2489. Number of Substrings With Fixed Ratio Premium

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You are given a binary string `s`, and two integers `num1` and `num2`. `num1` and `num2` are coprime numbers.

A **ratio substring** is a substring of s where the ratio between the number of `0`'s and the number of `1`'s in the substring is exactly `num1 : num2`.

- For example, if `num1 = 2` and `num2 = 3`, then `"01011"` and `"1110000111"` are ratio substrings, while `"11000"` is not.

Return *the number of **non-empty** ratio substrings of* `s`.

Note that:

- A **substring** is a contiguous sequence of characters within a string.
- Two values `x` and `y` are **coprime** if `gcd(x, y) == 1` where `gcd(x, y)` is the greatest common divisor of `x` and `y`.

Example 1:

```
Input: s = "0110011", num1 = 1, num2 = 2
Output: 4
Explanation: There exist 4 non-empty ratio substrings.
- The substring s[0..2]: "0110011". It contains one 0 and two 1's. The ratio is 1 : 2.
- The substring s[1..4]: "0110011". It contains one 0 and two 1's. The ratio is 1 : 2.
- The substring s[4..6]: "0110011". It contains one 0 and two 1's. The ratio is 1 : 2.
- The substring s[1..6]: "0110011". It contains two 0's and four 1's. The ratio is 2 : 4 == 1 : 2.
It can be shown that there are no more ratio substrings.
```

Example 2:

```
Input: s = "10101", num1 = 3, num2 = 1
Output: 0
Explanation: There is no ratio substrings of s. We return 0.
```

Constraints:

- `1 <= s.length <= 10^5`
- `1 <= num1, num2 <= s.length`
- `num1` and `num2` are coprime integers.

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Hint 1

Let Func(i) denote the number of 0's in the prefix [0...i]. We want to find the number of pairs of indices L and R such that Func(R) - Func(L) : R - L - Func(R) + Func(L) = num1 : num2.

Hint 2

It is better to simplify the formula.

Hint 3

Func(R) * (num1 + num2) - R * num1 = Func(L) * (num1 + num2) - L * num1.

Hint 4

Iterate from left to right and use a hash map to count the number of indices having the same value for the above formula.

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