Experiment-6

Student Name: Muskan Sai
UID: 22BCS13525
Branch: BE-CSE
Section/Group: KPIT-901/B
Semester: 6th
Date of Performance: 06/03/25
Subject Name: Advanced Programming Lab - 2
Subject Code: 22CSP-351

1. Aim: Dynamic Programming.

1. Problem: 55. Jump Game.
2. Problem: 322. Coin Change.

2. Objective:

1. This program checks whether you can reach the last index of the given array nums, where each element represents the maximum number of steps you can jump forward.
2. This program finds the minimum number of coins needed to make up a given amount using coins of different denominations. If it is not possible, it returns -1.

3. Implementation/Code:

1.)

```
class Solution {
public:
    bool canJump(vector<int>& nums) {
        int maxReach = 0;
        int n = nums.size();

        for (int i = 0; i < n; i++) {
            if (i > maxReach) return false;
            maxReach = max(maxReach, i + nums[i]);
            if (maxReach >= n - 1) return true;
```

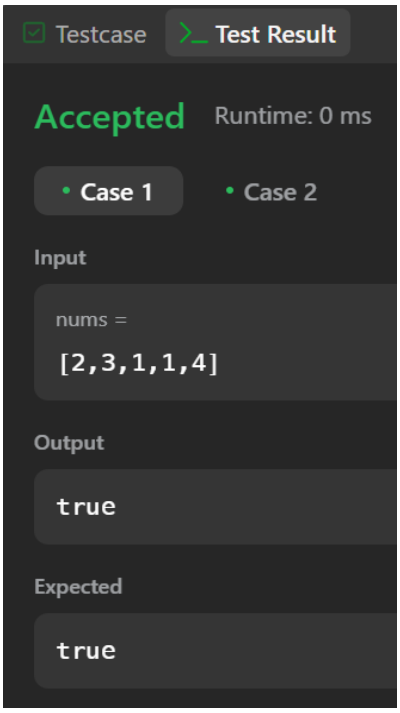
```
        }

        return false;
    }
};
```

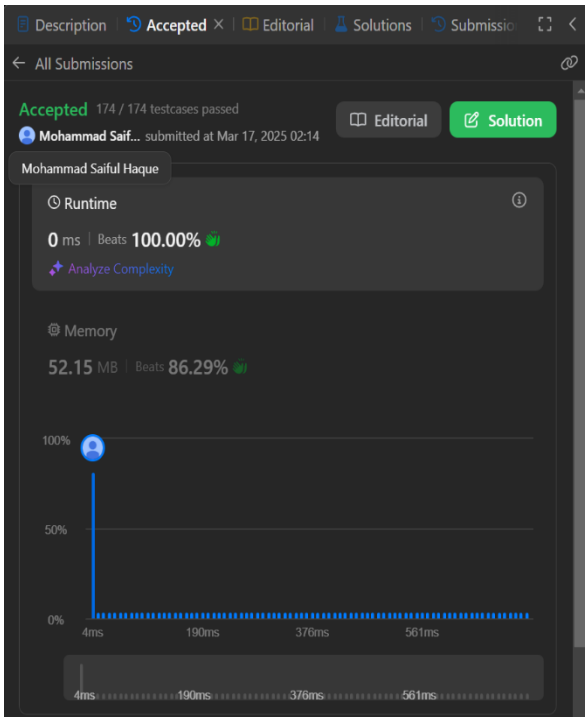
2.)

```
class Solution {
public:
    int coinChange(vector<int>& coins, int amount) {
        vector<int> dp(amount + 1, amount + 1);
        dp[0] = 0;

        for (int i = 1; i <= amount; i++) {
            for (int coin : coins) {
                if (i >= coin) {
                    dp[i] = min(dp[i], dp[i - coin] + 1);
                }
            }
        }

        return (dp[amount] == amount + 1) ? -1 : dp[amount];
    }
};
```

4. Output:

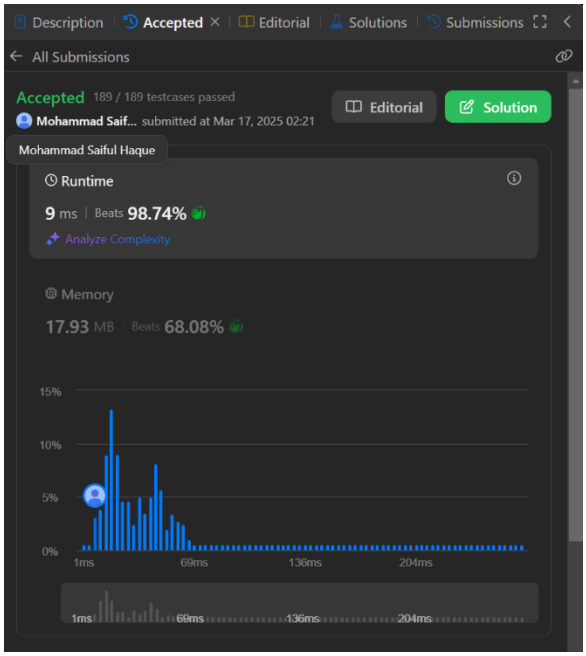
1.


Testcase
Test Result
Accepted
Runtime: 0 ms
Case 1
Case 2
Input
nums =
[2,3,1,1,4]
Output
true
Expected
true


Description
Accepted
Editorial
Solutions
All Submissions
Accepted 174 / 174 testcases passed
Mohammad Saif... submitted at Mar 17, 2025 02:14
Editorial
Solution
Mohammad Saiful Haque
Runtime
0 ms | Beats 100.00%
Analyze Complexity
Memory
52.15 MB | Beats 86.29%
100%
50%
0%
4ms
190ms
376ms
561ms

2.


Testcase
Test Result
Accepted
Runtime: 0 ms
Case 1
Case 2
Case 3
Input
coins =
[1,2,5]
amount =
11
Output
3
Expected
3


Description
Accepted
Editorial
Solutions
Submissions
All Submissions
Accepted 189 / 189 testcases passed
Mohammad Saif... submitted at Mar 17, 2025 02:21
Editorial
Solution
Mohammad Saiful Haque
Runtime
9 ms | Beats 98.74%
Analyze Complexity
Memory
17.93 MB | Beats 68.08%
15%
10%
5%
0%
1ms
69ms
136ms
204ms

5. **Time Complexity:**
   1. O(n)
   2. O (n * m)

6. **Space Complexity:**
   1. O (1)
   2. O(n)

7. **Learning Outcome:**
   1. Understand greedy algorithms and dynamic programming (DP) and their applications in solving optimization problems.
   2. Learn how to track reachability in arrays using a greedy approach and how to use a bottom-up DP approach to compute the minimum number of coins.
   3. Gain experience in handling edge cases, such as unreachable indices in the Jump Game and impossible amounts in the Coin Change problem.
   4. Improve problem-solving skills by breaking down complex problems into smaller sub-problems and optimizing solutions using efficient conditions and early exits.
   5. Learn how to optimize space complexity (O (1) in Jump Game, O(n) in Coin Change) while maintaining efficient time complexity.
   6. Gain insight into real-world applications, such as pathfinding, resource allocation, and financial computations, by applying DP and greedy strategies.