

2/9/23

week → 4 class → 5

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Date: 23/2

B.o.S more Questions →

(1) → Divide Two Numbers using B.o.S

i/p → 2 numbers

ex →  $29/7 = 4 \rightarrow$  Lie b/w 0 to 29

$57/8 \rightarrow 7 \downarrow \rightarrow$  Lie b/w 0 to 57  
ans

divisor / dividend | Quotient

Reminder

Quotient × Divisor + Reminder = Dividend

ex i/p → 29 , 7

Q      M<sub>id</sub>      29

Q = 0, R = 29, mid = 14

Is 14 a Possible ans

Quotient × Divisor ≤ Dividend

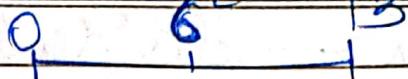
$14 * 7 \leq 29 \rightarrow$  false

R = mid - 1

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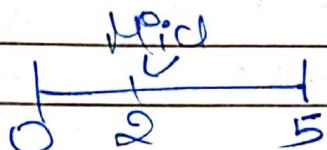
Mid



$$S=0, e=15, \text{mid} = \frac{0+15}{2} = 6$$

$$6 * 7 = 42 \leq 29 \rightarrow \text{False}$$

$$e = m - 1$$

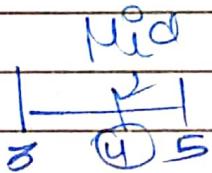


$$S=0, e=5, \frac{0+5}{2} = 2$$

Store 2

$$2 * 7 = 14 \leq 29 \rightarrow \text{True}$$

$$S = \text{mid} + 1$$



$$S=3, e=5, \text{mid} = 4$$

$$4 * 7 = 28 \leq 29 \rightarrow \text{True}$$

$$\text{Ans} = 4$$

$$S = m + 1$$

$S \rightarrow$  ~~5~~  
Mid

$$5 * 7 = 35 \geq 29 \rightarrow \text{So}$$

$$e = \text{mid} - 1$$

Out of Loop

Ans = 4  $\rightarrow$  closest answer

fun  $\rightarrow$  mid \* divisor

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Code  $\rightarrow$

If (fun == divisor)  
return mid

else if (fun < divisor)

ans = mid

s = mid + 1

+ve  
+ve

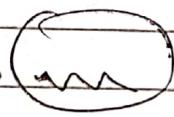
else  $\rightarrow$  e = mid - 1

Negative Case  $\rightarrow$   $\frac{-ve}{-ve} = +ve$

$$\frac{-ve}{+ve} = \left( \frac{+ve}{-ve} \right) \Rightarrow -ve$$

Ans  $\rightarrow$  +ve  $\rightarrow$  ka nikal lo  
+ve

check at last If (divisor < 0 || divisor > 0)  
then ans = -ans

H/W  $\rightarrow$  4.   $\rightarrow$  find freq. of character after point

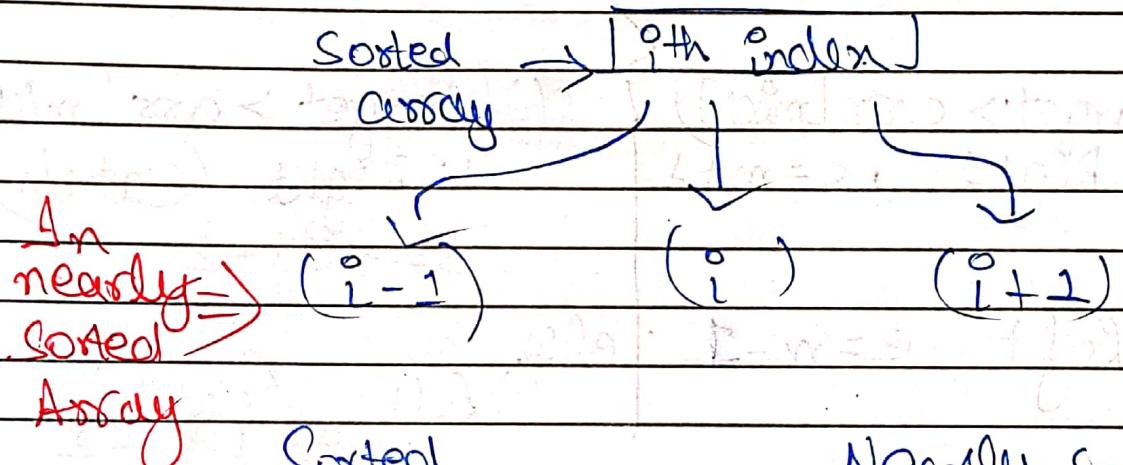
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## ② → BS on Nearly Sorted Array

