

Contains Duplicate II

For this problem we need to check if there are two equal elements whose indices differ by at most k .

Approach: Hash Map (Optimal)

Key Idea:

- Use a hash map to store the last index where each number appeared.
- While iterating:
 - If the number has been seen before and $i - \text{last index} \leq k$, return true.
 - Otherwise, update its last index in the map.

Algorithm:

- Create an unordered_map lastIndex.
- Iterate through nums with index i :
 - If $\text{nums}[i]$ exists in map:
 - Check if $i - \text{lastIndex}[\text{nums}[i]] \leq k$.
 - If true \rightarrow return true.
 - Update $\text{lastIndex}[\text{nums}[i]] = i$.
- Return false if no valid pair found.

Complexity:

- Time: $O(n)$ - single pass.
- Space: $O(n)$ - hash map storing indices of elements.