

# Problem 3352: Count K-Reducible Numbers Less Than N

## Problem Information

**Difficulty:** Hard

**Acceptance Rate:** 26.72%

**Paid Only:** No

**Tags:** Math, String, Dynamic Programming, Combinatorics

## Problem Description

You are given a **binary** string `s` representing a number `n` in its binary form.

You are also given an integer `k`.

An integer `x` is called **k-reducible** if performing the following operation **at most** `k` times reduces it to 1:

\* Replace `x` with the **count** of set bits in its binary representation.

For example, the binary representation of 6 is `"110"`. Applying the operation once reduces it to 2 (since `"110"` has two set bits). Applying the operation again to 2 (binary `"10"`) reduces it to 1 (since `"10"` has one set bit).

Return an integer denoting the number of positive integers **less** than `n` that are **k-reducible**.

Since the answer may be too large, return it **modulo** `109 + 7`.

**Example 1:**

**Input:** s = "111", k = 1

**Output:** 3

**\*\*Explanation:\*\***

`n = 7`. The 1-reducible integers less than 7 are 1, 2, and 4.

**\*\*Example 2:\*\***

**\*\*Input:\*\*** s = "1000", k = 2

**\*\*Output:\*\*** 6

**\*\*Explanation:\*\***

`n = 8`. The 2-reducible integers less than 8 are 1, 2, 3, 4, 5, and 6.

**\*\*Example 3:\*\***

**\*\*Input:\*\*** s = "1", k = 3

**\*\*Output:\*\*** 0

**\*\*Explanation:\*\***

There are no positive integers less than `n = 1`, so the answer is 0.

**\*\*Constraints:\*\***

\* `1 <= s.length <= 800` \* `s` has no leading zeros. \* `s` consists only of the characters '0' and '1'. \* `1 <= k <= 5`

## Code Snippets

**C++:**

```
class Solution {
public:
    int countKReducibleNumbers(string s, int k) {
        }
    };
}
```

**Java:**

```
class Solution {  
    public int countKReducibleNumbers(String s, int k) {  
        }  
    }
```

**Python3:**

```
class Solution:  
    def countKReducibleNumbers(self, s: str, k: int) -> int:
```