A child teaches an adult three things :-
to be happy for no reason, to be always
busy with something, and know how to
demand with all his might what he wants !

<u>Happy Childrens' Day</u>

Q1) Given an array of 1 and 0. We can replace one of the 0s with a 1. Return the count of max consecutive 1's in the array.

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Ex:-

0	1	2	3	4	5	6	7	8
1	1	0	1	1	0	1	1	1

$$1\ 1\ 0\ \underbrace{1\ 1\ 1\ 1\ 1\ 1} \Rightarrow 6$$

Ex:- $0\ \underbrace{1\ 1\ 1\ \cancel{0}\ 1\ 1}_{6}\ 0\ 1\ 1\ 0$

$\cancel{0}\to 1$

$\cancel{0}\ 1\ 1\ 1\ \cancel{0}\ 1\ 1\ \cancel{0}\ 1\ 1\ \cancel{0}$

$0+3+1 = 4$

$3+2+1 = 6$

$2+2+1 = 5$

$2+0+1 = 3$

$1\ 1\ 1\ \cancel{0}\ 0\ 1\ 1$

$3+0+1 = 4$

how many 1's x ← 0 → how many 1's y $\Rightarrow x+1+y$

For every 0 in the array :-

→ count number of consecutive 1's to the left l

→ count number of consecutive 1's to the right r

→ if ($l+r+1 >$ ans) {

  ans = $l+r+1$;

}

$O(n)$ T.C.

$O(1)$ S.C

Edge case :- all elements are 1 ⇒ ans is n.

$$0\ 0\ 0\ \boxed{0\ 1}\ 0\ 0\ 0$$

1 1 1 $0+1+1 = 2$

$1\ 1\ 1\ 1\ 1\ 1 \ldots 1 \Rightarrow n$.

0 1 1 1 0 1 1 0 1 1 1 1 0 0 1 1 0 1 1

each element → visited max 3 times

→ by the 0 on the left

→ by the 0 on the right

→ initial iteration.

Total no. of iterations ⇒ $\leq 3n$

$= O(n)$.

Q2) Given an array of 1 and 0. We can swap one of the 0s with a 1. Return the count of max consecutive 1's in the array.

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eg:- $1\ \cancel{1}\ 0\ \overbrace{1\ 1\ \cancel{0}\ 1\ 1\ 1}^{6}$ ⇒ extra 1 available ⇓ $l+r+1$

$l \quad 1 \quad (r-1)$

$\xleftarrow{l} 0 \xrightarrow{r}$

$\underbrace{0\ 1\ 1\ 1\ 1\ 0\ 1\ 1}_{6}\ 0$ ⇒ no extra 1 available ⇓ $l+r$

$0\ \cancel{1}\ 1\ 1\ \cancel{0}\ 1\ 1\ 0$

1 1 1 0 0 0 1 1 $\qquad 3+0+1 = 3.$

$\xleftarrow{3}$ $\vec{0}$

1

1 1 1 0 0 $\qquad 3+0=3$

$l=3$ $\quad r=0$

1

- Count no. of 1's in the array $\Rightarrow k$.
- For every 0 in the array :-
  - $\rightarrow$ count no. of consecutive 1's to the left (l)
  - $\rightarrow$ count no. of consecutive 1's to the right (r)
  - $\rightarrow$ if $l + r == k$:

    ans = max(ans, $l + r$) // no extra 1

    else :

    ans = max(ans, $l + r + 1$) // extra 1.

$$\boxed{\begin{array}{l} O(n) \text{ T.C.} \\ O(1) \text{ S.C.} \end{array}}$$

[Break till 10:33 PM]

Q3) No. of triplets

Given an array, count the no. of triplets (i, j, k)
s.t. $i < j < k$
and
$ar[i] < ar[j] < ar[k]$

	0	1	2	3	4
ar :-	2	6	9	4	10

i j k	ar[i] ar[j] ar[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)	⇒ $6 < 9 < 10$

idea :- Iterate over all possible triplets.

```
for(i=0; i<n; i++){
    for(j=i+1; j<n; j++){
        for(k=j+1; k<n; k++){
            if(ar[i] < ar[j] && ar[j] < ar[k])
                count++;
        }
    }
}
```

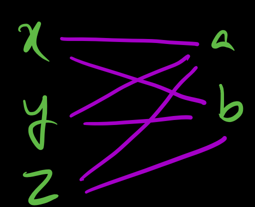
$O(n^3)$ T.C.
$O(1)$ S.C.

