Documentation: Next Permutation

Overview

The Next Permutation problem involves finding the next lexicographically greater permutation of a given array of integers. In other words, it aims to rearrange the elements of the array into the next sequence in lexicographical order.

Problem Statement

Given an array of integers `nums`, the task is to find the next permutation of `nums`. The replacement must be done in-place, using only constant extra memory.

Examples

Example 1:

<u>Input:</u> nums = [1,2,3]

Output: [1,3,2]

Example 2:

<u>Input:</u> nums = [3,2,1]

Output: [1,2,3]

Example 3:

<u>Input:</u> nums = [1,1,5]

Output: [1,5,1]

Approach

The solution follows these steps:

1. Find the First Decreasing Element from the Right:

a. Iterate from the right end of the array to find the first element `nums[i]` such that `nums[i] < nums[i + 1]`. This element is the pivot where a potential change needs to happen.

2. Find the Smallest Element to the Right of the Pivot that is Greater than the Pivot:

- a. Iterate from the right end again to find the smallest element `nums[j]` to the right of `nums[i]` such that `nums[j] > nums[i]`.
- b. Swap `nums[i]` and `nums[j]`.

3. Reverse the Sub-array to the Right of the Pivot:

a. Reverse the sub-array starting from the element immediately to the right of `nums[i]` until the end of the array.

Complexity Analysis

4 Time Complexity:

- \checkmark O(n), where n is the length of the input array `nums`.
- ✓ The algorithm involves traversing the array twice, and in the worst case, reversing a sub-array.

♣ Space Complexity:O(1)

✓ The solution operates in-place, using only constant extra memory.

Constraints

- 1 <= nums.length <= 100
- $-0 \le nums[i] \le 100$