Q (Adobe 65)

There are N doors (1 to N)

In front of each door, one person is standing

Initially all the doors are closed

1st person → 1st, 2nd, 3rd, 4th .... Nth door

2nd person → 2nd, 4th, 6th, 8th ..... (Toggle)

3rd person → 3rd, 6th, 9th, 12th .....

4th person → 4th, 8th, 12th, 16th .....

:

Nth person

Return which doors are open at the end.

O	C	C	O	C	C	C	C		
1	2	3	4	5	6	7	8	9	×

1 5
2 6
3 7
4

1	2	3	4	5	6	7	8	9	10
C	×		×	×	×	×	×	✓	

Initially everything is closed.

For any door i, if I toggle the door

odd times ⇒ Open

Even times ⇒ Closed.

$9 \Rightarrow \underset{i}{1}, \underset{\substack{i \\ N/i}}{3}, \underset{N/i}{9}$ (factors of 9)

⇒ For every i, only the factors of i can toggle the i^{th} door.

If a no. has

odd factors ⇒ OPEN

even factors ⇒ CLOSED

N ⇒ for (1 to N) ⇒ O(N)

factors always occurs in pairs

Except for a perfect square

⇒ i is a factor of N

⇒ N/i is also a factor.

⇒ for ($i = 1$ to sqrt(N))

i N/i

9 ⇒ 3 3

$\underbrace{3 \quad 3}_{1}$

count += 2 ??

if (i == n/i) {
(count++;)
}

8 ⇒ 4

$\frac{8}{4} = 2$

⇒ Only perfect squares have odd factors.

1 → N

Doors whose index is a perfect square will be open at the end.

⇓

Count the no. of perfect squares (Revise session 1)

T.C. = $O(N \log N)$ ⇒ $\sqrt{N}$

12 ⇒ 1, 2, 3 , 4, 6, 12

i

N/i

sqrt(N)

9 → 1, 3 , 9

3

$1 - N \Rightarrow$ sqrt (N)

$N = 100$

$sqrt(100) = 10$

$1 - 100$

$\forall i > 10, \quad i^2 > 100\,(N)$

$1 - 10$

$1^2 = 1$ [1, N]

$\Downarrow$

$2^2 = 4$ [1, sqrt(N)] Iterate from (1 to sqrt(N)){

$3^2 = 9$

$4^2 = 16$ print (i^2);

⋮

}

$9^2 = 81$ T.C. = sqrt(N)

$10^2 = 100$

$11^2 = 121 \times$

[1, 2]

$\Downarrow$

$N = 8 \Rightarrow sqrt(8) = 2$

$1^2, \quad 2^2$

$\downarrow \quad \Downarrow$

$1 \quad 4$

$\Downarrow$

$1 \rightarrow N$

Amazon

Q-2 Given a no. N.

Return the N^{th} magical no.

Magic No → A no. that can be expressed as a sum of unique powers of 5. >0

$(N=1)$

1 $N=1$ → 5^1

→ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

$10 \Rightarrow 5+5$

5^{1} 5^{1}

2 $N=2$ ⇒ 5^2 ⇒ 25

3 $N=3$ ⇒ 5^1+5^2 ⇒ 30

4 $N=4$ ⇒ $5^3 = 125$

5 $N=5$ ⇒ $5^3+ \quad +5^1$ ⇒ 130 (155)

$N=6$ ⇒ $5^3+5^2 = 150$

$N=7$ ⇒ $5^3+5^2+5^1 = 155$

$N=8$ ⇒ $5^4 =$

$10 = 5^1 + 5^1$ ✗

N			3	2	1	
1st	5	$\rightarrow 5^1$ + 0×5^3	0	0	5^1	001
2nd	25	$\rightarrow 5^2$ 0×5^3	0	5^2	0	010
⇒ 3rd	30	$\rightarrow 5^2+5^1$ 0×5^3	0	5^2	5^1	011
⇒ 4th	125	$\rightarrow 5^3$ -4	5^3	0	0	100
⇒ 5th	130	$\rightarrow 5^3+5^1$	5^3	0	5^1	101
⇒ 6th	150	$\rightarrow 5^3+5^2$	5^3	5^2	0	110
⇒ 7th	155	$\rightarrow 5^3+5^2+5^1$	5^3	5^2	5^1	111

3 2 1

1 ⇒ 0 0 1

↑ 5^1

3 2 1

2 ⇒ 0 1 0

↑ 5^2

5^4	1 0 0 0 0
5^4+5^1	
5^4+5^2	
$5^4+5^2+5^1$	1 0 0 0 1
5^4+5^3	1 0 0 1 1
$5^4+5^3+5^1$	1 0 1 0 0
$5^4+5^3+5^2$	1 0 1 0 1
$5^4+5^3+5^2+5^1$	

N = 11th magical no.