	0	1	2	3	4
arr :-	2	6	9	4	10

x	No. of elements to the left of x that are < x	No. of elements right of x that are > x	No. of triplets with x at centre
9	2 (2,6)	1 (10)	2*1=2
6	1 (2)	2 (9,10)	1*2=2
2	0	4	0*4=0
4	1 (1)	1 (10)	1*1=1
10	4	0	4*0=0

$\frac{x\ y\ z}{3}$ $\boxed{arr[j]}$ h $\frac{a\ b}{2}$

x h a
x h b
y h a
y h b
z h a
z h b



3 * 2 = 6

ans = 0

for every element A[i] :- // iterating over the center elements

- iterate from 0 to i-1, and count the nr. of elements less than A[i] $\Rightarrow l$
- iterate from i+1 to n-1, and count the nr. of elements more than A[i] $\Rightarrow r$
- add $(l * r)$ to the ans

$O(n^2)$ T.C.

$O(1)$ S.C.

	0	1	2	3	4
ar :-	2	6	$\boxed{9}$	4	10
	0	1	2	1	4

< 9

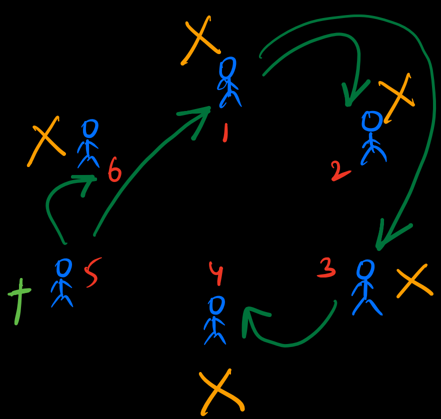
$-2 \quad -9 \quad -3 \quad -400000$

$\boxed{min = -32767} \rightarrow -2$

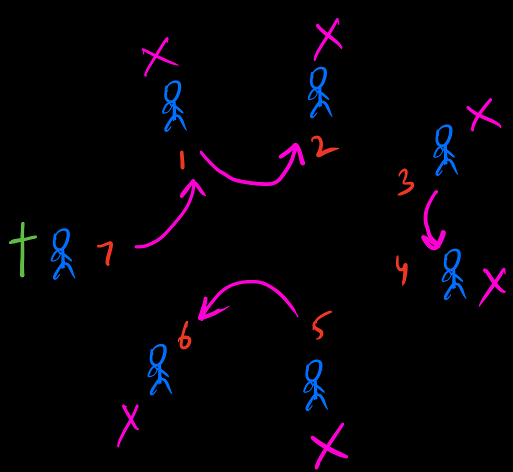
-2^{31} :- integer Integer.MIN_VALUE

-2^{63} :- long. Long.MIN_VALUE .

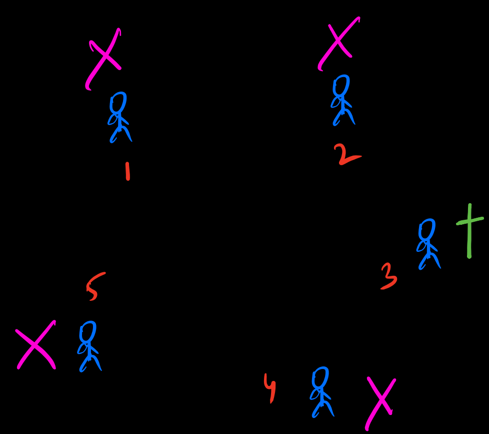
Q4) Josephus Problem



5 survives!



