WORKSHEET 6

Student Name: Jayant Sharma **UID:** 22BCS16668

Branch: BE-CSE **Section/Group:** 22BCS_NTPP-602-A

Semester: 6th **Date of Performance:** 20/02/2025

Subject Name: AP LAB - II **Subject Code:** 22CSP-351

1. **Aim:** Given an integer array nums representing the amount of money of each house, return the maximum amount of money you can rob tonight without alerting the police1

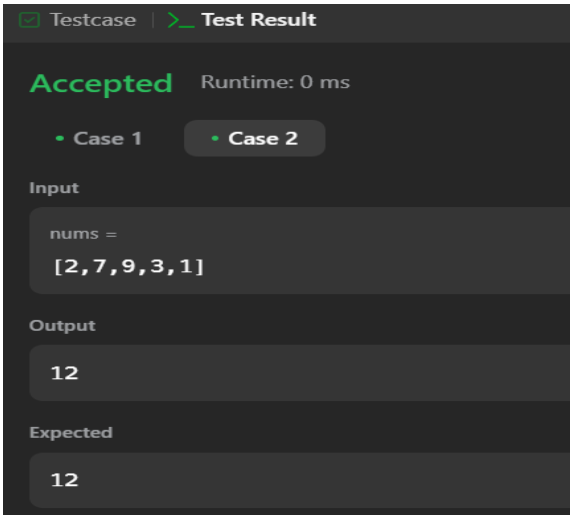
2. **Source Code:**

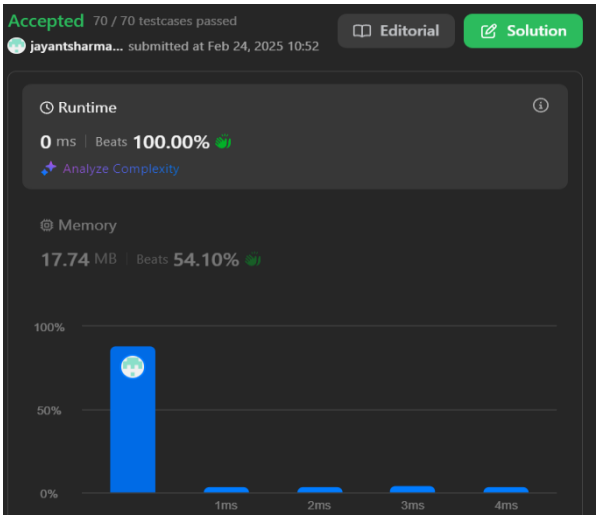
```
def rob(self, nums: List[int]) -> int:
    if not nums:
        return 0
    if len(nums) == 1:
        return nums[0]

    prev, curr = 0, 0
    for num in nums:
        prev, curr = curr, max(curr, prev + num)

    return curr
```

3. Screenshots of outputs:





2. Aim: Given the two integers m and n, return the number of possible unique paths that the robot can take to reach the bottom-right corner.