1) Convert to binary

11 ⇒ 1011 (Array)

Code

```
int generateMagicalno.(N) {
    ans = 0;
    power = 1;
    while (N>0) {            (atmost 32 times)
        if((N&1) == = 1) {
            ans = ans + 5^power
        }
        power++;
        N = N>>1;            N = N/2
    }
}
```

i = i+1

a = a+1

power

T.C = Constant time ($\log N$)

INT N ⇒ (32)

N&1

N ⇒ 0|1 0

000001

000000

N=11 0 0 1 0 1 1

$5^5 \; 5^4 \; 5^3 \; 5^2 \; 5^1$

$ans = 0 + 5^1 + 5^2 + 5^4$

power = ~~1~~ ~~2~~ ~~3~~ 4

001010 $\xrightarrow{1}$ 000101 >>1

000001   000001

1   1

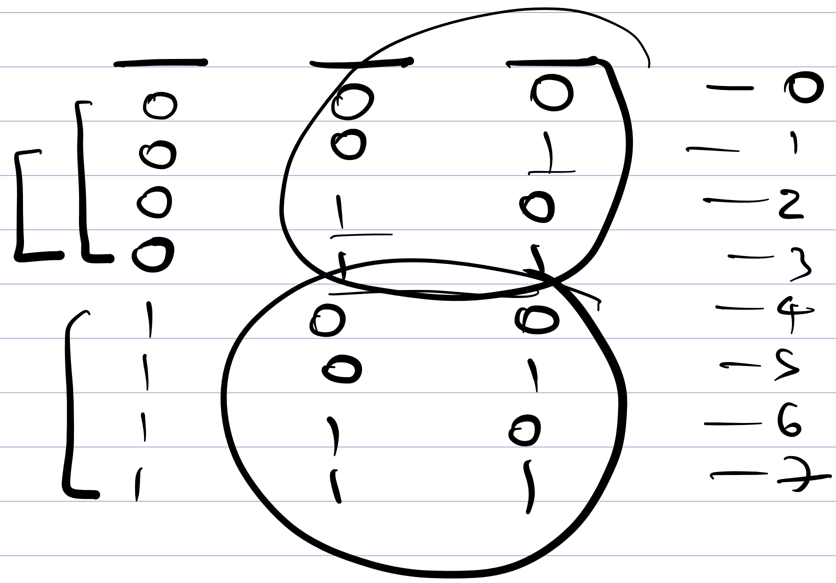
000010 >>1   000001 >>1

1   000001

0   1

000000

Doubt



A<<1

Yes

A <<= 1

$N = 11$

$$\Downarrow$$

$$((N>>1) \,\&\, 1)$$

Expression

temp $= (11>>1) = (5 \,\&\, 1) = 1$

$N>>1$

N

$a=3,\ b=2$

if $(((a+b) == 5))$

Google

Q Given an array of size N.

Return if there exists a no. with frequency $> N/2$

$\Rightarrow$ Majority element.

No extra space

s.c. $= O(1)$

A: 1, 6, 1, 1, 2, 1 $\quad N = 6$

$\frac{N}{2} = 3$, more than 3 times.

Majority $= 1$

Quiz

0 1 2 3 4 5 6 7 8 9 10

A: 3, 4, 3, 6, 1, 3, 2, 5, 3, 3, 3

$N = 11$

$N/2 = 5$ freq > 5

Quiz

$\forall i$

0 1 2 3 4 5 6 7 8 9

A: 4, 6, 5, 3, 4, 5, 6, 4, 4, 4

$N = 10$

$N/2 = 5$

freq ≥ 5

freq $> \frac{N}{2}$ $\Rightarrow$ $\frac{N}{2} + 1$

$N-1$, N

$N - \frac{N}{2} - 1$ $\frac{N}{2} - 1$

Sol^n

① Brute force

fix the element $\Leftarrow$ for ($i = 0$; $i \leq \frac{N}{2}$; $i{+}{+}$) {

count = 0;

Count A[i] $\Rightarrow$ for ($j = 0$; $j < N$; $j{+}{+}$) {

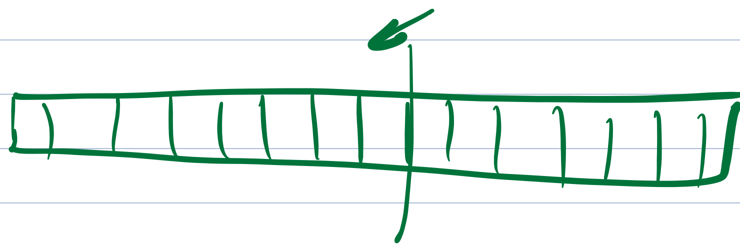
for (j ...