	0	1	2	3	4	5	6
Sorted Array	30	20	30	40	50	60	70

nearly sorted array	20	30	30	50	40	70	60



$$i = 0 \xrightarrow{0} (30) \quad \text{Nearly Sorted} \quad 1 \xrightarrow{(i+1)} (60)$$

$$i = 1 \xrightarrow{1} (20) \quad 0 \xrightarrow{(i-1)} (70)$$

$$i = 2 \xrightarrow{2} (30) \quad 2 \xrightarrow{(i)} (50)$$

$$i = 3 \xrightarrow{3} (40) \quad 4 \xrightarrow{(i+1)} (60)$$

$$i = 4 \xrightarrow{4} (50) \quad 3 \xrightarrow{(i-1)} (70)$$

$$i = 5 \xrightarrow{5} (60) \quad 6 \xrightarrow{(i+1)} (70)$$

$$i = 6 \xrightarrow{6} (70) \quad 5 \xrightarrow{(i-1)} (60)$$

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normal

```
> if (arr[mid] == target)
    return mid;
else
```

```
> if (target > arr[mid])
    ↳ Right, s = m + 1
```

else  
 ↳ Left, e = m - 1

nearly sorted array

```
> if (arr[mid-1] == target)
    return mid - 1;
```

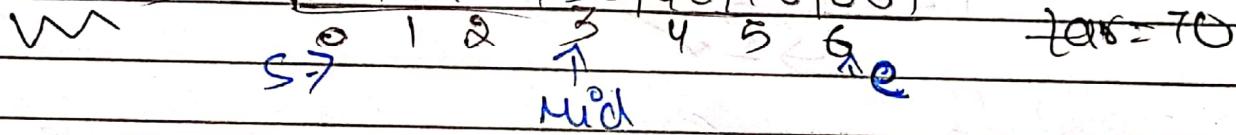
```
if (arr[mid] == target)
    return mid;
```

```
if (arr[mid + 1] == target)
    return mid + 1;
```

```
if (target > arr[mid])
    ↳ Right (Catch)
    s = mid + 2
```

else  
 ↳ Left (Catch)  
 e = mid - 2

DRY-Run →



$$s = 0 \rightarrow m = 3 \\ e = ?$$

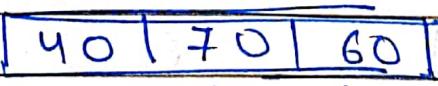
$arr[m-1] \rightarrow 30 = 70 \rightarrow X$

$arr[m] \rightarrow 50 = 70 \rightarrow X$

$arr[m+1] \rightarrow 40 = 70 \rightarrow X$

if ( $target > arr[mid]$ )  
 $40 > 50 \rightarrow True$

$$s = m + 1$$



$arr[mid-1] = 40 = 70$

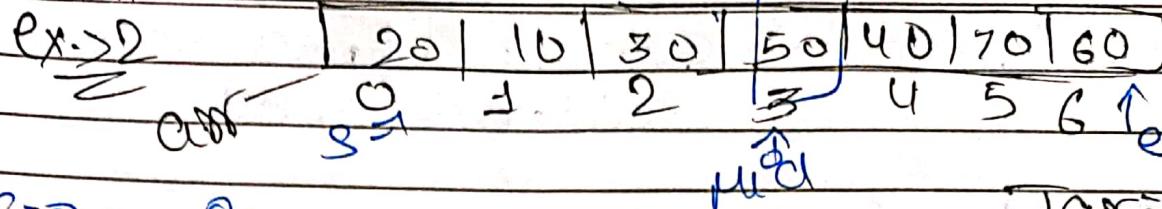
$$s = 4 \rightarrow m = 5 \\ e = 6 \rightarrow m = 6$$

