



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

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Experiment: -7

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Semester: 6th

Date of Performance: 19/03/2025

Subject Name: Advanced Programming Lab-2 **Subject Code:** 22CSP-351

Problem -1

1. Aim: Climbing Stairs

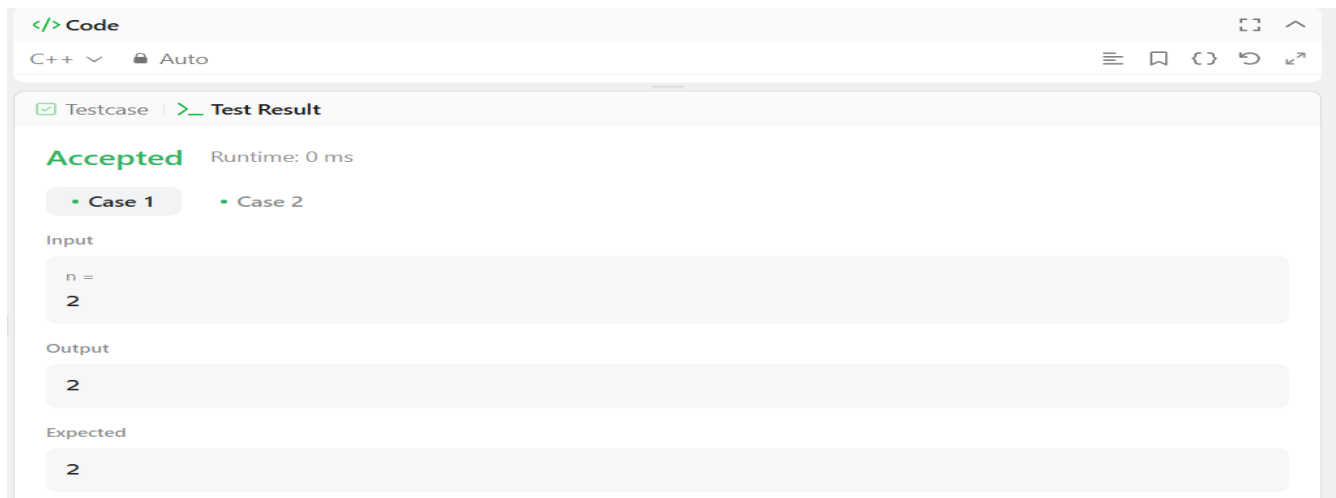
2. Objective:

- **Understanding the Problem:** To understand how to solve the staircase problem using a simple mathematical pattern based on previous steps.
- **Using Fibonacci Sequence:** To learn how the Fibonacci sequence helps calculate the number of ways to climb stairs.
- **Practicing Code Efficiency:** To practice using loops and variables to write efficient and clean code by updating values and avoiding repetitive calculations, which improves performance.
- **Handling Edge Cases:** To understand how to handle edge cases like small values and ensure correct output.
- **Improving Problem-Solving:** To improve problem-solving skills by applying dynamic programming concepts

3. Implementation/Code:

```
class Solution {
public:
    int climbStairs(int n) {
        if (n==1) return 1;
        int a=1,b=2;
        for (int i=3;i<=n;i++) {
            int temp =a+b;
            a=b;
            b=temp;
        }
        return b;
    }
};
```

4. Output:



The screenshot shows a C++ IDE interface. At the top, there's a 'Code' editor with a C++ dropdown and an 'Auto' button. Below it, the 'Test Result' tab is selected, showing a green 'Accepted' status. The input field contains 'n = 2' and the output field contains '2', which matches the 'Expected' value. The runtime is listed as '0 ms'.

Figure 1

5. Learning Outcome:

- **Pattern Recognition:** You will understand how to find patterns and use them to solve coding problems.
- **Applying Fibonacci:** You will learn how to apply the Fibonacci sequence in real-life scenarios.
- **Enhancing Coding Skills:** You will improve your coding skills by practicing loops and updating variables.
- **Simplifying Problems:** You will understand how to simplify problems by breaking them into smaller steps.
- **Building Confidence:** You will become more confident in solving mathematical problems using code.

Problem-2

1. Aim: Maximum Subarray

2. Objectives:

- **Understanding the Problem:** To understand how to find the subarray with the largest sum from a given integer array using a logical approach.
- **Using Kadane's Algorithm:** To learn how Kadane's algorithm helps find the maximum subarray sum by efficiently updating current and maximum sums.
- **Practicing Efficient Coding:** To practice using loops and conditions to update the sum quickly and avoid unnecessary calculations.
- **Handling Negative Numbers:** To understand how to handle both positive and negative values while calculating the maximum sum.
- **Exploring Advanced Approaches:** To explore the divide and conquer method for solving the problem more efficiently with deeper understanding.

3. Implementation/Code:

```
class Solution {  
public:  
    int maxSubArray(vector<int>& nums) {  
        int maxSum = nums[0], currentSum = nums[0];  
        for (int i = 1; i < nums.size(); ++i) {  
            currentSum = max(nums[i], currentSum + nums[i]);  
            maxSum = max(maxSum, currentSum);  
        }  
        return maxSum;  
    }  
};
```

4. Output:



The screenshot shows a C++ IDE with the following details:

- Code Editor:** Displays the C++ code for the `maxSubArray` function.
- Testcase:** A green checkmark indicates the test case passed.
- Test Result:** Shows "Accepted" in green text, with a runtime of "0 ms".
- Case Selection:** Three tabs are visible: "Case 1" (selected), "Case 2", and "Case 3".
- Input:** A text box shows the input array: `nums = [-2, 1, -3, 4, -1, 2, 1, -5, 4]`.
- Output:** A text box shows the result: `6`.
- Expected:** A text box shows the expected result: `6`.

