

### Experiment-7

**Name: RIYA RANA**

**UID: 22BET10314**

**Branch: BE-IT**

**Section/Group: 22BET\_702-B**

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

#### **Problem 1- House Robber**

**Aim** -You are given an array nums representing the amount of money in each house along a street. You cannot rob two adjacent houses. Find the maximum amount of money you can rob without alerting the police.

#### **Code:**

```
class Solution
{ public:
    int rob(vector<int>& nums)
        { int n = nums.size();

        if (n == 1)
            { return
              nums[0];
            }

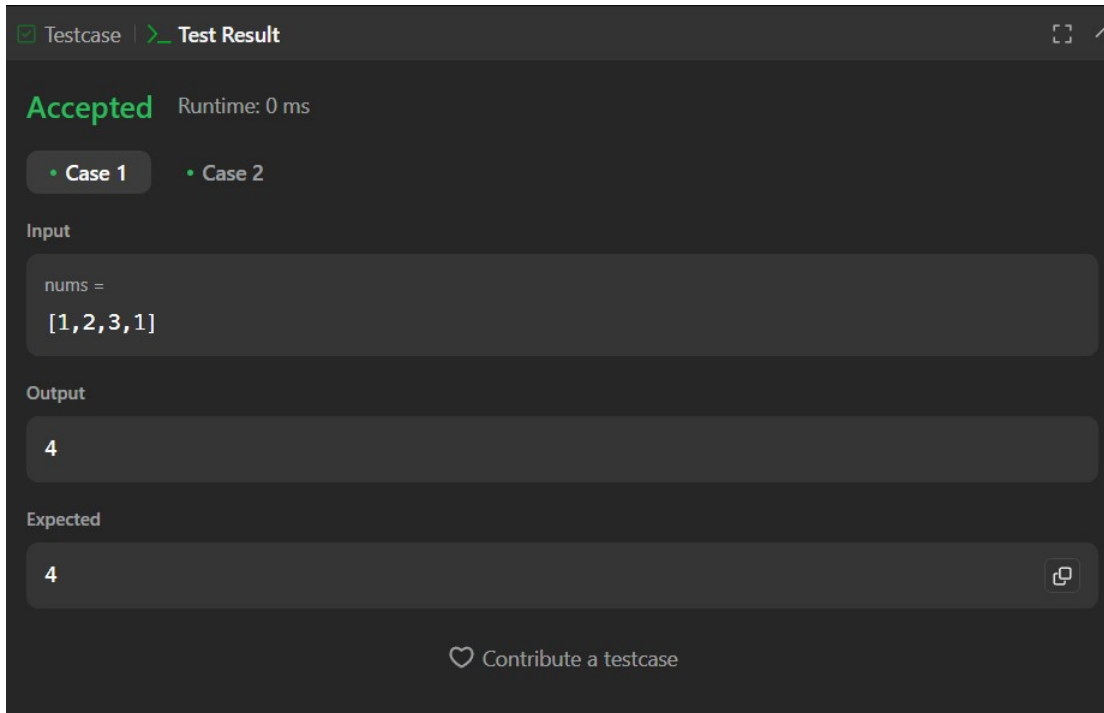
        vector<int> dp(n, 0);

        dp[0] = nums[0];
        dp[1] = max(nums[0], nums[1]);

        for (int i = 2; i < n; i++) {
            dp[i] = max(dp[i - 1], nums[i] + dp[i - 2]);
        }

        return dp[n - 1];
    }
};
```

