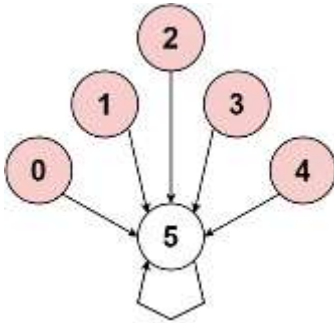
Example 1:



- **Input:** $nums = [2, -1, 1, 2, 2]$
- **Output:** true
- **Explanation:** The graph shows how the indices are connected. White nodes are jumping forward, while red is jumping backward.

We can see the cycle $0 \rightarrow 2 \rightarrow 3 \rightarrow 0 \rightarrow \dots$, and all of its nodes are white (jumping in the same direction).

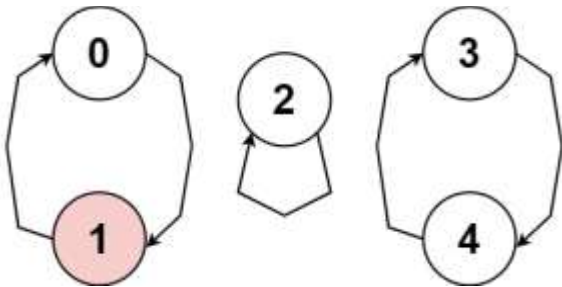
Example 2:



- **Input:** `nums = [-1,-2,-3,-4,-5,6]`
- **Output:** `false`
- **Explanation:** The graph shows how the indices are connected. White nodes are jumping forward, while red is jumping backward.

The only cycle is of size 1, so we return false.

Example 3:



- **Input:** `nums = [1,-1,5,1,4]`
- **Output:** `true`
- **Explanation:** The graph shows how the indices are connected. White nodes are jumping forward, while red is jumping backward.

We can see the cycle $0 \rightarrow 1 \rightarrow 0 \rightarrow \dots$, and while it is of size > 1 , it has a node jumping forward and a node jumping backward, so it is not a cycle.

We can see the cycle $3 \rightarrow 4 \rightarrow 3 \rightarrow \dots$, and all of its nodes are white (jumping in the same direction).

Constraints:

- $1 \leq \text{nums.length} \leq 5000$
- $-1000 \leq \text{nums}[i] \leq 1000$
- $\text{nums}[i] \neq 0$

Follow up: Could you solve it in $O(n)$ time complexity and $O(1)$ extra space complexity?