Experiment-2

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Subject Name: AP LAB-II
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1. **Aim:** Two Sum

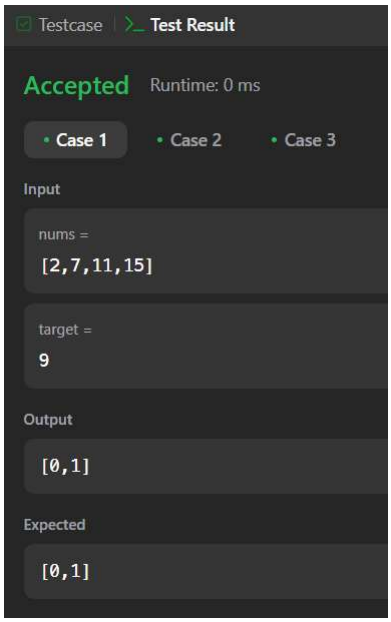
2. **Objective:** Given an array of integers nums and an integer target, return the indices of the two numbers such that they add up to target. Each input has exactly one solution, and you cannot use the same element twice. You can return the answer in any order. Example 1:
   Input: nums = [2,7,11,15], target = 9 Output: [0,1]
   Explanation: Because nums[0] + nums[1] == 9, we return [0, 1].

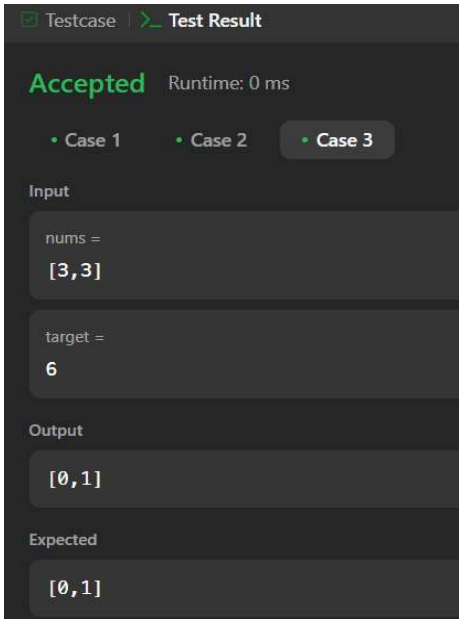
3. **Algorithm:**
   - Initialize an empty hash map (dict).
   - Iterate through the nums array:
   - For each element num, calculate the complement: complement = target - num.
   - Check if the complement exists in the hash map:
     If it does, return the indices of the complement and the current number.
   - If it doesn't, add the current number and its index to the hash map.
   - Return the indices of the two numbers that add up to the target.

4. **Implementation/Code:**

```
class Solution {
  public int[] twoSum(int[] nums, int target) {
    for (int i = 0; i < nums.length; i++) {
      for (int j = i + 1; j < nums.length; j++) {
        if (nums[i] + nums[j] == target) {
          return new int[] {i, j};
        }
      }
    }
    return new int[] {};
  }
}
```

5. Output:





6. Learning Outcome:

- We Learn About the use of maping.
- We Learn About the use of vector.
- We Learn About the use of indexing.
- We learn About the ordered map.
- We Learn About the Calling For the function.

7. **Time Complexity:** O (n), where n is the number of elements in the nums array. This is because we only iterate through the array once.

8. **Space Complexity**: O (n), since we store each number and its index in the hash map.

Question 2

1. **Aim:** Jump Game II.

2. **Objective:** You are given a 0-indexed array of integers nums of length n. You are initially positioned at nums[0]. Each element nums[i] represents the maximum length of a forward jump from index i. In other words, if you are at nums[i], you can jump to any nums[i + j] where: 0 <= j <= nums[i] and i + j < n. Return the minimum number of jumps to reach nums[n - 1]. The test cases are generated such that you can reach nums[n - 1].

   Example 1:

   Input: nums = [2,3,1,1,4]

   Output: 2

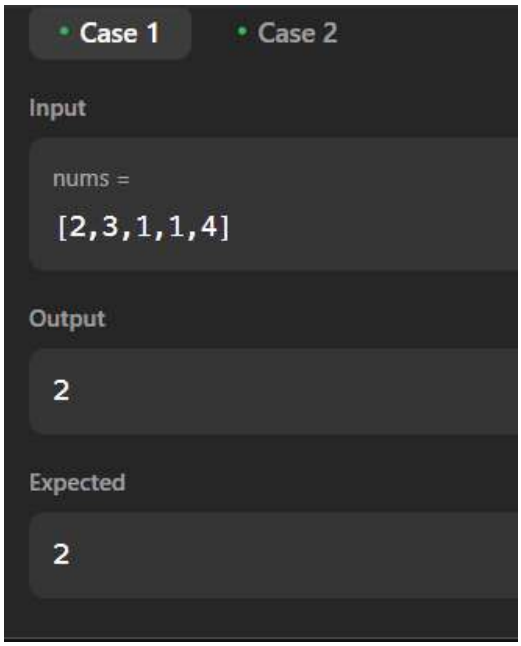
   Explanation: The minimum number of jumps to reach the last index is 2. Jump 1 step from index 0 to 1, then 3 steps to the last index.

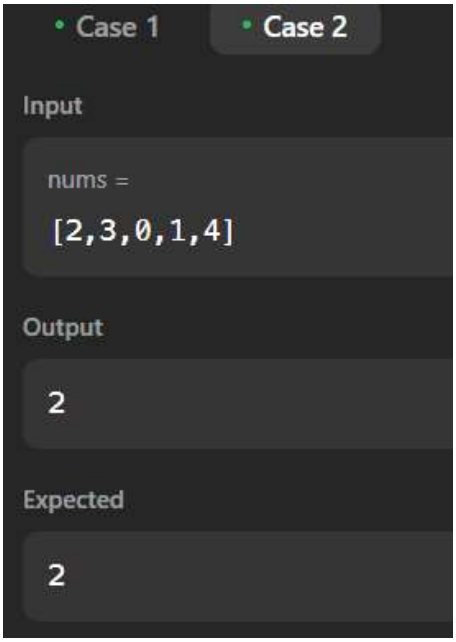
3. **Algorithm:**
   - Initialize jumps = 0, current_end = 0, farthest = 0.
   - Loop through indices i to n - 2, update farthest = max(farthest, i + nums[i]).
   - If i == current_end, increment jumps and set current_end = farthest.
   - Return jumps.

4. **Implementation/Code:**

```
class Solution {
    public int jump(int[] nums) {
        int jumps = 0, currentEnd = 0, farthest = 0;
        for (int i = 0; i < nums.length - 1; i++) {
            farthest = Math.max(farthest, i + nums[i]);
            if (i == currentEnd) {
                jumps++;
                currentEnd = farthest;
            }
        }
        return jumps;
    }
}
```

5. Output:





6. Learning Outcome:

- We Learn About the use of Running vector.
- We Learn About the use of vector.
- We Learn About the use of max function.
- We learn About the jumping into int indexes.
- We Learn About the Calling For the libraries.

7. Complexity:

- The time complexity of the algorithm is O(n). The loop iterates through the array once, performing constant-time operations at each index.
- The space complexity of the algorithm is O(1).It uses a constant amount of extra space for variables like jumps, current_end, and farthest.