## Output:



## Problem 2-Jump Game

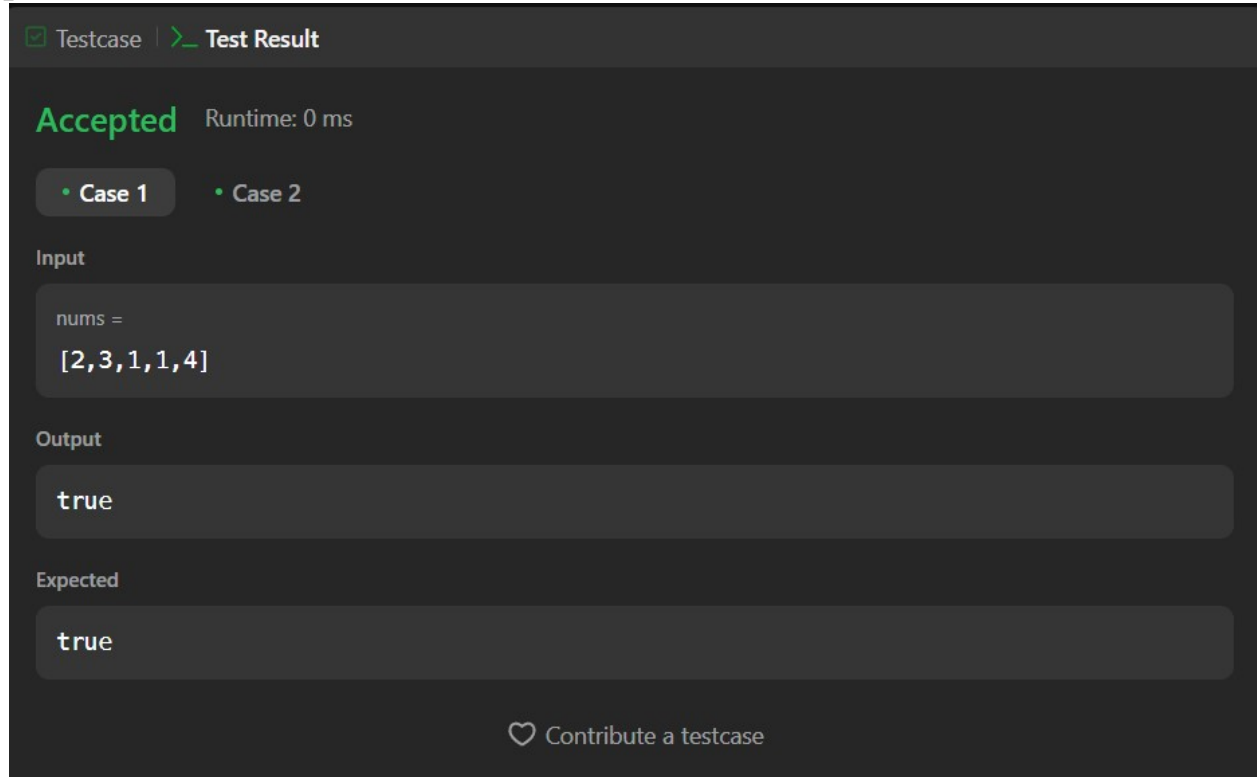
**Aim :-** Given an array `nums` where `nums[i]` represents the maximum jump length from index `i`, determine if you can reach the last index starting from index 0.

### Code:

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

```
        return goal == 0;
    }
};
```

## Output:



Testcase | Test Result

**Accepted** Runtime: 0 ms

• Case 1 • Case 2

Input

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

Output

true

Expected

true

♥ Contribute a testcase

## Problem 3:-Unique Paths

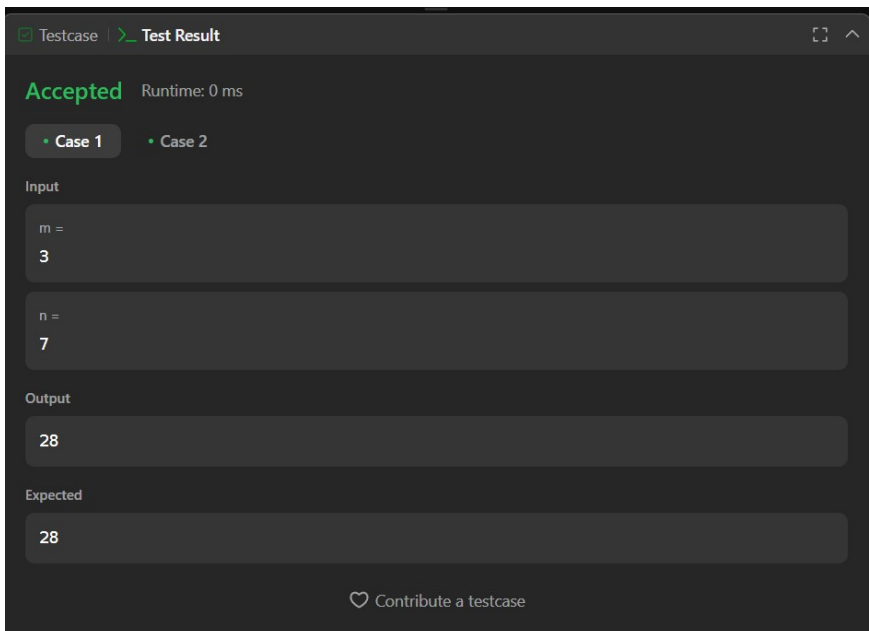
**Aim-** Given the two integers m and n, return the number of possible unique paths that the robot can take to reach the bottom-right corner.

