

# 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  $i$ th 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:
```