

Largest Combination With Bitwise AND Greater Than Zero

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🌐 Platform	LeetCode
🔧 difficulty	Medium
# Serial	2275
🏷️ tags	Bit Manipulation Logic
🗣️ language	C++
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🔗 link	https://leetcode.com/problems/largest-combination-with-bitwise-and-greater-than-zero/
✅ Completion	✓

Intuition

The goal is to find the largest group of numbers in the array that, when combined with a bitwise AND operation on a specific bit position, results in a non-zero value. This means that we are essentially looking for the most frequent set bit position across all numbers, as this indicates the largest subset where each number has this bit set, resulting in a bitwise AND greater than zero.

Approach

- Iterate Over Bit Positions:** We only need to consider up to 24 bits (or 32 bits, depending on the constraints), as most practical inputs will not require checking beyond standard integer bit sizes.
- Count Set Bits:** For each bit position from 0 to 23:
 - Initialize a counter for each bit position.
 - For each number in the array, check if that bit position is set (using bitwise AND with a left-shifted `1 << i` mask).
 - If the bit is set, increment the counter for that bit position.
- Track the Maximum Count:** Update the maximum count across all bit positions, as this represents the largest group of numbers that have a common set bit.
- Return Result:** Return the maximum count obtained.

This approach efficiently finds the bit position that appears most frequently set among all numbers, which represents the largest combination with a bitwise AND greater than zero.

Complexity

- Time Complexity:** $O(n \cdot b)$, where **n** is the number of elements in the array and **b** is the number of bits we need to check (typically up to 24 or 32).
- Space Complexity:** $O(1)$, since we only need a few integer variables.

Code

```
class Solution {
public:
    int largestCombination(vector<int>& candidates) {
        int maxCount = 0;

        for (int i = 0; i < 24; i++) {
            int count = 0;
            for (auto cand : candidates) {
                if (cand & (1 << i)) {
                    count++;
                }
            }
            maxCount = max(maxCount, count);
        }

        return maxCount;
    }
};
```