## Code:

```
class Solution
{ public:
//    int f(int m,int n,vector<vector<int>>& dp){
//        if(m==0 && n==0) return 1;
//        if(m<0 || n<0) return 0;
//        if(dp[m][n]!=-1) return dp[m][n];
//        int up = f(m-1,n,dp);
```

```
//      int left = f(m,n-1,dp);
//      return dp[m][n] = up+left;
//  }
int uniquePaths(int m, int n)
{ int dp[m][n];
  // tabulation
  dp[0][0]=1;
  for(int i = 0 ; i<m ;
    i++){ for(int j = 0 ; j<n ;
    j++){
      if(i==0 && j==0) continue;
      int up=0,left=0;
      if(i>0) up = dp[i-1][j];
      if(j>0) left = dp[i][j-1];
      dp[i][j] = up + left;
    }
  }
  return dp[m-1][n-1];
}
```

## Output:



The screenshot shows a web-based code execution environment. At the top, it says "Testcase" and "Test Result". Below this, it indicates "Accepted" with a green checkmark and "Runtime: 0 ms". There are two tabs: "Case 1" (selected) and "Case 2". Under "Input", there are two fields: "m =" with the value "3" and "n =" with the value "7". Under "Output", there is a field showing the value "28". Under "Expected", there is a field showing the value "28". At the bottom, there is a link that says "Contribute a testcase" with a heart icon.

### Problem 4:- Coin Change

**Aim-** Given a list of coins with different denominations and an integer amount, find the fewest number of coins needed to make up that amount. If it's not possible, return -1.

#### Code:

```
class Solution
{ public:
    int coinChange(vector<int>& coins, int amount)
    { int n=coins.size();
      int t[n+1][amount+1];
      for(int i=0;i<n+1;i++){
          for(int
              j=0;j<amount+1;j++){ if(i==
              0){
                  t[i][j]=INT_MAX-1;
              }
              if(j==0){ t[i]
                  [j]=0;
              }
          }
      }
      for(int
          i=1;i<amount+1;i++){ if(i%coins[0]
          ==0) t[1][i]=i/coins[0]; else
          t[1][i]=INT_MAX-1;
      }
      for(int i=2;i<n+1;i++){
          for(int
              j=1;j<amount+1;j++){ if(c
              oins[i-1]<=j){
                  t[i][j]=min(1+t[i][j-coins[i-1]],t[i-1][j]);
              }
              else{
                  t[i][j]=t[i-1][j];
              }
          }
      }
    }
```

```
        }  
    }  
    if( t[n][amount]==INT_MAX-  
        1){ return -1;  
    }  
    else{  
        return t[n][amount];  
    }  
}  
};
```

## Output:

☒ Testcase | [Test Result](#)

Accepted Runtime: 0 ms

[• Case 1](#) [• Case 2](#) [• Case 3](#)

Input

coins =  
[1,2,5]

amount =  
11

Output

3

Expected

3

[♥ Contribute a testcase](#)

