Experiment 1

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Branch: CSE **Section:** NTPP_602-A
Semester: 6th **DOP:** 20/01/25
Subject: AP-LAB-2 **Subject Code:22CSP-351**

Aim:

Problem 1.2.1: Two Sum

- **Problem Statement:** 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.

Problem 1.2.2: Jump Game II

- **Problem Statement:** You are given a 0-indexed array 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. Return the minimum number of jumps to reach nums[n - 1].

Problem 1.2.3: Simplify Path

- **Problem Statement**: Given a string path, which is an absolute path to a file or directory in a Unix-style file system, convert it to the simplified canonical path.

Algorithm:

1. Two Sum Problem (Algorithm)

1. Create a hash map to store numbers and their indices.
2. Iterate through the array `nums`:
    - For each number `num`, compute the difference `diff = target - num`.
    - Check if `diff` exists in the hash map.
        - If yes, return `[index of diff, current index]`.
        - Otherwise, store `num` and its index in the hash map.

2. Jump Game II (Algorithm)

1. Initialize `jumps = 0`, `current_end = 0`, and `farthest = 0`.
2. Traverse the array from index `0` to `len(nums) - 1`:
    - Update `farthest = max(farthest, i + nums[i])`.
    - If you reach `current_end`:
        - Increment `jumps`.
        - Update `current_end = farthest`.
3. Return `jumps` after reaching the end of the array.

Simplify Path (Algorithm)

1. Split the input `path` by `/` to get components.
2. Use a stack to process the components:
    - For each component:
        - If it is `.` or empty, skip it.
        - If it is `..`, pop from the stack (if the stack is not empty).
        - Otherwise, push the component onto the stack.
3. Join the elements in the stack with `/` and prepend `/` to construct the simplified path.
4. Return the result.

