XOR of Numbers from 1 to n in Constant Time

To find the XOR of numbers from 1 to n in constant time, you can use a mathematical property based on the pattern of XOR results.

The XOR of numbers from 1 to n can be derived as follows:

1. If n mod 4 = 0: XOR = n
2. If n mod 4 = 1: XOR = 1
3. If n mod 4 = 2: XOR = n + 1
4. If n mod 4 = 3: XOR = 0

So, the formula to find the XOR from 1 to n in constant time is:

XOR(1, n) =

- n if n mod 4 = 0
- 1 if n mod 4 = 1
- n + 1 if n mod 4 = 2
- 0 if n mod 4 = 3

This method works in O(1) time, as it only involves simple modulus and conditional operations.