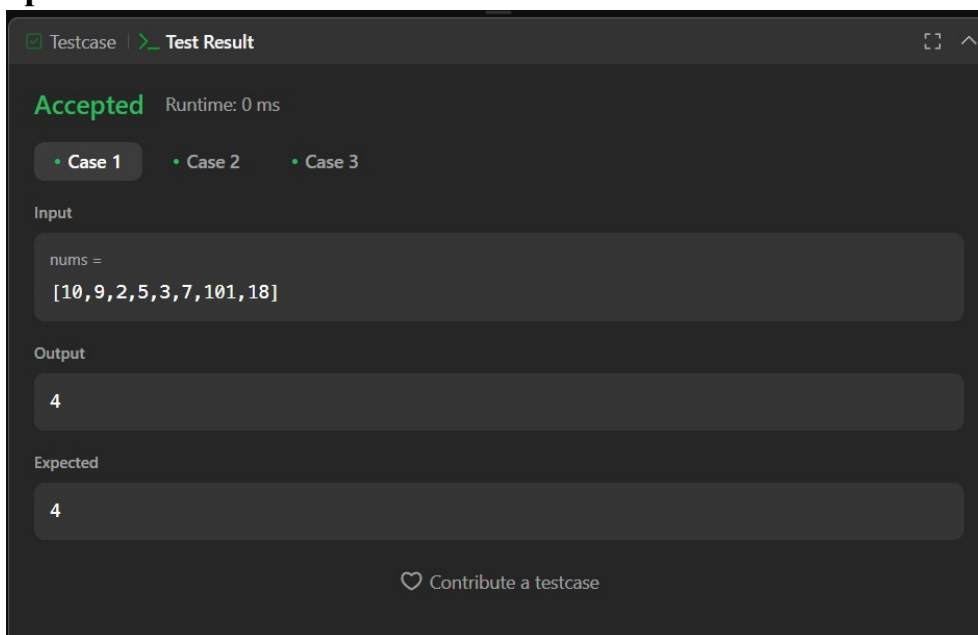
## Problem 5. Longest Increasing Subsequence

**Aim-**Given an integer array nums, return the length of the longest increasing subsequence (LIS). A subsequence is a sequence derived from an array by deleting some or no elements without changing the order.

### Code:

```
class Solution { // 256 ms, faster than 42.84%
public:
    int lengthOfLIS(vector<int>& nums)
    { int n = nums.size();
      vector<int> dp(n, 1);
      for (int i = 0; i < n; ++i)
          for (int j = 0; j < i; ++j)
              if (nums[i] > nums[j] && dp[i] < dp[j] + 1)
                  dp[i] = dp[j] + 1;
      return *max_element(dp.begin(), dp.end());
    }
};
```

### Output:



The screenshot shows a web-based code execution environment. At the top, there are tabs for 'Testcase' and 'Test Result', with 'Test Result' being the active tab. Below the tabs, the status 'Accepted' is displayed in green, followed by 'Runtime: 0 ms'. There are three tabs for different test cases: 'Case 1', 'Case 2', and 'Case 3', with 'Case 1' being selected. Under the 'Input' section, the variable 'nums =' is followed by the array '[10,9,2,5,3,7,101,18]'. The 'Output' section shows the result '4'. The 'Expected' section also shows '4'. At the bottom, there is a link to 'Contribute a testcase'.

## Problem 6. Maximum Product Subarray

**Aim-**Given an integer array nums, find the contiguous subarray (of at least one number) that has the largest product and return the product.

### Code:

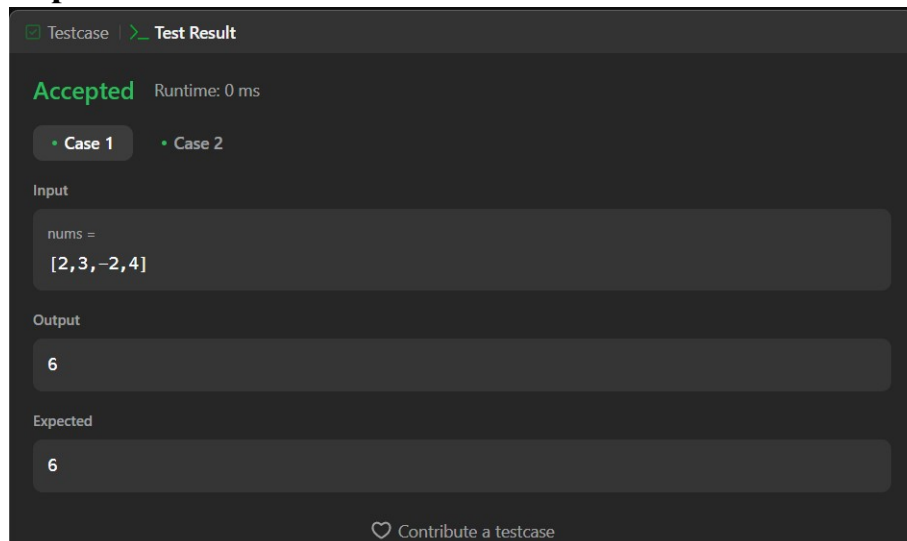
```
class Solution
{ public:
    int maxProduct(vector<int>& nums) {
        int res = *max_element(nums.begin(), nums.end());
        int curMax = 1, curMin = 1;

        for (int n : nums) {
            int temp = curMax * n;
            curMax = max({temp, curMin * n, n});
            curMin = min({temp, curMin * n, n});

            res = max(res, curMax);
        }

        return res;
    }
};
```