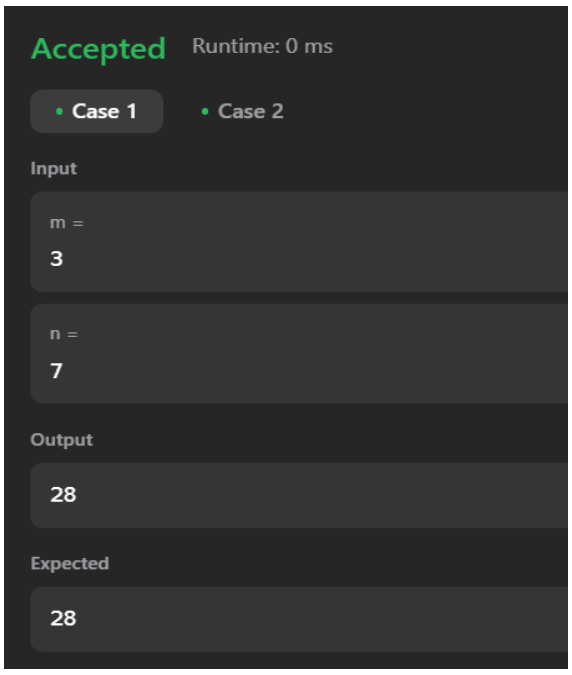
Source Code

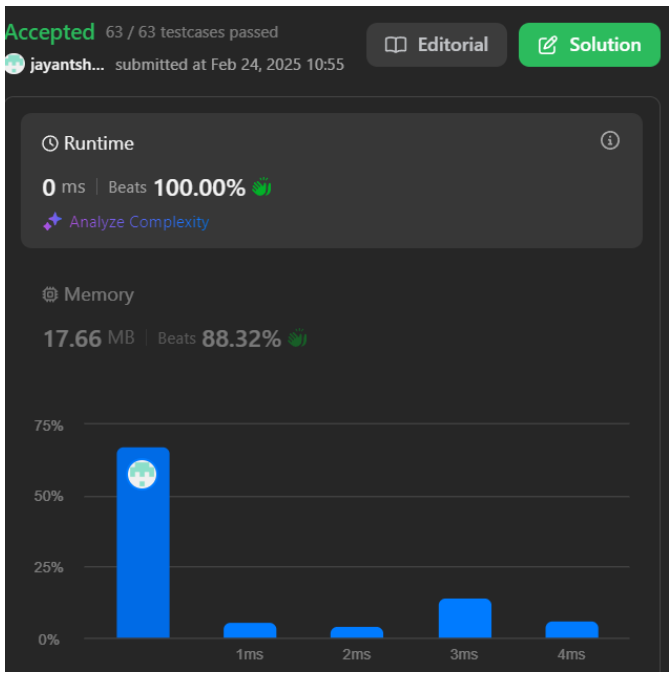
```
class Solution:
    def uniquePaths(self, m: int, n: int) -> int:
        dp = [[1] * n for _ in range(m)]

        for i in range(1, m):
            for j in range(1, n):
                dp[i][j] = dp[i - 1][j] + dp[i][j - 1]

        return dp[-1][-1]
```

Screenshots of outputs:





3. Aim: Given an integer array nums, find a subarray that has the largest product, and return the product.

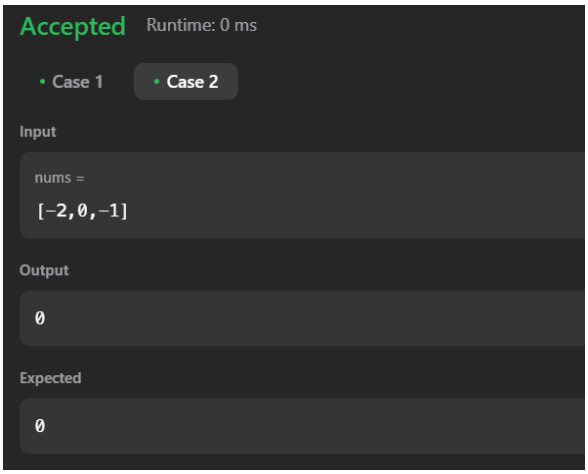
Source Code:

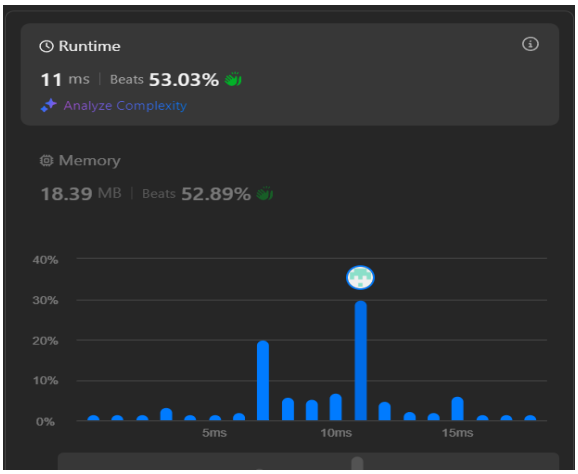
```
class Solution:
    def maxProduct(self, nums: List[int]) -> int:
        max_prod = min_prod = result = nums[0]

        for num in nums[1:]:
            temp_max = max(num, max_prod * num, min_prod * num)
            min_prod = min(num, max_prod * num, min_prod * num)
            max_prod = temp_max
            result = max(result, max_prod)

        return result
```

