Interveiw Problems2

Topics:- 0,1 , add ✓
-0,1 , swap ✓
- thriplets
- Josephase

Google
TC

P1 Given an array of 0 & 1s, we can replace exactly one of the 0s with a 1, return the count of max consecutive 1's in the array:

ex $a[]:\{1, 1, 0, 1, 1, \overset{1}{\cancel{0}}, 1, 1\}$ ans=5 $\{1,1,1\}$

0 1 2 3 4 5 6 7

Quiz $a[]:\{1, 1, 0, 1, 1, 0, 1, 1, 1\}$ ans=6

0 1 2 3 4 5 6 7 8

Quiz $a[]:\{0, 1, 1, 1, 0, 1, 1, 0, 1, 1, 0\}$ $\{1,0,0,1\}$

0 1 2 3 4 5 6 7 8 9 10

1

$\underbrace{0+1+3}_{4}$ $\underbrace{3+1+2}_{\boxed{6}}$ $\underbrace{2+1+2}_{5}$ $\underbrace{2+1+0}_{3}$

$\xleftarrow{}$ lcount 0 $\xrightarrow{}$ rcount

ans= max(ans, lcount+1+rcount)

ex $a[]:\{1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 0, 0, 1, 1, 0, 1, 1\}$ i

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

$\underset{\cancel{6}}{3+1+2}$ $\underset{\underline{7}}{2+1+4}$ $\underset{6}{4+1+0}$ | $\underset{3}{0+1+2}$ $\underset{5}{2+1+2}$

j

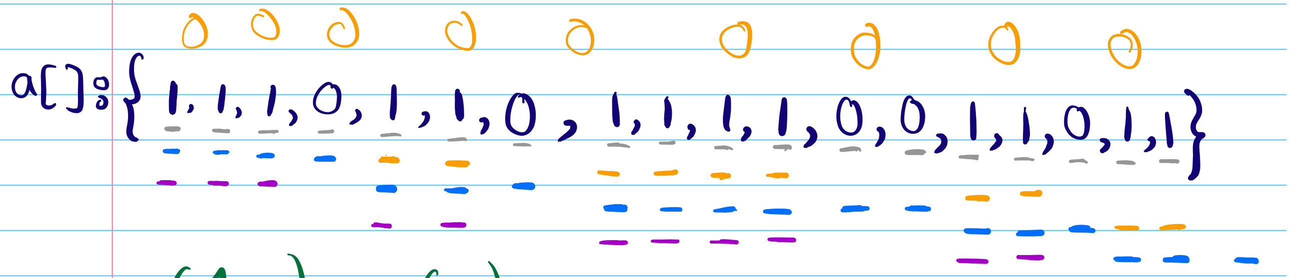
Quiz

$TC: \boxed{O(n)}$

$SC: O(1)$

```
int CountMaxOnes(int a[]){                                  {0,0,0}
    ans = 0
    ① Count all 1s.  i   #1s == n  ret n     O(n)
    ② for(i=0; i<n; i++){
        if(a[i] == 0){                                        ⓙ
            lCount ← look left Count 1s till 0 or strat of arr
            rCount ← look right Count 1s till 0 or end of arr   ⓙ
            ans = Max(ans, lCount+1+rCount)
        }
    }
    ③ ret ans
}
```

⚠



a[]: {1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 0, 0, 1, 1, 0, 1, 1}

$$O(4n) = O(n)$$

$$O(n+n+n+n) = O(4n)$$

P2 Given an array of 0 & 1s, we can swap exactly one of the 0s with a 1. Return the count of max consecutive 1's in the array:

```
010110101
01010010
101001
```

ex a: { 1, 0, 1, 1, 0, 1 } $0, 0, \underbrace{1, 1, 1, 1}_{4 = ans}$

Quiz { 1, 1, 0, 1, 1, 1 } $0, \underbrace{1, 1, 1, 1, 1}_{ans = 5}$

ex   a[]: { 1, 1, 0, 1, 1, 0, 1, 1, 1 }
$\qquad\quad$ 0 $\;$ 1 $\;$ 2 $\;$ 3 $\;$ 4 $\;$ 5 $\;$ 6 $\;$ 7 $\;$ 8

{ 0, 0, 1, 1, 1, 0, 1, 1, 1 }

① lcount + 1 + rcount
Ⅱ lcount + rcount

```
int CountMaxOnes(int a[]){
    ans = 0
    ① Count all 1s.   #1S == n  ret n  // pre calculate # of 1s
    ② for (i = 0; i < n; i++){
        if (a[i] == 0){
            lcount ← look left  count 1s till 0 or strat of arr
            rcount ← look right count 1s till 0 or end of arr
            neighborOnes = lcount + rcount
        if (neighborOnes == #1S)  chainLen = lcount + rcount
        else  chainLen = lcount + rcount + 1
        ans = Max(ans, chainLen )
    }
    ③ ret ans
}
```