### Output:



The screenshot shows a test result interface with a dark theme. At the top, there are tabs for 'Testcase' and 'Test Result', with 'Test Result' being the active tab. Below the tabs, the word 'Accepted' is displayed in green, followed by 'Runtime: 0 ms'. There are two tabs for test cases, 'Case 1' and 'Case 2', with 'Case 1' being the active tab. Under the 'Case 1' tab, the 'Input' section shows 'nums =' followed by a text box containing '[2,3,-2,4]'. The 'Output' section shows a text box containing '6'. The 'Expected' section shows a text box containing '6'. At the bottom of the interface, there is a link that says 'Contribute a testcase' with a heart icon.



### Problem 7:- Decode Ways

**Aim-**Given a string  $s$  containing digits, return the number of ways to decode it. Each digit (1-26) maps to A-Z (1  $\rightarrow$  A, 2  $\rightarrow$  B, ..., 26  $\rightarrow$  Z).

#### Code:

```
class Solution
{ public:
    int numDecodings(string s)
    { if (s[0] == '0') {
        return 0;
    }

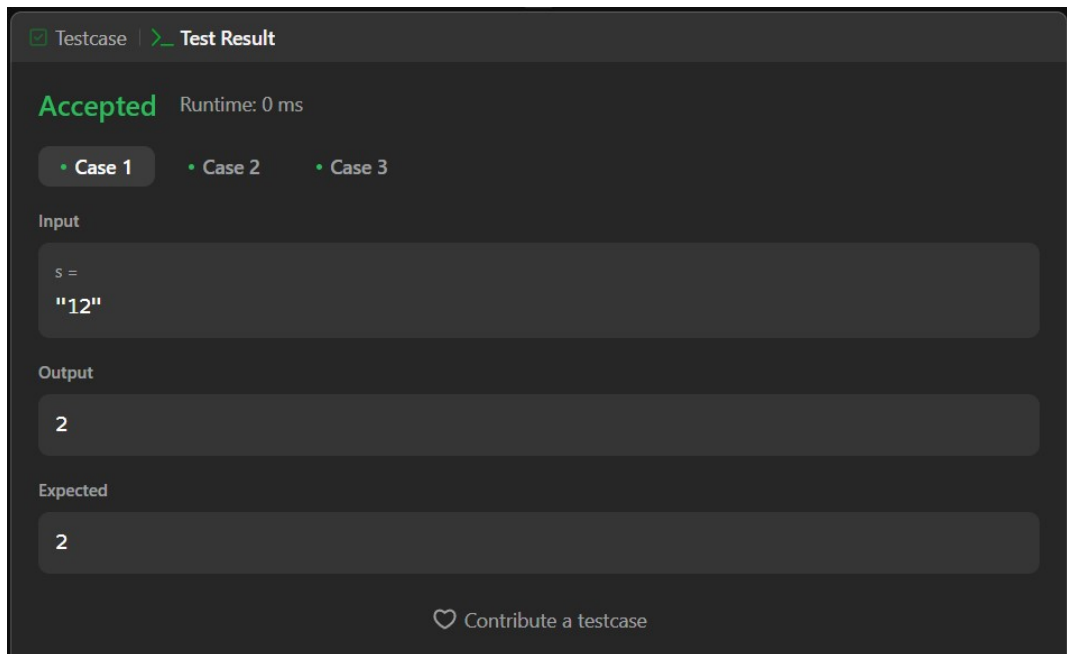
    int n = s.length();
    vector<int> dp(n + 1, 0);
    dp[0] = dp[1] = 1;

    for (int i = 2; i <= n; i++)
    { int one = s[i - 1] - '0';
      int two = stoi(s.substr(i - 2, 2));

      if (1 <= one && one <= 9)
      { dp[i] += dp[i - 1];
      }
      if (10 <= two && two <= 26)
      { dp[i] += dp[i - 2];
      }
    }

    return dp[n];
}
};
```

## Output:



## Problem 8:-Best time to buy and Sell a Stock with Cooldown

**Aim-**You are given an array prices where prices[i] is the price of a given stock on day i. You may buy and sell the stock multiple times, but after selling, you must wait one day (cooldown) before buying again. Find the maximum profit you can achieve.

