DAY 1-OF DO U KNOW? SERIES

QUESTION: DO U KNOW WHAT IS EXACT USE OF XOR OPERATOR?

The XOR (Exclusive OR) operator is a bitwise operator represented by ^ in Python.

A	B	A^B
0	0	0
0	1	1
1	0	1
1	1	0

1. 🔧 Key Properties of XOR:
2. a ^ a = 0 → A number XORed with itself is 0
3. a ^ 0 = a → A number XORed with 0 is itself
4. XOR is commutative and associative:
   a. a ^ b = b ^ a
   b. a ^ b ^ c = (a ^ c) ^ b

WHERE WE USE?

1. FINDING UNIQUE ELEMENTS:

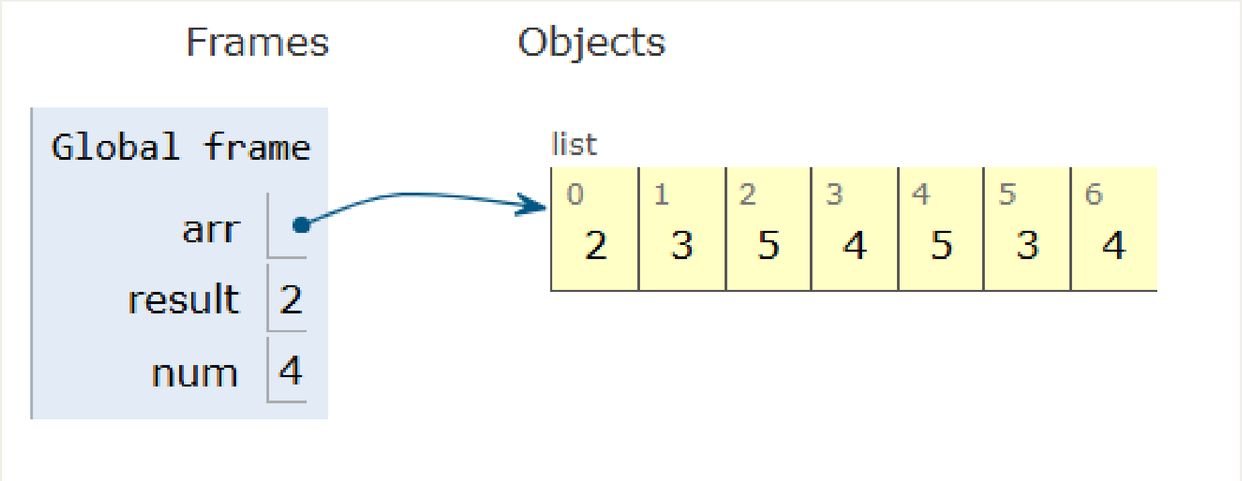
- When you have an array where all elements appear twice except for one, XOR can efficiently find that unique element.
- By XORing all the elements together, the pairs cancel each other out (since x ^ x = 0), leaving only the unique element.
- For example, in an array [2, 3, 2, 4, 3], 2 ^ 3 ^ 2 ^ 4 ^ 3 results in 4.

1. Find the Unique Element in an Array?----LEETCODE:136

All numbers appear twice except one. XOR all elements.

PYTHON CODE

- arr = [2, 3, 5, 4, 5, 3, 4]
- result = 0
- for num in arr:
- result ^= num
- print("Unique element:", result)
- Output: 2



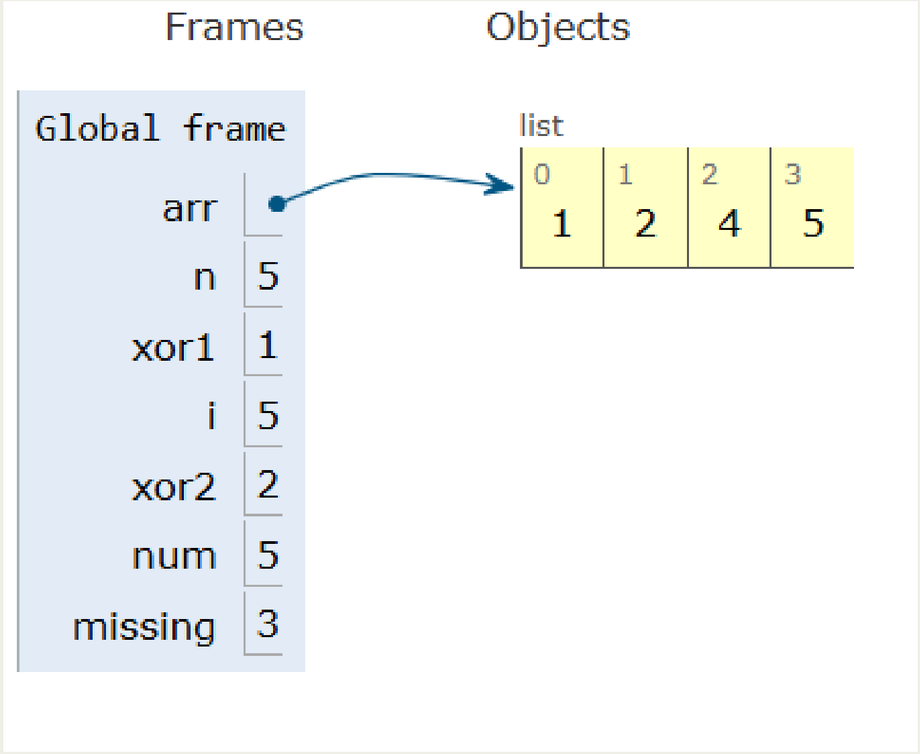
2. Swapping Two Numbers Without Temp Variable

```
a, b = 10, 20
a = a ^ b
b = a ^ b  # Now b = 10
a = a ^ b  # Now a = 20
print(a, b)
```

Output: 20 10

3. Finding Missing Number from 1 to N

```
arr = [1, 2, 4, 5]
n = 5
xor1 = 0
for i in range(1, n + 1):
    xor1 ^= i
xor2 = 0
for num in arr:
    xor2 ^= num
missing = xor1 ^ xor2
print("Missing number:", missing)  # Output: 3
```



4. Detecting Data Changes:

- XOR can be used to detect changes in data. If two data values are the same, their XOR will be 0. If they differ, the XOR will be non-zero.
- For example, result = data1 ^ data2. If result is 0, the data is the same. If result is non-zero, the data is different.
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5. Other Applications:

- Checking for Opposite Signs: (x ^ y) < 0 can determine if two numbers have opposite signs.
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- Toggling Bits: XORing a bit with 1 flips its value.
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- XOR Basis: In more advanced algorithms, XOR basis is used to find a minimal set of vectors that can generate all other vectors in a vector space.