

390. Elimination Game

Question Editorial Solution

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- Total Accepted: **1146**
- Total Submissions: **5798**
- Difficulty: **Medium**

There is a list of sorted integers from 1 to n . Starting from left to right, remove the first number and every other number afterward until you reach the end of the list.

Repeat the previous step again, but this time from right to left, remove the right most number and every other number from the remaining numbers.

We keep repeating the steps again, alternating left to right and right to left, until a single number remains.

Find the last number that remains starting with a list of length n .

Example:

```
Input:
n = 9,
1 2 3 4 5 6 7 8 9
2 4 6 8
3 6
6

Output:
6
```

```
class Solution {
public:
    int lastRemaining(int n) {
        int head=1;
        bool left = true;
        int step=1;
        int remaining = n;
        while(remaining>1)
        {
            if(left || remaining%2==1)
            {
                head = head+step;
            }
            remaining/=2;
            step*=2;
            left=!left;
        }
        return head;
    }
};
```

Comments:

My idea is to update and record **head** in each turn. when the total number becomes 1, head is the only number left.

When will head be updated?

- if we move from left
- if we move from right and the total remaining number $\% 2 == 1$
like 2 4 6 8 10, we move from 10, we will take out 10, 6 and 2, head is deleted and move to 4
like 2 4 6 8 10 12, we move from 12, we will take out 12, 8, 4, head is still remaining 2

then we find a rule to update our head.

example:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

1. Let us start with **head = 1, left = true, step = 1 (times 2 each turn), remaining = n(24)**

2.

3. we first move from left, we definitely need to move head to next position. (**head = head + step**)

So after first loop we will have:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 -> 2 4 6 8 10 12 14 16 18 20 22 24

head = 2, left = false, step = 1 * 2 = 2, remaining = remaining / 2 = 12

4.

5. second loop, we move from right, in what situation we need to move head?

only if the remaining $\% 2 == 1$, in this case we have $12 \% 2 == 0$, we don't touch head.

so after this second loop we will have:

2 4 6 8 10 12 14 16 18 20 22 24 -> 2 6 10 14 18 22

head = 2, left = true, step = 2 * 2 = 4, remaining = remaining / 2 = 6

6.

7. third loop, we move from left, move head to next position

after third loop we will have:

2 6 10 14 18 22 -> 6 14 22

head = 6, left = false, step = 4 * 2 = 8, remaining = remaining / 2 = 3

8.

9. fourth loop, we move from right, NOTICE HERE:

we have remaining(3) $\% 2 == 1$, so we know we need to move head to next position

after this loop, we will have

6 14 22 -> 14

head = 14, left = true, step = 8 * 2 = 16, remaining = remaining / 2 = 1

10.

11. while loop end, return head

12.