## Code:-

```
class Solution
{ public:
    int maxProfit(vector<int>& prices) {

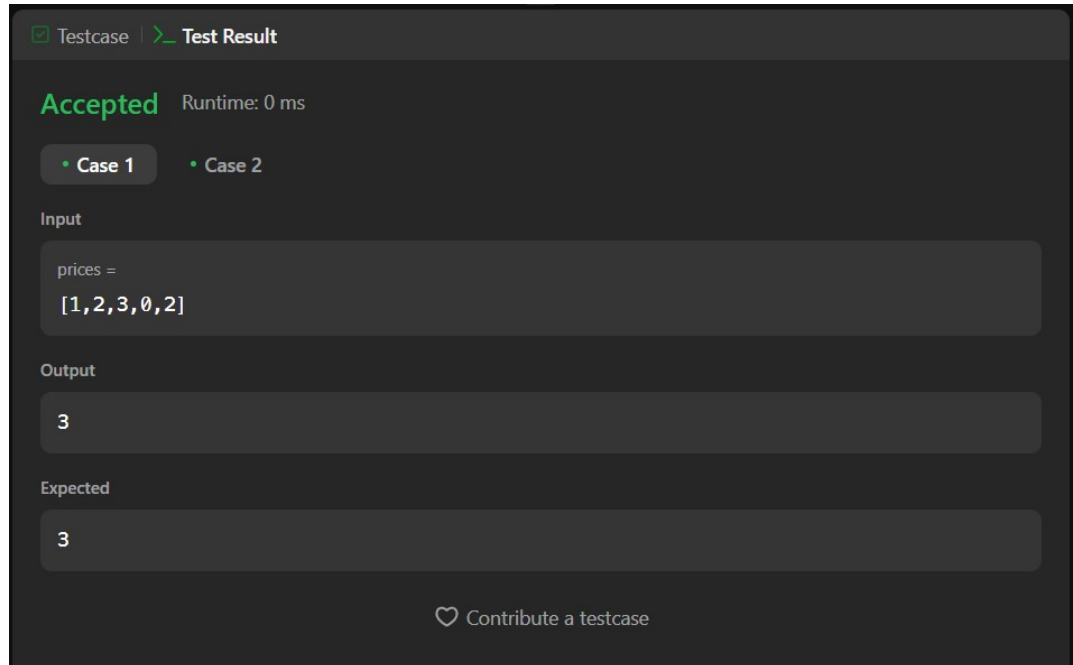
        int coolDown=0, sell=0, hold=std::numeric_limits<int>::min();

        for( int stockPrice_Day_i : prices){

            int prevCoolDown = coolDown, prevSell = sell, prevHold = hold;
            coolDown = max(prevCoolDown, prevSell);
            sell = prevHold + stockPrice_Day_i;
            hold = max(prevHold, prevCoolDown - stockPrice_Day_i);
```

```
    }  
  
    return max( sell, coolDown );  
}  
}
```