40 Poh check  
 log40 so

mid + 2

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$$S=0 \rightarrow \text{mid} = 3$$

$$e=6 \rightarrow \text{tar} = 20$$

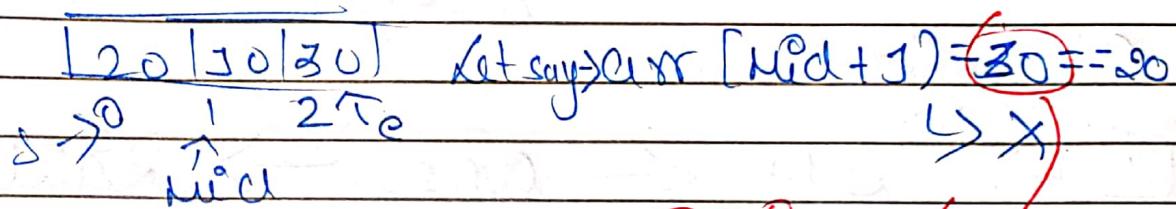
$$\text{arr}[mid-1] = 30 \neq 20 \times$$

$$\text{arr}[mid] = 50 \neq 20 \times$$

$$\text{arr}[mid+1] = 40 \neq 20 \times$$

If  $[\text{tar} > \text{arr}[mid]]$   
 $20 > 50 \rightarrow \text{false}$

$$e = \text{mid} - 1$$



This is already checked so,

$$[e = \text{mid} - 2]$$

③) Find the odd occurring element

$\Leftrightarrow$  all elements  $\rightarrow$  even no of times occur except one  $\rightarrow$  odd

i) XOR  $\rightarrow O(n)$

$\rightarrow$  all repeating no  
 $\downarrow$   
 pair repeat

ii) Count  $\rightarrow$  Map  $\times$

$\rightarrow$  And No pairs in

iii) Sorting  $\rightarrow$  odd times  $\rightarrow$   $O(n \log n)$

$\rightarrow$  Repeated  
 $\rightarrow$  Ek baar koi bhi 2 se razgar baar

(iv) BS  $\rightarrow O(\log n)$

$\rightarrow$  Nahi ac raha

20/01/23 Conditions

i) all elements  $\rightarrow$  even no of times occur  
except one  $\rightarrow$  odd

