

Week-3

APCO

34 19/23

Assignments

Question - 1

⑨ → key pair

$N = G, \rightarrow$ size , $x = 16 \rightarrow$ sum
of points

$\stackrel{0}{\text{I}}/\text{p} \rightarrow$ 14145161018

Approach → i) Nested Loop $\rightarrow O(n^2)$

ii) Two pointers $O(n)$ \rightarrow Want this

There is
only

14361018

Sort this array

~~x -> given sum~~

~~BEST~~

```

1 | 4 | 6 | 8 | 10 | 45
l → if (arr[l] + arr[s] > x)
else if (arr[l] + arr[s] <= x)
else of → found
return s
arr[l] + arr[s]

```

(m)

SHYRON

0	1	2	3	4	5
1	4	5	8	10	45

$$\underline{x = 16}$$

$$i) l=0, r=3, \text{ min } \alpha_{xx}[0]=1, \alpha_{xx}[5]=45$$

$$1+43=46 > 16$$
$$x = - \Rightarrow x = 4$$

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 Date: 14/9

$$(i) l = 0, r = 4$$

$$\text{arr}[l] = 1, \text{arr}[r] = 10$$

$$1 + 10 = 11 < 16$$

$$l++ \rightarrow 1$$

 arr^{copy}

$$l = 1, r = 4$$

$$\text{arr}[l] = 4, \text{arr}[r] = 10$$

0	1	2	3	4	5
1	4	6	8	10	45

$\overbrace{\quad}^l \quad \overbrace{\quad}^r$

$$4 + 10 = 14 < 16$$

$$l++ \rightarrow 2$$

 arr^{copy}

$$0 \ 1 \ 2 \ 3 \ 4 \ 5$$

0	1	2	3	4	5
1	4	6	8	10	45

$\overbrace{\quad}^l \quad \overbrace{\quad}^r$

$$l = 2, r = 4$$

$$\text{arr}[l] = 6, \text{arr}[r] = 10$$

$$6 + 10 = 16 \rightarrow \text{True}$$

return True;

(iii) Approach (Set) $a+b = \text{sum}$

$$b = \text{sum} - a$$

temp arr

$\overbrace{\quad}^l \quad \overbrace{\quad}^r$ arr

$\overbrace{\quad}^l \quad \overbrace{\quad}^r$ temp arr

i) $16 - 1 = 15 \rightarrow$ it is present in arr No
so, 1 will be in temp arr

ii) $16 - 4 = 12$; 11(likely)

iii) $16 - 45 \rightarrow -29 \rightarrow$ Not present in arr

iv) $16 - 10 = 6 \rightarrow$ present in Set

So, No = 6 & 10

Q-1) Two Sum
Variety -> 2

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Date: 18/4

$$\text{arr} = [1, 4, 4, 5, 6, 8] \quad \text{target} = 16$$

Return Index:

for $i \leftarrow 0 \rightarrow n$

$$\text{more} = \text{target} - \text{arr}[i]$$

If ($\text{m.find}(\text{more}) \neq \text{m.end}()$)

$\text{ans.push}(i)$;

$\text{ans.push}(m[\text{more}])$;

return ans

else \rightarrow

$$m[\text{arr}[i]] = i$$

Hashing Map + m

(6, 3)
(4, 2)
(1, 0)

i) $i=0, \text{more} = 16-15=1$
 1 is not in hash
 $m[1]=0$

No 1 index
 (\uparrow, \uparrow)

ii) Skip to $i=3, \text{arr}[i]=6, \text{more}=16-6=10$
 10 is not in has
 $m[6]=3$.

iii) $i=4, \text{arr}[i]=10, \text{more}=16-10=6$

6 is in hash

14 3

\rightarrow hash $i \rightarrow$ in vector

$\rightarrow m[\text{more}] \rightarrow m[6] \rightarrow$ return

14 3 \rightarrow found index

key value
 \downarrow
 3

Question - 2

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Date: 180

14 9 2 3

② → Find Pivot Index →

$i/p \rightarrow [1 | 7 | 3 | 6 | 5 | 6]$

$o/p \rightarrow 3$

$$\text{left sum} = 1 + 7 + 3 = 11$$

$$\text{Right Sum} = 4 + 5 = 11$$

Approach → i) Brute force

$\rightarrow \text{for } i = 0 \rightarrow n-1$
 $L_S = 0, R_S = 0$
 $\rightarrow \text{for } j = 0 \rightarrow i$
 $L_S += a[j]$
 $\text{for } j = i+1 \rightarrow n$
 $R_S += a[j]$

if ($L_S == R_S$)
 return i ;

i , starts from 1
 if you want

$T.C \rightarrow O(n^2)$
 space $\rightarrow O(1)$

ii) $\begin{array}{c|c|c|c|c|c} 0 & 1 & 2 & 3 & 4 & 5 \\ \hline 1 & 7 & 3 & 6 & 5 & 6 \end{array}$
 $L_SUM + [1 | 7 | 3 | 6 | 5 | 6]$
 $R_SUM + 0 | 20 | 17 | 13 | 6 | 0$
 $0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad (n-2)$

