add_binary

May 21, 2025

1 Add Binary

1.1 Problem Definition

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

1.1.1 Example Cases

Example 1:

Input: a = “11”, b = “1”
Output: “100”

Example 2:

Input: a = “1010”, b = “1011”
Output: “10101”

1.1.2 Constraints

- 1 <= a.length, b.length <= 10^4
- a and b consist only of ‘0’ or ‘1’ characters.
- Each string does not contain leading zeros except for the zero itself.

1.2 Example test cases

[1]:
```
def test_cases():
    assert addBinary(a = "11", b = "1") == "100"
    assert addBinary(a = "1010", b = "1011") == "10101"
    print("All test cases passed!")
```

1.3 Solutions

$O(max(n, m))$, where n = len(a), m = len(b)

[35]:
```
def addBinary(a, b):
    len_a = len(a)
    len_b = len(b)

    carry = 0
    pointer = -1
```

```
    result = []


    while (pointer >= -max(len_a, len_b)) or (carry == 1):

        num_a = "0" if (pointer < -len_a) else a[pointer]
        num_b = "0" if (pointer < -len_b) else b[pointer]

        carry = carry + int(num_a) + int(num_b)

        result.append(str(carry % 2))
        carry = carry // 2

        pointer -= 1

    return "".join(result[::-1])
```

[36]:
```
addBinary(a = "1111", b = "1")
```

[36]:
```
'10000'
```

[37]:
```
test_cases()
```

```
All test cases passed!
```