ii) all repeating no  $\rightarrow$

1	1	3	5	2	2	3	3	2	4	4
0	1	2	3	4	5	6	7	8	9	10

left of ans  $\leftarrow$

Right of ans  $\rightarrow$

Observation  $\rightarrow$

①  $\rightarrow$  Left  $\leftarrow$  Ans  $\rightarrow$  Right

1<sup>st</sup> Element = Even Index

Odd Index

2<sup>nd</sup> Element = Odd Index

Even Index

②  $\rightarrow$  Ans  $\rightarrow$  always at even index

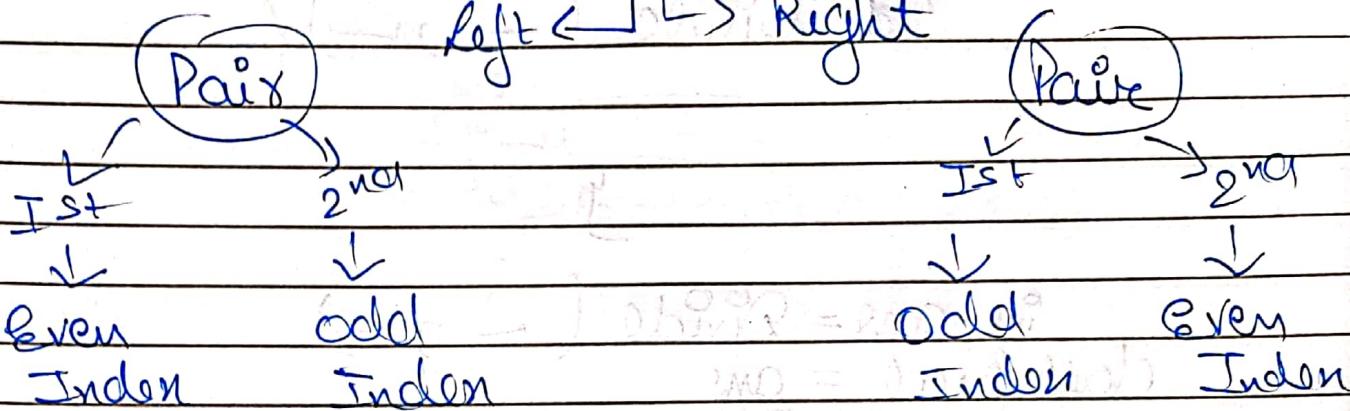
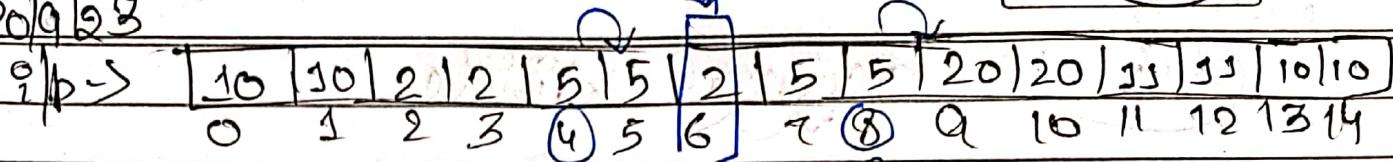
③  $\rightarrow$  single element case  $\leftarrow$  return that no

$s \rightarrow e \leftarrow$  If ( $s == e$ )  
return  $s/e/mid$

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Ans.

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Logic  $\rightarrow$  ans

if ( $\text{mid} \% 2 == 0$ )  $\rightarrow$  (Even)

if ( $\text{arr}[\text{mid}] == \text{arr}[\text{mid} + 1]$ )  $\rightarrow$  True (Left)  $\rightarrow$  false  $\rightarrow$  (Right)

$s = \text{mid} + 2$

$\text{mid} + 1 \rightarrow$  already checked

~~else~~ else  $\rightarrow$  ans at even index, so ans also included here

$$e = \text{mid}$$

our Ans

is at even index

so also

$s = \text{mid} + 1$   $\rightarrow$  even

$e = \text{mid} - 1$

else  $\rightarrow$  At odd (odd)

if ( $\text{arr}[\text{mid}] == \text{arr}[\text{mid} - 1]$ )

$s = \text{mid} + 1$

else  $\rightarrow$  1me 2 also included

$e = \text{mid} - 1$

while ( $s \leq e$ )  $s = e$

$\downarrow$  because I handled

$$s = e$$

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H/W  $\rightarrow$  decimal Divide

int Divide ( - , - )

y

int ans = Divide ( - , - )

double final = ans

precision = 2;

double step = 0.1;

for (i = 0; i < precision) {

    for (j = final; j \* abs(divisor) <= abs(divide); j += step)

        final = j;

divisor = 7

divide = 29

y  
step) = 10;

cout << final;

$\Rightarrow i = 0$

j = 4 ;  $4 \times 7 = 28 \leq 29 \rightarrow \sqrt{29} ; j + step$

f F j

j = 4.1 ;  $4.1 \times 7 = 28.7 \leq 29 \rightarrow P ; j + 0.1$

j = 4.2

j = 4.2 ;  $4.2 \times 7 = 29.4 \leq 29 \rightarrow F,$

Out of Loop

Step 1 = 10  $\rightarrow 0.01$

$i = 1$  $j = 0$  — $j = 1$  — $j = 2$  — $j = 3$  — $j = 4$  —  
 $j = 5 \rightarrow \text{out of loop}$ 

That's how loop is working