→ Two array
 Initialize with zero

for ($i = 1$; $i < \text{num.size()}; i++$)

$L_SUM[i] = L_SUM[i-1] + \text{num}[i-1];$

$\text{num}[i-1];$

for ($i = n-2$; $i \geq 0$; $i--$)
 $R_SUM[i] = R_SUM[i+1] + \text{num}[i+1];$

for ($i \rightarrow c$)

$$\text{if } (\text{sum } P_i) == R\text{sum}[i]$$

\leftarrow
pref fix sum

\downarrow
return

\downarrow
post fix sum

(2) Missing Number \rightarrow

$n \rightarrow \text{Size}$
 $0 \rightarrow n$
numbers

but only
 n can get in
already so

$n+1 \rightarrow \text{numbers}$
 \downarrow
Total

1, number will be missing

Ex:

[3 | 0 | 1]

$n = 3 \rightarrow \text{Distinct NO}$

But Miss a No from $[0, n] = [0, 3]$
I have to tell \downarrow
this

(S-1) \rightarrow Sort $\rightarrow [0 | 1 | 3]$
Index 0 1 2

(S-2) if $(\text{arr}[i] - i) \neq 0$ \rightarrow return i

Fail At \rightarrow Input $[0 | 1]$ \rightarrow 2 is Missing
that \rightarrow where last no is Missing

So, also return $\text{arr}[n-1] \rightarrow$ last element

L) If array has return the last element all bhai

→ Ig → 168
o o
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8) Missing Number (leet code)

[0, n] → Distinct No

Question → 3

Approaches: i) B.o.S

ii) Sort them B.o.S OR Sort → Then index - n = 0

iii) $\text{SUM} = n(n+1)/2$ $n \rightarrow \text{Pta } m$
 $\text{for } (i = 0; i \leq n; i++)$ Did not work on (0, 1)

Sum of
n Terms

Arr Sum + arr(i);

Final Result: SUM - ArrSum = Missing No

Question → 4

1) Remove Duplicates from sorted Array

0 1 2
n = 3

0) p → [1 1 2]

0) p → [1 2] return → 2, also

i) → Temp array

void

for (i → n-1)

if (num[i] == num[i+1])

Temp.push_back(num[i])

14/9/23 After loop

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Date: 18/8

temp.back (move front size (-1));

→ In this the last value will not be pushed

diffElement = temp[0];

return diffElement;

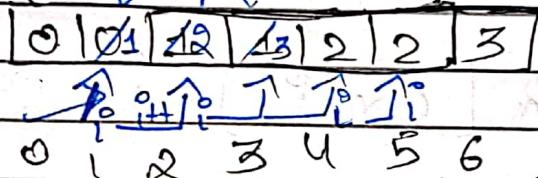
TC $\rightarrow O(n)$

Space $\rightarrow O(n)$

(ii)

Two Pointers

p → p → p



pos⁰ = 1;
i⁰ = 1;

0 1 2 3 4 5 6

```
for (i=1; i< nums.size(); i++)  
    if (nums[i] != nums[pos])  
        nums[pos] = nums[i];  
        pos++;
```

3

return pos;

DRY RUN

i⁰ = 1, pos⁰ = 1

0 = 0, i++

i⁰ = 2, pos⁰ = 1

0 ≠ 1

nums[1] = nums[2]

p++;

i⁰ = 3, pos⁰ = 3

nums[3] = 1, nums[2] = 1
1 = 1 → i++

iv) i⁰ = 4, p = 1

nums[4] = 2, nums[1] = 1

2 ≠ 1

pos⁰ + 1, i⁰ + 1

nums[1] nums[p]

v) i⁰ = 5, p = 2, 2 = 2 → i++

vi) i⁰ = 6, p 2, nums[6] ≠ nums[2]

3 ≠ 2 → i++ → out of loop
p++

Do Kadane's Algorithm

Question → B

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Q) Maximum Average Subarray →

i) P →

1	12	-5	-6	50	31
---	----	----	----	----	----

, k = 4 & contiguous
0 1 2 3 4 5

$$O/b \rightarrow \text{Max Avg.} \Rightarrow (12 - 5 - 6 + 50)/4 = 51/4 = 12.75$$

i) Brute force → 4 Loop Laga ke Max No
~~X (wrong)~~ Nikal liga them Avg of that 4 Max no

$$\Rightarrow TC = O(n^2) \rightarrow O(n^2)$$

Space = $O(n)$
Complexity

ii) Nested Loop
Brute force → element should be contiguous
→ Nested Loop

So, for ($i=0 \rightarrow \leq n-k$)
for ($j=i \rightarrow j+k$) then check
 $\text{sum} = \text{ans}(i) \rightarrow (\text{avg} > \text{ans})$

iii) Best Approach → Sliding Window Algo

(S-1) $\text{int sum} = 0$
 $\text{for } (i=0 \rightarrow k)$
 $\quad \text{sum} = \text{num}[i];$