**Output:-**



### Problem 9:- Perfect Squares

**Aim-** Given an integer n, return the least number of perfect square numbers (1, 4, 9, 16, ...) that sum to n.

**Code:-**

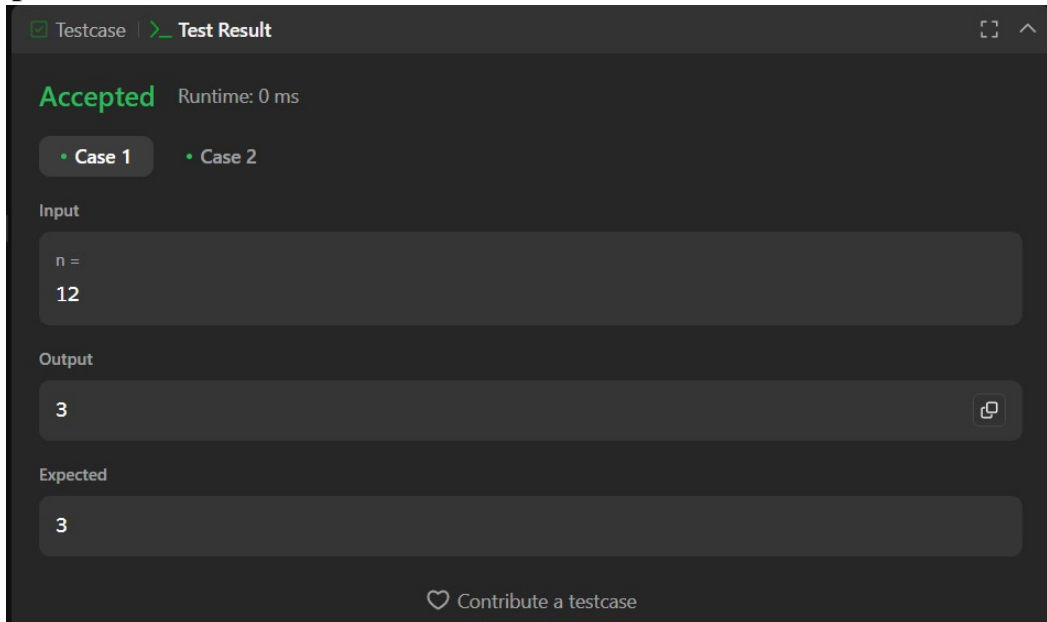
```
class Solution  
{ public:  
    int numSquares(int n) {  
        vector<int> dp(n + 1, INT_MAX);  
        dp[0] = 0;  
        for (int i = 1; i <= n; ++i) {  
            for (int j = 1; j * j <= i; ++j){  
                dp[i] = min(dp[i], dp[i - j * j] + 1);  
            }  
        }  
    }  
}
```

```

    }
  }
  return dp[n];
}
};

```

**Output:-**



## Problem 10:- Word Break

**Aim-**Given a string *s* and a dictionary of strings *wordDict*, return true if *s* can be segmented into a space-separated sequence of one or more dictionary words.

**Code:-**

```

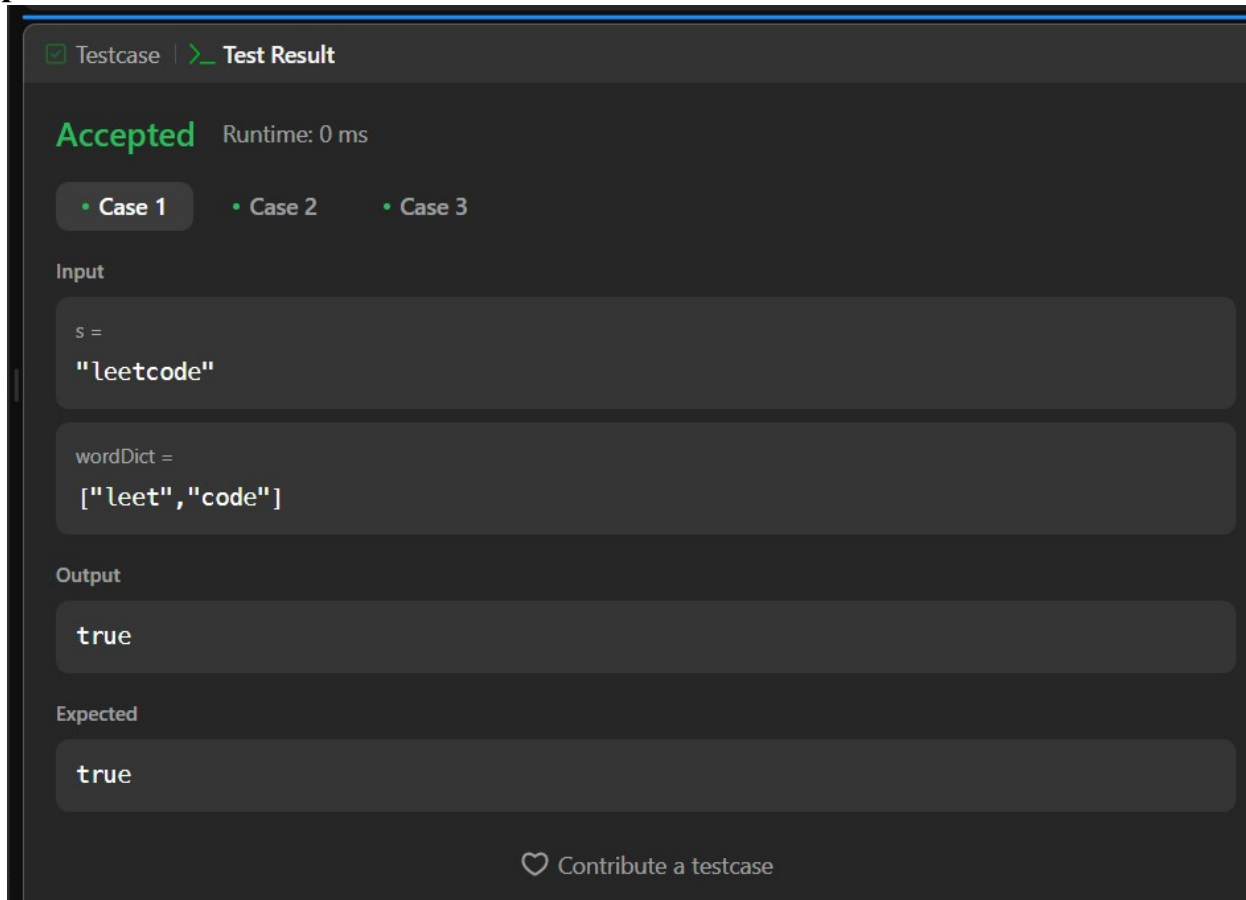
class Solution
{ public:
    bool wordBreak(string s, vector<string>& wordDict)
    { vector<bool> dp(s.size() + 1, false);
      dp[0] = true;

      for (int i = 1; i <= s.size(); i++) {
        for (const string& w : wordDict)
          { int start = i - w.length();

