N	Binary xpr	N-1 (binary)	N & N-1
2	10	1 :- 01	0
4	100	3 :- 011	0
8	1000	7 :- 0111	0
16	10000	15 :- 01111	0
32	100000	31 :- 011111	0
40	101000	39 :- 100111	32
23	10111	22 :- 10110	22.

if, N is a power of 2.

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

N-1, if N is a power of 2.

0 1 1 1 1 1 1 1 1

$\boxed{N = 2^x}$

If, N is a power of 2, then,

N & (N-1) == 0

Q.1. Given x & y, place x set bits & y unset bits, return the decimal value

i/p ⇒ x = 2, y = 3.

11000 ⇒ 24 o/p.

i/p ⇒ x = 3, y = 2

11100 ⇒ 28 o/p.

i/p ⇒ x = 4, y = 2.

111100 ⇒ 60 o/p

binary :- 0 0 0 0 0 0 0 0

$$\begin{array}{lcccccccccl} & & & & & 4 & 3 & 2 & 1 & 0 & \\ \text{set 1 bit} \rightarrow & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & & \rightarrow 16 \end{array}$$

unset 4 bits

16 ↓ $\underline{2^4}$ ↓ $\boxed{1<<4}$

set 2 bits : 0 0 0 1 1 0 0 0

unset 3 bits

2^4 2^3

$(1<<4) + (1<<3)$

set 3 bits : 0 0 0 1 1 1 0 0

unset 2 bits :

2^4 2^3 2^2

Set $x \Rightarrow 2$

unset $y \Rightarrow 3$.

1<<4 or,

1<<3

1 1 0 0 0

x

$1<<(x+y-1)$

$x--$

or,

$1<<(x+y-1)$

```
ans = 0
while( x > 0 ) {
    ans = ans + (1<<(x+y-1))
    x--;
}
```

$$\boxed{\begin{array}{l} TC \Rightarrow O(x) \\ SC \Rightarrow O(1) \end{array}}$$

Q) Given x, create a no. having all x set bits

eg $\Rightarrow$ $x: 2$:- 11 $\rightarrow$ 3 $\Rightarrow 2^2 - 1 \rightarrow 2^x - 1$

$x: 3$:- 111 $\rightarrow$ 7 $\Rightarrow 2^3 - 1 \rightarrow 2^x - 1$

$x: 4$:- 1111 $\rightarrow$ 15 $\Rightarrow 2^4 - 1 \rightarrow 2^x - 1$

$x = 5$:- 11111 $\rightarrow$ 31 $\Rightarrow 2^5 - 1 \rightarrow 2^x - 1$

x set bits $\Rightarrow 2^x - 1 \Rightarrow (1<<x) - 1$

b) x set bits & y unset bits.

$N \Rightarrow$ 0 0 0 1 1 1 0 0

$x = 3. \Rightarrow (1 << x) - 1$

$y = 2. \Rightarrow ((1 << x) - 1) << y.$

$\boxed{((1 << x) - 1)}$

$<< y$

0 0 0 0 0 1 1 1

new $\Rightarrow$ 0 0 0 1 1 1 0 0

$$((1 << x) - 1) << y$$

$\underbrace{x \text{ set bits}}$ followed by unset bits

$$((1 << x) - 1)) << y$$

$$\boxed{\begin{aligned} TC &\Rightarrow O(1) \\ SC &\Rightarrow O(1) \end{aligned}}$$

: Multiply :-

$a = 10^5$ $\quad$ $b = 10^6$.

int range : $[-2 * 10^9, 2 * 10^9]$

int c = a * b.

$c = 10^{11}$ X (out of range) X

↓

overflow.

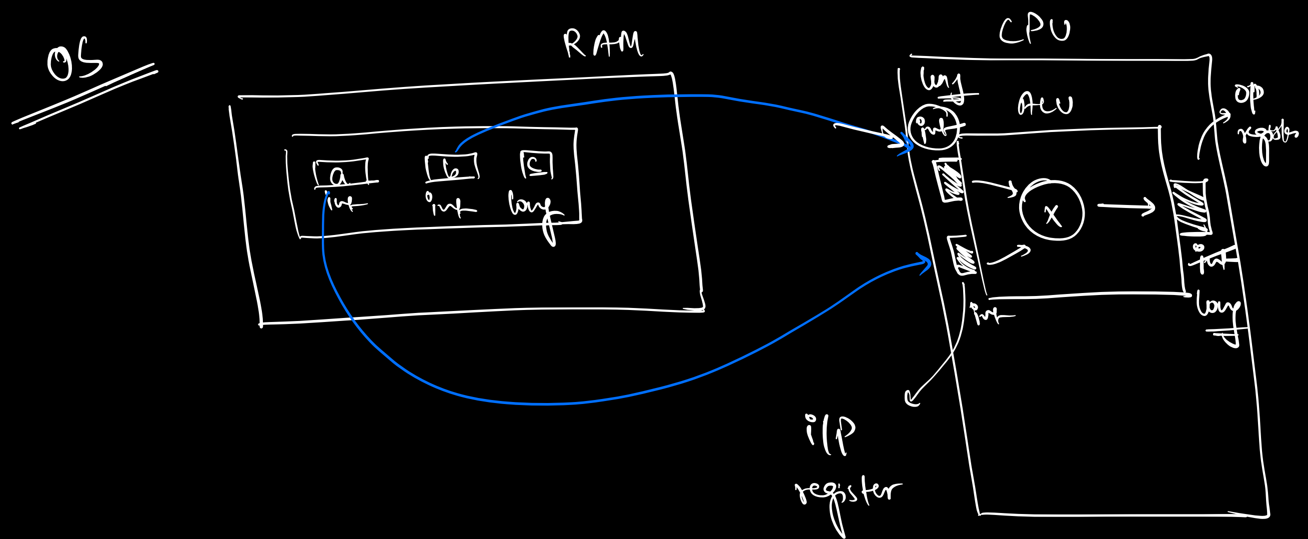
long range :- $[-2 * 10^{18}, 2 * 10^{18}]$

long c = a * b

$c = 10^{11}$ → ~~overflows~~.

