

BINARY

Negabinary

- Non-standard positional numeral system that uses base of -2
- Allow representing negative numbers in binary
- Example:

1101_{-2}

$$(-2)^3 + (-2)^2 + 0 + (-2)^0 = -8 + 4 + 0 + 1 = -3$$

Summing Negabinary

- Add as a regular binary number, but with **negative carry**

$$0 + 0 = 0$$

$$1 + 0 = 1$$

$$1 + 1 = 0 \quad \text{with a negative carry 1}$$

$$\mathbf{1} + 1 = 0 \quad (\text{subtract})$$

$$\mathbf{1} + 0 = 1 \quad \text{with a positive carry 1}$$

Negabinary

Example 1

$$\begin{array}{r} 11\ 1 \\ 1011 \\ + 1110 \\ \hline = 110001 \end{array}$$

1 + 0 = 1

1 + 1 = 0 with negative carry 1

1 + 1 = 0

1 + 1 = 0 with negative carry 1

1 + 0 = 1 with positive carry 1

1 + 0 = 1

red 1 = negative carry
green 1 = regular carry

Example 2

$$\begin{array}{r} 1111 \\ 101010 \\ + 101100 \\ \hline = 11110110 \end{array}$$

Reference

<https://math.stackexchange.com/questions/3251605/how-to-add-negabinary-numbers>

Problem 1073 – Adding Two Negabinary Numbers

Medium

<https://leetcode.com/problems/adding-two-negabinary-numbers>

Given two numbers `arr1` and `arr2` in base -2, return the result of adding them together.

Each number is given in *array format*: as an array of 0s and 1s, from most significant bit to least significant bit. For example, `arr = [1,1,0,1]` represents the number $(-2)^3 + (-2)^2 + (-2)^0 = -3$. A number `arr` in array, format is also guaranteed to have no leading zeros: either `arr == [0]` or `arr[0] == 1`.

Return the result of adding `arr1` and `arr2` in the same format: as an array of 0s and 1s with no leading zeros.

Example 1

Input: `arr1 = [1,1,1,1,1]`, `arr2 = [1,0,1]`

Output: `[1,0,0,0,0]`

Explanation: `arr1` represents 11, `arr2` represents 5, the output represents 16.

Example 2

Input: `arr1 = [0]`, `arr2 = [0]`

Output: `[0]`

Example 3

Input: `arr1 = [0]`, `arr2 = [1]`

Output: `[1]`

Solution 1073 – Adding Two Negabinary Numbers

Medium

<https://leetcode.com/problems/adding-two-negabinary-numbers>