DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

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DOMAIN WINTER WINNING CAMP 2024

Student Name: Sreshtha Sharma **UID:** 22BCS11268
Branch: CSE **Section/Group:** 22BCS_FL_IOT-603/A
Semester: 6th

VERY EASY

1. N-th Tribonacci Number

The Tribonacci sequence Tn is defined as follows:
T0 = 0, T1 = 1, T2 = 1, and Tn+3 = Tn + Tn+1 + Tn+2 for n >= 0. Given n, return the value of Tn.

Example 1:
Input: n = 4
Output: 4
Explanation:
T_3 = 0 + 1 + 1 = 2
T_4 = 1 + 1 + 2 = 4

Example 2: Input: n = 25
Output: 1389537
Constraints: 0 <= n <= 37
The answer is guaranteed to fit within a 32-bit integer, ie. answer <= 2^31 - 1.

CODE:
```
def tribonacci(n:
int) -> int:
   if n == 0:        return 0
if n in (1, 2):        return
1     dp = [0, 1, 1]      for i
in range(3, n + 1):
       dp.append(dp[i - 1] + dp[i - 2] + dp[i - 3])
return dp[n]
print(tribonacci(4))
```

Output

```
4

=== Code Execution Successful ===
```

Easy

2. Climbing Stairs

You are climbing a staircase. It takes n steps to reach the top. Each time you can either climb 1 or 2 steps. In how many distinct ways can you climb to the top?

Example 1: Input: n = 2
Output: 2
Explanation: There are two ways to climb to the top.
1. 1 step + 1 step
2. 2 steps
Constraints:1 <= n <= 45

CODE: def climbStairs(n: int) -> int: if n == 1: return 1 dp = [0] * (n + 1) dp[1], dp[2] = 1, 2 for i in range(3, n + 1): dp[i] = dp[i - 1] + dp[i - 2] return dp[n]

print(climbStairs(2)) # Output: 2

```
Output

2

=== Code Execution Successful ===
```

***Medium*:**

3. Longest Palindromic Substring

Given a string s, return the longest palindromic substring in s.

Example 1: Input: s = "babad"
Output: "bab"
Explanation: "aba" is also a valid answer.

Example 2: Input: s = "cbbd"
Output: "bb"

Constraints: 1 <= s.length <= 1000 s consist of only digits and English letters.

CODE: def longestPalindrome(s: str) -> str: def expand_around_center(left, right): while left >= 0 and right < len(s) and s[left] == s[right]: left -= 1
right += 1
  return left + 1, right - 1

 start, end = 0, 0 for i in range(len(s)):
l1, r1 = expand_around_center(i, i)
l2, r2 = expand_around_center(i, i + 1)
if r1 - l1 > end - start: start, end = l1, r1 if r2 - l2 > end - start:
start, end = l2, r2
 return s[start:end + 1]

print(longestPalindrome("babad")) # Output: "bab" or "aba"

```
Output
bab

=== Code Execution Successful ===
```

Hard

4. Maximal Rectangle

Given a rows x cols binary matrix filled with 0's and 1's, find the largest rectangle containing only 1's and return its area.

Example-

1	0	1	0	0
1	0	1	1	1
1	1	1	1	1
1	0	0	1	0

Input:matrix=
[["1","0","1","0","0"],["1","0","1","1","1"],["1","1","1","1","1"],["1","0","0","1","0"]]
Output: 6

Explanation: The maximal rectangle is shown in the above picture.

Constraints: rows == matrix.length cols == matrix[i].length 1 <= row, cols <= 200 matrix[i][j] is '0' or '1'.