```

```
        if (start >= 0 && dp[start] && s.substr(start, w.length()) == w)
            { dp[i] = true;
              break;
            }
        }
    }
    return dp[s.size()];
}
};
```

**Output:-**



The screenshot displays a test result interface with a dark theme. At the top, there are tabs for 'Testcase' and 'Test Result', with 'Test Result' being the active tab. Below the tabs, the status 'Accepted' is shown in green, followed by 'Runtime: 0 ms'. There are three tabs for different test cases: 'Case 1' (selected), 'Case 2', and 'Case 3'. Under the 'Input' section, there are two text boxes: the first contains 's =' followed by '"leetcode"' on the next line, and the second contains 'wordDict =' followed by '["leet", "code"]' on the next line. The 'Output' section shows a text box with the value 'true'. The 'Expected' section also shows a text box with the value 'true'. At the bottom, there is a link with a heart icon that says 'Contribute a testcase'.

### Problem 11:- Word Break 2

**Aim** - Given a string *s* and a dictionary of strings *wordDict*, add spaces in *s* to construct a sentence where each word is a valid dictionary word. Return all such possible sentences in any order.

#### Code:-

```
class Solution
{ public:
    void solve(string s, vector<string>& res, unordered_set<string>& st,
vector<string>&temp){
        if(s.length() ==
            0){ string str = "";
            for(auto it:temp){
                str += it + " ";
            }
            str.pop_back();
            res.push_back(str);
            return;
        }
        for(int i=0;i<s.length();
            i++){ if(st.count(s.substr(0,
            i+1))) {
                temp.push_back(s.substr(0, i+1));
                solve(s.substr(i+1), res, st, temp);
                temp.pop_back();
            }
        }
    }
vector<string> wordBreak(string s, vector<string>& wordDict)
{ vector<string>res, temp;
    unordered_set<string>st(wordDict.begin(), wordDict.end());

    solve(s, res, st, temp);
    return res;
}
};
```



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## Output-

☒ Testcase | [Test Result](#)

**Accepted** Runtime: 0 ms

- Case 1
- Case 2
- Case 3

Input

```
s =  
"catsanddog"
```

```
wordDict =  
["cat", "cats", "and", "sand", "dog"]
```

Output

```
["cat sand dog", "cats and dog"]
```

Expected

```
["cats and dog", "cat sand dog"]
```

[Contribute a testcase](#)