TC
SC

int

P3 Given an array a[n] Count the number of triplets.

triplets def. $\begin{cases} i < j < k \\ a[i] < a[j] < a[k] \end{cases}$

ex a: {1, 2, 3, 4, 5}   ans = 10

0 1 2 3 4

(1,2,3),(1,2,4),(1,2,5), (1,3,4),(1,3,5),(1,4,5)
(2,3,4),(2,3,5)(2,4,5)
(3,4,5)

Quiz a[]: {2, 6, 9, 4, 10}

0 1 2 3 4

Count = 5

ans

i	j	k	a[i]	a[j]	a[k]
0	1	2	2	6	9
0	1	4	2	6	10
0	2	4	2	9	10
0	3	4	2	4	10
1	2	4	6	9	10

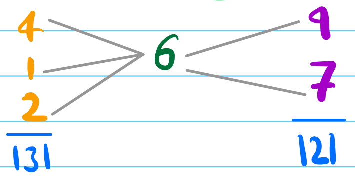
TC: $O(n^3)$

SC: $O(1)$

```
int CountTriplet(int a[]){
    n= a.len; Count= 0;
    for(i=0;i<n;i++){          → n-2
        for(j=i+1;j<n;j++){    → n-1
            for(k=j+1;k<n;k++){
                if(a[i]<a[j] && a[j]<a[k]){
                    Count++
                }
            }// k
        }// j
    }// i
    ret Count
}
```

ex $a[]: \{ \underset{0}{4}, \underset{1}{1}, \underset{2}{2}, \underset{3}{6}, \underset{4}{9}, \underset{5}{7}, \underset{6}{2} \}$

hint
Contribution technique



3x2=6

ⓘ 1 to n-1

① iterate over all elements, consider $\underbrace{a[i]}_{c}$ as center

ⓙ for loop left of count if a[j]<c ⟶ l

ⓙ for loop right of count if a[j]>c ⟶ r

ans += l x r

② ret ans

TC: $O(n^2)$

SC: $O(1)$

why time complexity is $O(n^2)$ → n

```
for( i=1 ; i<n-1 ; i++){
    ⓧ for( j= i-1 ; j>=0 ; j--)  if...
    ⓨ for( j= i+1 ; j<n ; j++)  if
}
```

x+y~n

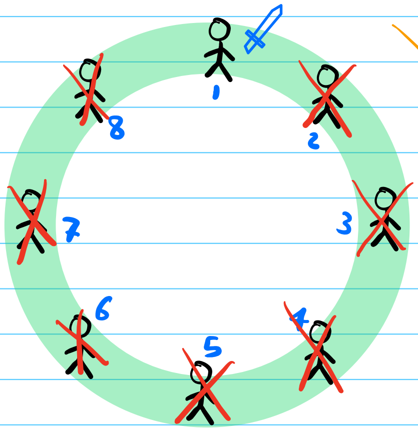
n x n

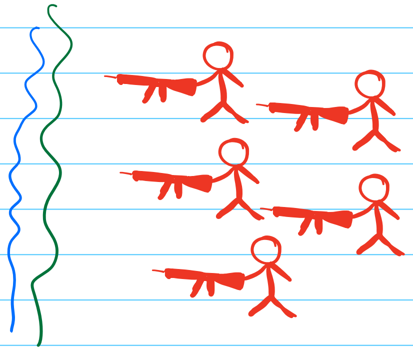
Puzzle problem, not common in interveiws!

P4 Josephus problem:

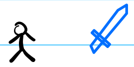
*find which location in the circle will stay alive

