

Problem 1908: Game of Nim

Problem Information

Difficulty: Medium

Acceptance Rate: 62.45%

Paid Only: Yes

Tags: Array, Math, Dynamic Programming, Bit Manipulation, Brainteaser, Game Theory

Problem Description

Alice and Bob take turns playing a game with **“Alice starting first”**.

In this game, there are `n` piles of stones. On each player's turn, the player should remove any **“positive”** number of stones from a non-empty pile **“of his or her choice”**. The first player who cannot make a move loses, and the other player wins.

Given an integer array `piles`, where `piles[i]` is the number of stones in the `ith` pile, return **“true”** **_if Alice wins, or_** **“false”** **_if Bob wins_**.

Both Alice and Bob play **“optimally”**.

“Example 1:”

“Input:” piles = [1] **“Output:”** true **“Explanation:”** There is only one possible scenario: - On the first turn, Alice removes one stone from the first pile. piles = [0]. - On the second turn, there are no stones left for Bob to remove. Alice wins.

“Example 2:”

“Input:” piles = [1,1] **“Output:”** false **“Explanation:”** It can be proven that Bob will always win. One possible scenario is: - On the first turn, Alice removes one stone from the first pile. piles = [0,1]. - On the second turn, Bob removes one stone from the second pile. piles = [0,0]. - On the third turn, there are no stones left for Alice to remove. Bob wins.

“Example 3:”

Input: piles = [1,2,3] **Output:** false **Explanation:** It can be proven that Bob will always win. One possible scenario is: - On the first turn, Alice removes three stones from the third pile. piles = [1,2,0]. - On the second turn, Bob removes one stone from the second pile. piles = [1,1,0]. - On the third turn, Alice removes one stone from the first pile. piles = [0,1,0]. - On the fourth turn, Bob removes one stone from the second pile. piles = [0,0,0]. - On the fifth turn, there are no stones left for Alice to remove. Bob wins.

Constraints:

```
* `n == piles.length` * `1 <= n <= 7` * `1 <= piles[i] <= 7`
```

Follow-up: Could you find a linear time solution? Although the linear time solution may be beyond the scope of an interview, it could be interesting to know.

Code Snippets

C++:

```
class Solution {  
public:  
    bool nimGame(vector<int>& piles) {  
  
    }  
};
```

Java:

```
class Solution {  
public boolean nimGame(int[] piles) {  
  
}
```

Python3:

```
class Solution:  
    def nimGame(self, piles: List[int]) -> bool:
```