7 survives.



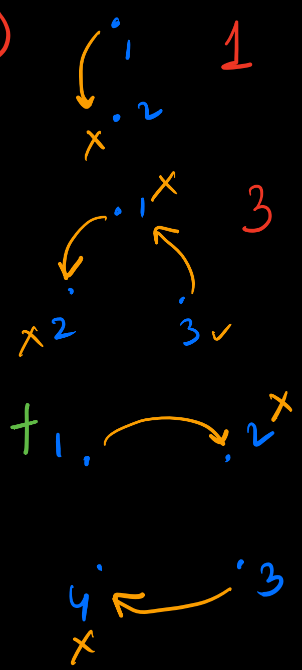
3 survives.

$n=1 \Rightarrow 1$

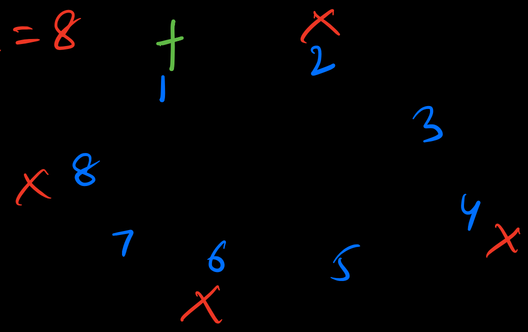
$n=2 \Rightarrow$ 1

$n=3 \Rightarrow$ 3

$n=4 \Rightarrow$ 1



$n=8$ 1

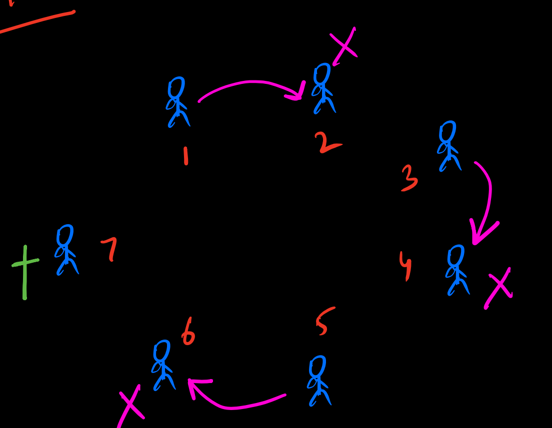


$$2^n \longrightarrow 2^{n-1} \longrightarrow \cdots \; 2^1$$

$$1^s \qquad 1^s \qquad 1^s$$

Any power of 2 $\Rightarrow$ Soldier who starts will survive.

<u>$n=7$</u>



4 people left

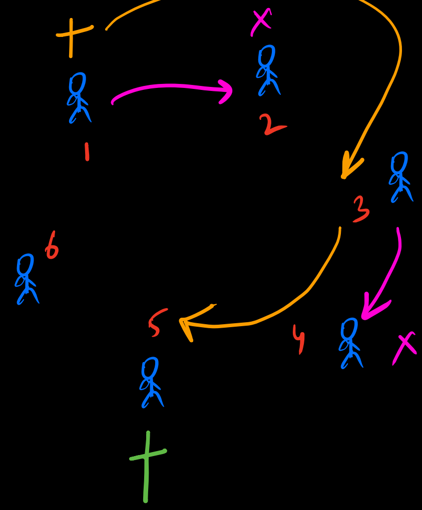
7 has the sword.

Ans $\to$ 7.

$$7 \xrightarrow{-3} 4$$

$$1+3*2=7$$

$n = 6$



4 people left

5 has the sword

5 wins

pos^n of sword $= 1 + 2 * 2 = 5$

$$n = 100 \xrightarrow{-36} 64$$

36 hits $\Rightarrow 1 + 2 * 36$

$$= 1 + 72 = 73$$

$$\boxed{\text{person who gets sword} = 1 + 2 * (\text{no. of hits})}$$