

# 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**  $10^9 + 7$ .

**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:\*\***

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

## 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:
```