if (A[j] == A[i]) {
count++;
}

}

if (count > N/2) {
return A[i];
}

}



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

Approach 2 ⇒ Sorting

A: 4, 6, 5, 3, 4, 5, 6, 4, 4, 4

count = ~~1~~ ~~2~~ ~~3~~ ~~4~~ ~~5~~ ~~1~~ ~~2~~ ~~1~~ 2

A: 3, 4, 4, 4, 4, 4, 5, 5, 6, 6

1 N/2 N/2 + 1

count = 1

for (i = 1; i < N; i++) {

if (A[i-1] == A[i]) {
count++;

}

else {
count = 1;
}
$\Rightarrow$ if (count > N/2)
return A[i];
}
}

Sorting $\Rightarrow$ ✓

$$T.C. = O(N + N\log N)$$

$$= O(N\log N)$$

$$= O(N)$$

Array $\Rightarrow$ N

$\Downarrow$

$\left(\frac{N}{2} + 1\right) \Rightarrow \left(\frac{N}{2} - 1\right)$

freq of majority

freq of all remaining elements

$+1$

-1

$\left(\frac{N}{2} + 1\right) 1 - 1 \left(\frac{N}{2} - 1\right)$

$= 2$

N = 9 , 5

A: 5, 5, 2, 3, 5, 1, 2, 5, 5

ME: 5, 5, 5

Count: 1, 2, 1

3 ⇒ 2 of them are 5

1 of them is 2

N

N = 11, N/2 = 5, freq = 6

	0	1	2	3	4	5	6	7	8	9	10
A:	4	3	6	3	1	3	2	5	3	3	3
ME	4	4	6		1		2		3	3	3
Count	~~1~~	0	~~1~~	0	~~1~~	0	~~1~~	0	1	2	3

for an array, as long as count is +ve.

majority element may be present

N = 9 freq ≥ 5

A: 1, 2, 1, 2, 1, 2, 2, 1, 2, 1

ME 1 -1 1 -1 1 -1 1 -1 2 -1

C 1 0 1 0 1 0 1 0 1 0

>N/2

A: 1, 2, 3, 4, 1, 2, 1, 1, 3, 1, 1, 2

ME 1 × 3 × 1 × 1 1 1 1 1 1

C 1 0 1 0 1 0 1 2 1 2 3 2

i=3

N=7 N/2 = 3, fre = 4

A: 1, 2, 3, 4, 5, 6, 7

ME 1 × 3 × 5 × 7

C 1 0 1 0 1 0 1

i++

cont tie

~~A: 4, 3, 6, 3, 1, 3, 2, 5~~

N=10 fre = 6

A: 3, 3, 2, 3, 3, 3, 3, 2 5, 7

ME 3 3 3 3 3 3 3 3 3 3

c 1 2 1 2 3 4 5 4 3 2

Code

m = A[0]
c = 1

```
for (i=1; i<N; i++) {
    if (A[i] == m) {
        c++;
        continue;
    }
    else {
        c--; :
    }
    if (c == 0) {
        i++;
        if (i < N) {
            m = A[i]
            c = 1; }
    }
}

if (c>0) {
    count = 0;
    for (i=0; i<N; i++) {
```

```
    if (A[i] == m) {
        count++;
    }
  }
  if (count > N/2)
     return m;
  }
}
```

$$T.C. = O(2n) = \underline{O(n)}$$

$$S.C. = \underline{O(1)}$$

Doubt

N = 3

1+1+1

Back In (Recursion)

⇒ 5 → 1+1+1+1+1

3 → 1+1+1

5

5 ⇒

N ⇒ Nth fibonacci

0th

0 1 1 2 3 5

3 2 1

10^2 10^1 10^0

B

10^4 10^3 10^2 10^1 10^0

$1 \rightarrow N$

Sum of all N no's

$$\frac{(N)(N+1)}{2}$$

1 ass

$X \wedge A$

$1 \rightarrow N$

$$\frac{(N)(N+1)}{2}$$

$$\frac{(N)(N+1)}{2} - X + A$$

$X - 2A$ / $2A - X$

$X - A =$

$B \wedge A$

$N = 10$

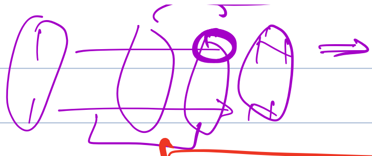
1, 2, 3, 4, 5, 6, 7, 8, 9, 10

7

$A = 7$
$B = 4$

Ada B^A

$A \wedge B = 0$

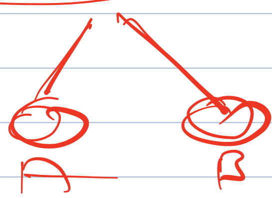


$A \wedge B = \bigcirc - ②$

$$\boxed{(A \wedge B) \,\&\, (\sim((A \wedge B) - 1))}$$

$1 \rightarrow N+1$

$1 — N+2 \; (\rightarrow 2$



$\frac{A}{B}$

$1 \rightarrow N$ $\frac{A}{B}$ Overflow