Add Binary

Problem Description

Given two binary strings a and b, return their sum as a binary string.

Example 1

- **Input:** a = "11", b = "1"
- **Output:** "100"

Example 2

- **Input:** a = "1010", b = "1011"
- **Output:** "10101"

Constraints

- The lengths of a and b are between 1 and 10^4.
- Both a and b consist only of '0' or '1' characters.
- Each string does not contain leading zeros except for the zero itself.

Solution

The provided solution is implemented in Python and defines a class Solution with a method addBinary. This method takes two binary strings as input and returns their sum as a binary string.

Detailed Explanation

1. **Initialization:**
   - An empty list result is initialized to store the binary digits of the sum.
   - A variable carry is initialized to 0 to keep track of any carry-over during the addition.
   - Two pointers i and j are set to point to the last characters of the strings a and b, respectively.

2. **Loop through the strings:**
   - The loop continues as long as there are digits left in either a or b or there is a carry to be added.
   - If the current digit of a is available (i >= 0), it is added to carry and the pointer i is decremented.
   - Similarly, if the current digit of b is available (j >= 0), it is added to carry and the pointer j is decremented.
   - The current digit of the result is determined by carry % 2, which is appended to the result list.
   - The carry is then updated to be the integer division of carry by 2.

3. **Final Result:**
   - Since the digits in result are appended in reverse order, the list is reversed at the end.
   - The result list is joined to form the final binary string which is returned.