long c = (long)(a * b) → first a × b calculated then o/p will be changed long

$c = 10^{11}$ → overflows



long c = (long) a * b ✓

- MSB
- Ranges
- Bitwise properties
- Basic checkbit properties
- Overflows.

Q2. Given a binary arr[ ], we can atmost replace a single 0 with 1, find max^m consecutive 1s possible.

	0	1	2	3	4	5	6	7	8	9	10
ex ⇒ arr ⇒	~~0~~ 1	1	1	1	~~0~~ 1	1	1	~~0~~ 1	1	1	~~0~~

4

6

5

3.

O/p = 6.

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

[3] & [4]   [4] & [2]   [2] & [0]   [0] [2]   [2] & [2]

8   7   3   3   5.

O/P: 8

for each zero :-

1) count of consecutive 1's on left side

2) count of cons. 1's on right side

3) total = leftC + rightC + 1

ans = maxm(all total counts).

pseudo

```
ans = 0
for( i=0; i<N; i++) {
    if( arr[i] == 0) {
        LC = 0   RC = 0.
        for ( j=i-1; j>=0; j--) {
            if( arr[j] == 1)
                LC++
            else
                break
        }
        for( j=i+1; j<N; j++){
            if( arr[j] == 1)
                RC++
            else break
        }
```

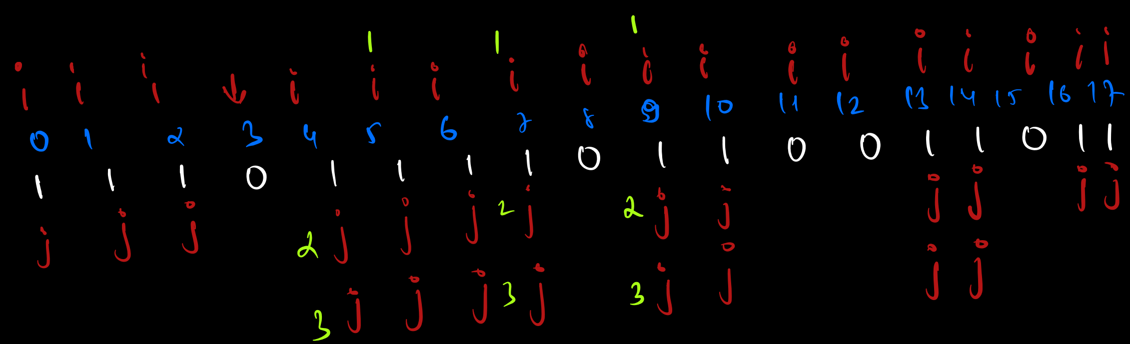
total = LC + RC + 1

ans = max(ans, total)

}

return ans.

};



$\boxed{\begin{array}{l} TC \Rightarrow O(3N) \approx O(N) \\ SC \Rightarrow O(1) \end{array}}$

edge case : i) if arr is completely 1's

return N.

ii) if arr is completely 0's

return 1.

Q. Given a binary arr[], we can swap almost one '0' with a '1' from the arr, find maxm consecutive 1's.

ex ⇒ arr ⇒ { 1 1 0 1 1 1 0 1 1 }

6

6

O/P = 6.

arr ⇒ { 0 0 1 1 0 1 1 1 0 1 }

LC RC

1 3 5

2 3 no extra 1's

+1

2+3+1 maxm con. ⇒ 5

O/P = 5

arr[] ⇒ { 0 0 1 1 0 1 1 0 }

O/P = 4.

Soln

I) find count 1

II) for every 0,

LC

RC

then, if (C1 > (LC+RC))

ans = max (ans, LC+RC+1)

else

ans = max(ans, LC+RC)

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

$\xleftarrow{2}$ 1 $\xrightarrow{3}$

ct => 5

LC + RC == ct { 6 (LC+RC)

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

$\xleftarrow{2}$ 1 $\xrightarrow{3}$

ct => 6

(LC + RC) < ct

6 => LC + RC + 1

c1 = 3

2 2 2 2

1 0 0 1 0 0 1

o/p = 2

(1+0)<3 (1+0)<3 (1+0)<3

L+R+1 L+R+1 L+R+1

$\boxed{\begin{array}{l} TC \Rightarrow O(N) \\ SC \Rightarrow O(1) \end{array}}$

i i

1 0 1 1 0 1 1 1 1

j j

j j

8 4 2

1 0 1 0 → 10

& 0 1 1 0

0 0 1 0

8 0 0 1

1 0 0 1

&

0 1 1 0

0 0 1 0

0 0 1 0

0 0 1 0

No, find the right most set bit position

N & ~(N-1) → no. with right bit 1