Problem 3154: Find Number of Ways to Reach the K-th Stair

Problem Information

Difficulty: Hard
Acceptance Rate: 37.05%
Paid Only: No
Tags: Math, Dynamic Programming, Bit Manipulation, Memoization, Combinatorics

Problem Description

You are given a **non-negative** integer `k`. There exists a staircase with an infinite number of stairs, with the **lowest** stair numbered 0.

Alice has an integer `jump`, with an initial value of 0. She starts on stair 1 and wants to reach stair `k` using **any** number of **operations**. If she is on stair `i`, in one **operation** she can:

* Go down to stair `i - 1`. This operation **cannot** be used consecutively or on stair 0. * Go up to stair `i + 2jump`. And then, `jump` becomes `jump + 1`.

Return the _total_ number of ways Alice can reach stair `k`.

Note that it is possible that Alice reaches the stair `k`, and performs some operations to reach the stair `k` again.

Example 1:

Input: k = 0

Output: 2

Explanation:

The 2 possible ways of reaching stair 0 are:

* Alice starts at stair 1. * Using an operation of the first type, she goes down 1 stair to reach stair 0. * Alice starts at stair 1. * Using an operation of the first type, she goes down 1 stair to reach stair 0. * Using an operation of the second type, she goes up 20 stairs to reach stair 1. * Using an operation of the first type, she goes down 1 stair to reach stair 0.

Example 2:

Input: k = 1

Output: 4

Explanation:

The 4 possible ways of reaching stair 1 are:

* Alice starts at stair 1. Alice is at stair 1. * Alice starts at stair 1. * Using an operation of the first type, she goes down 1 stair to reach stair 0. * Using an operation of the second type, she goes up 20 stairs to reach stair 1. * Alice starts at stair 1. * Using an operation of the second type, she goes up 20 stairs to reach stair 2. * Using an operation of the first type, she goes down 1 stair to reach stair 1. * Alice starts at stair 1. * Using an operation of the first type, she goes down 1 stair to reach stair 0. * Using an operation of the second type, she goes up 20 stairs to reach stair 1. * Using an operation of the first type, she goes down 1 stair to reach stair 0. * Using an operation of the second type, she goes up 21 stairs to reach stair 2. * Using an operation of the first type, she goes down 1 stair to reach stair 1.

Constraints:

* `0 <= k <= 109`

Code Snippets

C++:

```
class Solution {
public:
int waysToReachStair(int k) {

}
};
```

Java:

```
class Solution {
public int waysToReachStair(int k) {

}
}
```

Python3:

```
class Solution:
def waysToReachStair(self, k: int) -> int:
```