

Problem of the Week – Bitwise AND of a Range

Company: Yahoo

Difficulty: Medium

Topic: Bit Manipulation

Problem Statement

Write a function that returns the **bitwise AND** of all integers between **M** and **N** (inclusive).

Formally:

```
result = M & (M+1) & (M+2) & ... & N
```

Example 1

Input:

M = 5, N = 7

Output:

4

Explanation:

```
5 = 101
6 = 110
7 = 111
-----
5 & 6 & 7 = 100 = 4
```

Example 2

Input:

M = 0, N = 1

Output:

0

Explanation:

0 = 0
1 = 1
0 & 1 = 0

Approaches

1. **Naive Approach:**
 - Iterate from M to N.
 - Keep applying & operator.
 - Time Complexity: $O(N-M)$ (Not efficient for large ranges).
 2. **Optimized Approach (Bitwise Trick):**
 - The result is the **common prefix of M and N in binary**.
 - Keep shifting M and N right until they are equal.
 - Shift the result back left.
 - Time Complexity: $O(\log N)$
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Practice Links

- [LeetCode – Bitwise AND of Numbers Range](#)
 - [GeeksforGeeks – Bitwise AND of a Range](#)
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