input:
N



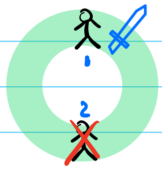


N=1



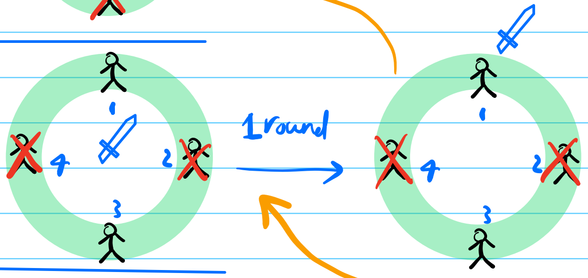
ans=1

Quiz
N=2



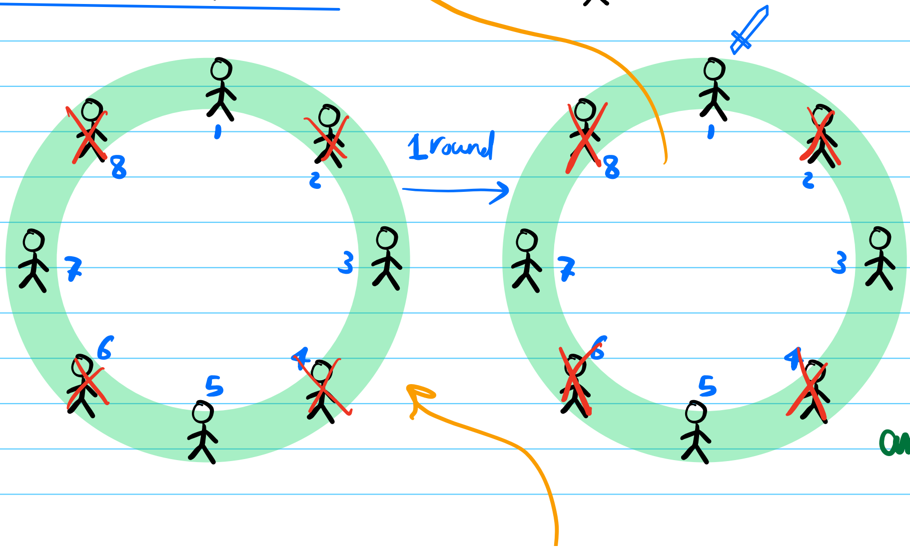
ans=1

Quiz*
N=4



ans=1

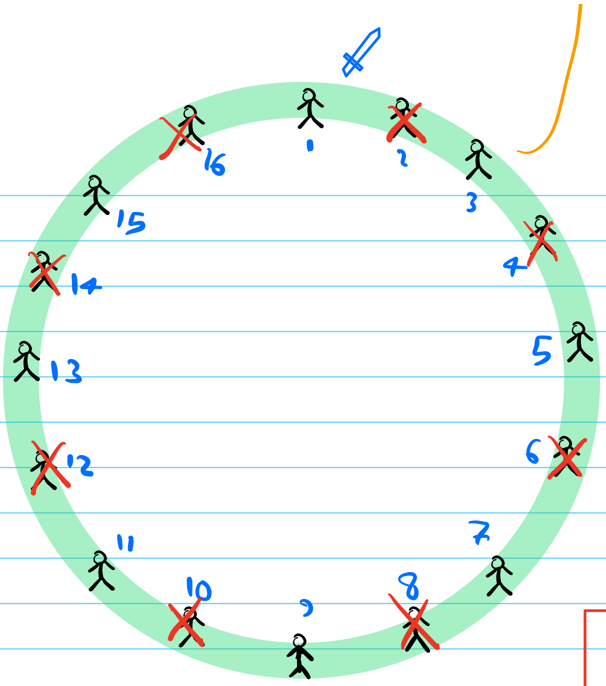
N=8



ans=1

Quiz

N=16



ans=1

$N=2^n$ 2^{n-1}

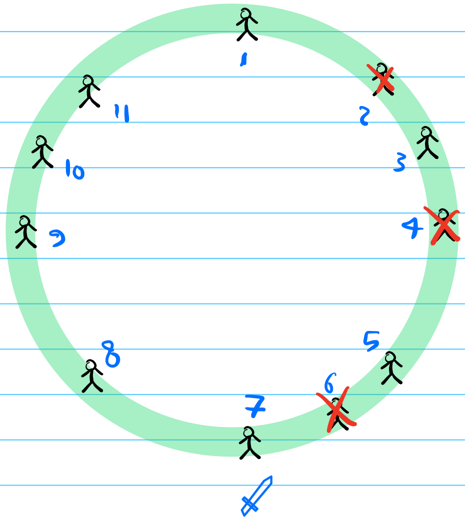
$N \xrightarrow{\text{1st round}} \frac{N}{2}$

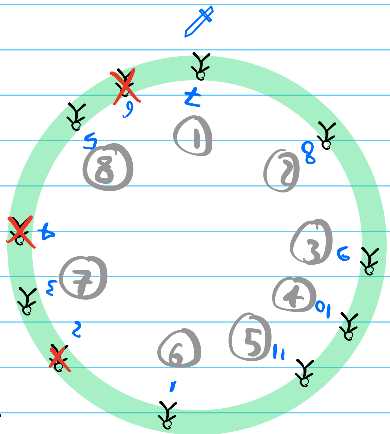
proof by induction

$\boxed{\text{for all } N=2^n \text{ Josephus problem ans. is } 1}$

Quiz

N=11





remaining

$8=2^3$

$8<11<16$

$2^3<11<2^4$ $\lfloor \log_2 11 \rfloor \rightarrow 3$

step 1 - find the closest power of 2 $N=11-8=3$ k

O(1) $N-2^{\lfloor \log_2 N \rfloor}=k$ $11-2^{\lfloor \log_2 11 \rfloor}=3$

step 2 - $2k+1 \rightarrow$ ans $2 \times 3+1=7$

$100 - 64 = 36$

$36 \times 2 + 1 = 73$