

Problem 3621: Number of Integers With Popcount-Depth Equal to K I

Problem Information

Difficulty: Hard

Acceptance Rate: 21.31%

Paid Only: No

Tags: Math, Dynamic Programming, Bit Manipulation, Combinatorics

Problem Description

You are given two integers `n` and `k`.

For any positive integer `x`, define the following sequence:

* `p0 = x` * `pi+1 = popcorn(pi)` for all `i >= 0`, where `popcorn(y)` is the number of set bits (1's) in the binary representation of `y`.

This sequence will eventually reach the value 1.

The **popcount-depth** of `x` is defined as the **smallest** integer `d >= 0` such that `pd = 1`.

For example, if `x = 7` (binary representation "111"). Then, the sequence is: `7 -> 3 -> 2 -> 1`, so the popcorn-depth of 7 is 3.

Your task is to determine the number of integers in the range `[1, n]` whose popcorn-depth is **exactly** equal to `k`.

Return the number of such integers.

Example 1:

Input: n = 4, k = 1

Output: 2

****Explanation:****

The following integers in the range `[1, 4]` have popcount-depth exactly equal to 1:

x | Binary | Sequence ---|---|--- 2 | `"10" | `2 -> 1` 4 | `"100" | `4 -> 1` Thus, the answer is 2.

****Example 2:****

****Input:**** n = 7, k = 2

****Output:**** 3

****Explanation:****

The following integers in the range `[1, 7]` have popcount-depth exactly equal to 2:

x | Binary | Sequence ---|---|--- 3 | `"11" | `3 -> 2 -> 1` 5 | `"101" | `5 -> 2 -> 1` 6 | `"110" | `6 -> 2 -> 1` Thus, the answer is 3.

****Constraints:****

* `1 <= n <= 1015` * `0 <= k <= 5`

Code Snippets

C++:

```
class Solution {
public:
    long long pageCountDepth(long long n, int k) {
        }
};
```

Java:

```
class Solution {
public long pageCountDepth(long n, int k) {
```

```
    }  
    }
```

Python3:

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