CODE:

```
def maximalRectangle(matrix):     if not matrix:
return 0     def largest_histogram_area(heights):
stack = []         max_area = 0         heights.append(0)
for i, h in enumerate(heights):             while stack and
heights[stack[-1]] > h:                 height =
heights[stack.pop()]                 width = i if not stack
else i - stack[-1] - 1                 max_area =
max(max_area, height * width)
stack.append(i)         return max_area     cols =
len(matrix[0])     heights = [0] * cols     max_area = 0
for row in matrix:
        for j in range(cols):
            heights[j] = heights[j] + 1 if row[j] == "1" else 0
max_area = max(max_area, largest_histogram_area(heights))
return max_area
matrix = [["1", "0", "1", "0", "0"], ["1", "0", "1", "1", "1"], ["1", "1", "1", "1", "1"],
["1", "0", "0", "1", "0"]] print(maximalRectangle(matrix))
```

Output

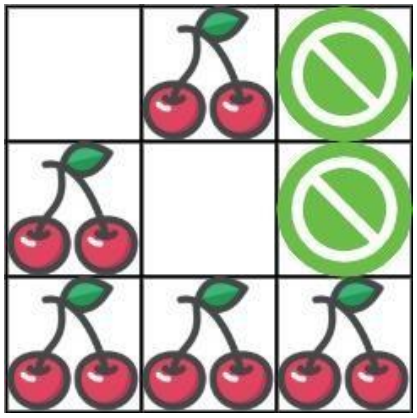
```
6

=== Code Execution Successful ===
```

Very Hard

5. Cherry Pickup

You are given an n x n grid representing a field of cherries, each cell is one of three possible integers.
0 means the cell is empty, so you can pass through,
1 means the cell contains a cherry that you can pick up and pass through, or -1 means the cell contains a thorn that blocks your way.

Return the maximum number of cherries you can collect by following the rules below:
Starting at the position (0, 0) and reaching (n - 1, n - 1) by moving right or down through valid path cells (cells with value 0 or 1).
After reaching (n - 1, n - 1), returning to (0, 0) by moving left or up through valid path cells. When passing through a path cell containing a cherry, you pick it up, and the cell becomes an empty cell 0.
If there is no valid path between (0, 0) and (n - 1, n - 1), then no cherries can be collected.



Input: grid = [[0,1,-1],[1,0,-1],[1,1,1]]
Output: 5
Explanation: The player started at (0, 0) and went down, down, right right to reach (2, 2). 4 cherries were picked up during this single trip, and the matrix becomes [[0,1,-1],[0,0,1],[0,0,0]].
Then, the player went left, up, up, left to return home, picking up one more cherry. The total number of cherries picked up is 5, and this is the maximum possible.

Example 2: Input: grid = [[1,1,-1],[1,-1,1],[-1,1,1]]
Output: 0

Constraints: n ==
grid.length n ==
grid[i].length 1 <=
n <= 50
grid[i][j] is -1, 0, or 1.
grid[0][0] != -1
grid[n - 1][n - 1] != -1

CODE: def
cherryPickup(grid):
    n = len(grid)
    dp = [[[float('-inf')] * n for _ in range(n)] for __ in range(n)]
dp[0][0][0] = grid[0][0]

```
   for r1 in range(n):        for c1 in range(n):            for c2 in
range(n):                r2 = r1 + c1 - c2                if 0 <= r2 < n and
grid[r1][c1] != -1 and grid[r2][c2] != -1:
                cherries = grid[r1][c1]                    if c1 != c2:
cherries += grid[r2][c2]                prev = max(                    dp[r1 -
1][c1][c2] if r1 > 0 else float('-inf'),                    dp[r1][c1 - 1][c2] if
c1 > 0 else float('-inf'),                dp[r1 - 1][c1][c2 - 1] if r1 > 0 and
c2 > 0 else float('-inf'),                dp[r1][c1 - 1][c2 - 1] if c1 > 0 and
c2 > 0 else float('-inf'),
                )
                dp[r1][c1][c2] = prev + cherries if prev != float('-inf') else float('-inf')

   return max(0, dp[n - 1][n - 1][n - 1])

grid = [[0, 1, -1], [1, 0, -1], [1, 1, 1]] print(cherryPickup(grid))
```

Output

```
0

=== Code Execution Successful ===
```