Figure 2

5. Learning Outcomes

- **Better Problem-Solving Skills:** You will learn how to analyze array problems and develop a logical approach to find the largest sum.
- **Understanding Kadane's Algorithm:** You will understand how Kadane's algorithm works and why it is effective for finding maximum subarray sums.
- **Writing Clean and Fast Code:** You will improve your ability to write efficient code by properly using loops and conditions.
- **Handling Edge Cases:** You will be able to handle cases with mixed positive and negative numbers confidently.
- **Applying Advanced Methods:** You will gain experience in using the divide and conquer approach to solve complex array problems.

Problem: -3

1. Aim: Jump Game

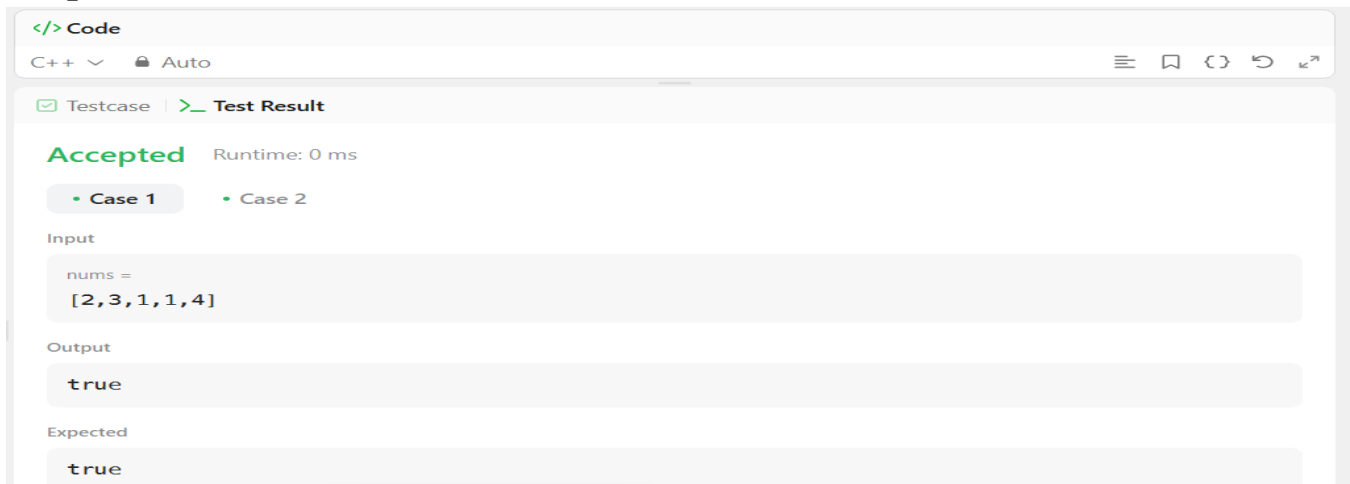
2. Objectives:

- **Understanding the Problem:** To understand how to check if you can reach the last index using jump values in the array.
- **Using Greedy Approach:** To learn how the greedy approach helps in finding the maximum reachable index at each step.
- **Practicing Efficient Code:** To practice writing efficient code using loops and conditions to reduce calculations.
- **Handling Stuck Positions:** To understand how to handle cases where progress is blocked due to zero jump value.
- **Optimizing Performance:** To improve performance by stopping early once the last index is reachable.

3. Implementation/Code:

```
class Solution {  
public:  
    bool canJump(vector<int>& nums) {  
        int maxReach=0;  
        for (int i=0; i<nums.size();i++) {  
            if (i > maxReach) return false;  
            maxReach=max(maxReach,i+nums[i]);  
            if (maxReach>=nums.size()-1) return true;  
        }  
        return false;  
    }  
};
```

4. Output:



The screenshot shows a C++ IDE with the following details:

- Code Editor:** Displays the C++ code for the Jump Game problem.
- Testcase:** A green checkmark indicates the test case is passed.
- Test Result:** Shows "Accepted" in green text, with a runtime of "0 ms".
- Case Selection:** Two tabs are visible: "Case 1" (selected) and "Case 2".
- Input:** A text box shows the input array: `nums = [2, 3, 1, 1, 4]`.
- Output:** A text box shows the output: `true`.
- Expected:** A text box shows the expected output: `true`.

Figure 3



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5. Learning Outcomes:

- **Better Problem Solving:** You will learn how to solve array-based movement problems step-by-step.
- **Understanding Greedy Method:** You will understand how the greedy approach helps in making the best jump decision.
- **Writing Clean Code:** You will improve your coding skills by writing simple and optimized code.
- **Handling Edge Cases:** You will know how to handle cases where movement is blocked by zero jump value.
- **Improving Efficiency:** You will learn to write faster solutions by reducing unnecessary calculations.