

CS-594: Lab Exam - 3

Instructors: Dr. Sanasam Ranbir Singh and Prof. S.V. Rao

(Duration: 3 hrs)

Instructions:

- **You need to solve all questions using recursion** and apply memoization/dynamic programming wherever necessary, you are required to **explain your logic of recursion, base case and recursive part**.
- Make sure you take inputs from console and program should **not be hardcoded**.
- **Partial Marks for Quality of Code, Explanation and Efficiency to handle cases and marks will not be for input examples.**

Q1 Climbing Stairs [1 Mark]

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?

Constraints: $1 \leq n \leq 45$

Example 1: Input: n = 2 Output: 2	Example 2: Input: n = 3 Output: 3
Explanation: There are two ways to climb to the top. 1. 1 step + 1 step 2. 2 steps	Explanation: There are three ways to climb to the top. 1. 1 step + 1 step + 1 step 2. 1 step + 2 steps 3. 2 steps + 1 step.

Hint: Try to think in terms of famous series taught in class.

Q2 Decode Ways [2 Marks]

A message containing letters from A-Z can be encoded into numbers using the following mapping:

'A' -> "1"

'B' -> "2"

...

'Z' -> "26"

To decode an encoded message, all the digits must be grouped then mapped back into letters using the reverse of the mapping above (there may be multiple ways). For example, "11106" can be mapped into:

"AAJF" with the grouping (1 1 10 6)

"KJF" with the grouping (11 10 6)

Note that the grouping (1 11 06) is invalid because "06" cannot be mapped into 'F' since "6" is different from "06".

Given a string *s* containing only digits, return the number of ways to decode it.

Constraints:

1 <= *s*.length <= 20

s contains only digits and may contain leading zero(s).

Example 1: Input: <i>s</i> = "12" Output: 2	Example 2: Input: <i>s</i> = "226" Output: 3
Explanation: "12" could be decoded as "AB" (1 2) or "L" (12).	Explanation: "226" could be decoded as "BZ" (2 26), "VF" (22 6), or "BBF" (2 2 6).

Hint: This is similar to climbing stairs problem, difference being you need to start from index 0 and think in terms of how you can combine 1 or 2 digits and count ways.