Screenshots of outputs:





4. Aim: Given an integer n, return *the least number of perfect square numbers that sum to* n.

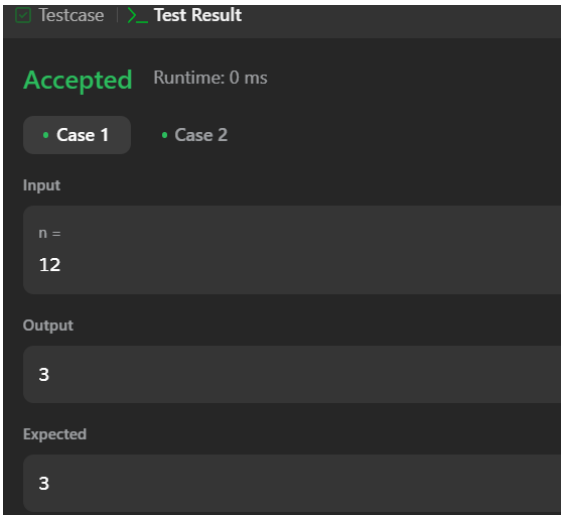
Source Code:

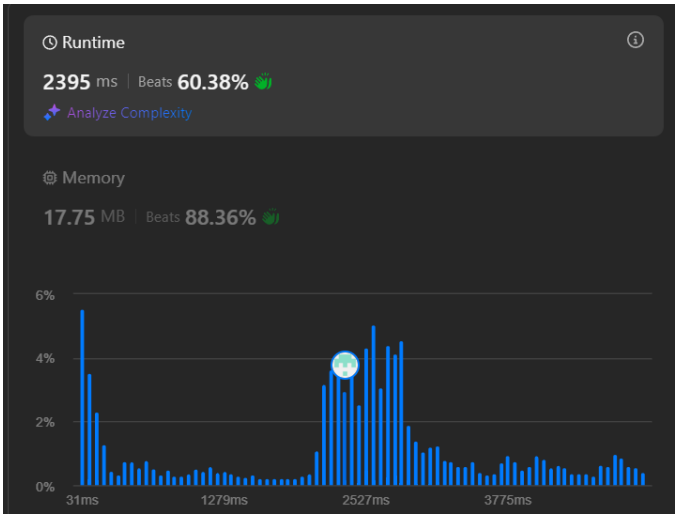
```
class Solution:
    def numSquares(self, n: int) -> int:
        dp = [float('inf')] * (n + 1)
        dp[0] = 0

        for i in range(1, n + 1):
            for j in range(1, int(math.sqrt(i)) + 1):
                dp[i] = min(dp[i], dp[i - j * j] + 1)

        return dp[n]
```

4. Screenshots of outputs:





Learning Outcomes:

- Binary Tree Construction:* Efficiently reconstruct a binary tree from inorder and postorder traversals using recursion and hash maps.
- Dynamic Programming (DP) Concepts:* Applying DP to solve problems like the minimum number of perfect squares summing to n, unique paths in a grid, and house robber problem.
- State Transition Optimization:* Utilizing DP and variable swapping to optimize space complexity, as seen in rob() and maxProduct().
- Mathematical Approaches:* Understanding how mathematical properties like square numbers and factorial-based paths contribute to problem-solving.
- Algorithmic Thinking:* Developing problem-solving skills with recursive tree construction, iterative DP, and greedy strategies for maximizing results.