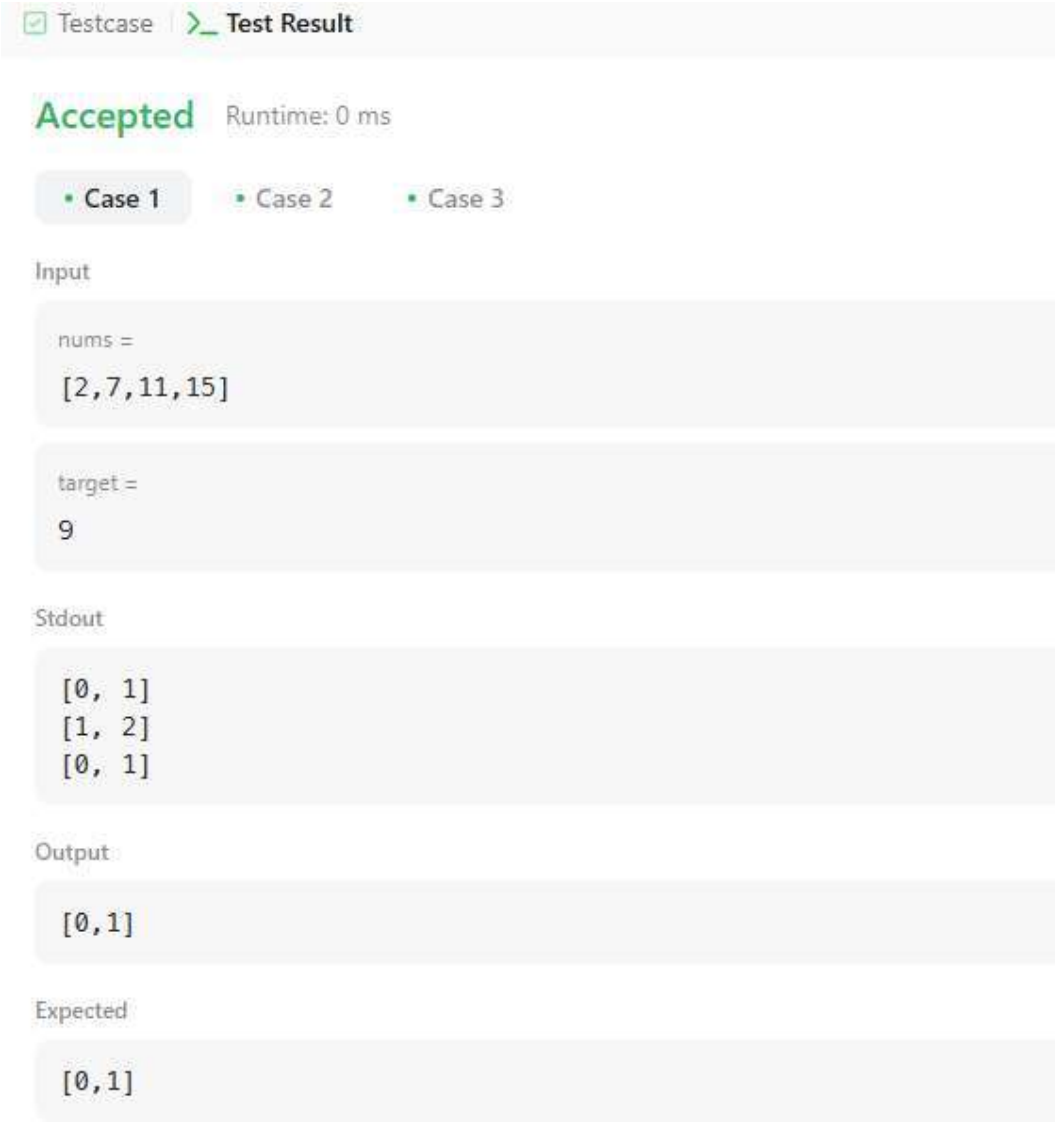
Code: 1.2.1

</> Code

Python3 Auto

```python
class Solution:
    def twoSum(self, nums, target):
        seen = {}
        for i, num in enumerate(nums):
            complement = target - num
            if complement in seen:
                return [seen[complement], i]
            seen[num] = i

# ROSH
solution = Solution()

nums1 = [2, 7, 11, 15]
target1 = 9
print(solution.twoSum(nums1, target1))

nums2 = [3, 2, 4]
target2 = 6
print(solution.twoSum(nums2, target2))

nums3 = [3, 3]
target3 = 6
print(solution.twoSum(nums3, target3))

```

Output:


Testcase
Test Result
Accepted
Runtime: 0 ms
Case 1
Case 2
Case 3
Input
nums =
[2,7,11,15]
target =
9
Stdout
[0, 1]
[1, 2]
[0, 1]
Output
[0,1]
Expected
[0,1]

Testcase | Test Result

Accepted Runtime: 0 ms

• Case 1 • Case 2 • Case 3

Input

nums =
[3,2,4]

target =
6

Output

[1,2]

Expected

[1,2]

Testcase | Test Result

Accepted Runtime: 0 ms

• Case 1 • Case 2 • Case 3

Input

nums =
[3,3]

target =
6

Output

[0,1]

Expected

[0,1]

CODE: 1.2.2

Code

Python3 Auto

```python
class Solution:
    def jump(self, nums):
        n = len(nums)
        jumps = 0
        current_end = 0
        farthest = 0

        for i in range(n - 1):
            farthest = max(farthest, i + nums[i])
            if i == current_end:
                jumps += 1
                current_end = farthest
                if current_end >= n - 1:
                    break

        return jumps

# ROSH
solution = Solution()

nums1 = [2, 3, 1, 1, 4]
print(solution.jump(nums1))

nums2 = [2, 3, 0, 1, 4]
print(solution.jump(nums2))

```

OUTPUT:

Testcase | Test Result

Accepted Runtime: 0 ms

• Case 1 • Case 2

Input

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

Stdout

2
2

Output

2

Expected

2

Testcase | Test Result

Accepted Runtime: 0 ms

• Case 1 • Case 2

Input

nums =
[2,3,0,1,4]

Output

2

Expected

2

CODE: 1.2.3

</> Code

Python3 Auto

```
    def simplifyPath(self, path):
        stack = []
        parts = path.split('/')
        for part in parts:
            if part == '..':
                if stack:
                    stack.pop()
            elif part and part != '.':
                stack.append(part)
        return '/' + '/'.join(stack)

# ROSH
solution = Solution()

path1 = "/home/"
print(solution.simplifyPath(path1))

path2 = "/home//foo/"
print(solution.simplifyPath(path2))

path3 = "/home/user/Documents/../Pictures"
print(solution.simplifyPath(path3))

path4 = "/../"
print(solution.simplifyPath(path4))

path5 = "/.../a/../b/c/../d/./"
print(solution.simplifyPath(path5))
```

OUTPUT:

Testcase | Test Result

Accepted Runtime: 0 ms

• Case 1 • Case 2 • Case 3 • Case 4 • Case 5

Input

path =
"/home/"

Stdout

```
/home
/home/foo
/home/user/Pictures
/
/.../b/d
```

Output

"/home"

Expected

"/home"

Testcase | Test Result

Accepted Runtime: 0 ms

• Case 1 • Case 2 • Case 3 • Case 4 • Case 5

Input

path =
"/home//foo/"

Output

"/home/foo"

Expected

"/home/foo"

Testcase | Test Result

Accepted Runtime: 0 ms

• Case 1 • Case 2 • Case 3 • Case 4 • Case 5

Input

path =
"/home/user/Documents/../Pictures"

Output

"/home/user/Pictures"

Expected

"/home/user/Pictures"

Testcase | Test Result

Accepted Runtime: 0 ms

• Case 1 • Case 2 • Case 3 • Case 4 • Case 5

Input

path =
"/../"

Output

"/"

Expected

"/"

Learning Outcomes:

- Understand how to efficiently solve the Two Sum Problem using a hash map to optimize time complexity.
- Learn to implement a greedy algorithm for Jump Game II to minimize jumps while maintaining linear time complexity.
- Acquire skills in processing and simplifying file paths using stacks in the Simplify Path problem.
- Develop problem-solving techniques for handling string manipulation and edge cases in Unix-style file systems.
- Enhance algorithmic thinking by applying data structures like hash maps and stacks to solve real-world problems effectively.