(S-2) $\text{MaxSum} = \text{sum};$

(S-3) $\text{int s} = 0$
 $\text{int e} = k$

$\text{while } (e \leq \text{num}.length)$

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Sum = num[s]; // Remove 1st element
s++;

Sum + num[e] -> // Add next element
e++;

maxSum = Math.max(maxSum, sum);
return (double) maxSum/k;

DYRUN \rightarrow Sliding Window

i/p \rightarrow [1 | 12 | -5 | -6 | 50 | 3], k=4
 $s \uparrow$ $e \uparrow$

(i) \rightarrow maxSum = 2, e=4, num.length = 6
while ($4 < 6$)

Same for Now \rightarrow sum - num[s] $\Rightarrow 2 - 1 \Rightarrow 1$

sum + num[e] $\Rightarrow 1 + 5 \Rightarrow 51$
e++, maxSum $\leftarrow 51$

(ii)

[1 | 12 | -5 | -6 | 50 | 3]
 $s \uparrow$ $e \uparrow$
 $5 < 6$

\hookrightarrow sum - num[s] $= 51 - 12 = 49$, s++

sum + num[e] $= 49 + 3 = 52$

maxSum > sum \rightarrow false

(iii)

[1 | 12 | -5 | -6 | 50 | 3]
 $s \uparrow$ $e \uparrow$

\rightarrow while ($6 \leq 6$)
 \rightarrow sum - num[s] \rightarrow out of loop

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Question 6

Apeo
Date: 18/7

(6) → Sort Colors ↴

Input → [2 1 0 1 2 1 1 3 1 0]

Zeroes Count → 0 [0, 0] →

One → 1 [1, 1]

Twos → 2 [2, 2]

i) Counting Method

Then store it in arr

[2 0 1 8 1 8 1 1 2 3 1 2] → [0 0 1 3 3 9 2 2]

if (nums[i] == 0) → i++

= = 1 → one++

= = 2 → Two

This

Put i = 0;

while (zeros - i)

num[i] = 0;

i++

Not
In-place

while (ones - i)

nums[i] = 0;

while (twos - i)

num[i] = 2;

i++;

TC → O(n)

Space = O(1)

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(ii) In-place \rightarrow 3-pointers approach
$$\rightarrow 2 \mid 0 \mid 2 \mid 3 \mid 1 \mid 0$$

$\swarrow l$ $\nwarrow m$ $\uparrow h$

(S-1) \rightarrow arrange score zero age (l)(S-2) \rightarrow Arrange $\rightarrow h$ at last (h)(S-3) \rightarrow move m every time

If ($\text{nums}[m] == 0$)
 Swap ($\text{nums}[l]$, $\text{nums}[m]$)

 $l++$, $m++$

If ($\text{nums}[m] == 1$)
 $m++$

If ($\text{nums}[m] == 2$)

Swap ($\text{nums}[h]$, $\text{nums}[m]$)

 $h--$

$$2 \mid 0 \mid 2 \mid 3 \mid 1 \mid 0$$

$\swarrow l$ $\nwarrow m$ $\uparrow h$

 $n[m] = 2$ Swap, $h--$ (i) $0 \mid 0 \mid 2 \mid 3 \mid 1 \mid 2$

$\swarrow l$ $\uparrow m$

if $\text{nums}[m] == 0$ Swap(l, m) $l++, m++$ If ($\text{nums}[m] == 0$)Swap, $l++, m++$

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(iii) 0|0|2|3|2
 $\frac{3}{m}$ $\frac{1}{h}$

nums[m] = 2
swap(m, h), h--

(iv) 0|0|9|1|2|2
 $\frac{3}{m}$ $\frac{1}{h}$

nums[m] = 1
m++

v) 0|0|3|3|2|2
 $\frac{3}{m}$

nums[m] = 1
m++

$m > h \rightarrow \text{sort}$

while ($m \leq h$)

$T.C \Rightarrow O(n)$ space $\Rightarrow O(1)$

(iii) Sort

ls sort (arr, arr+n) \rightarrow It is library function

$T.C \geq O(n \log n)$

\hookrightarrow Min of Quick sort + heap in O(n)

Question - 7

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(H) \rightarrow Move all Negative Number to left side of an Array

$$i/p \rightarrow \{12, -3, 4, -5, 6\}$$

o/p \rightarrow $-3, -5, 1, 2, 4, 6 \rightarrow$ can be sorted or not doesn't matter

i) Sort \rightarrow ascending order / increasing

Sort $\rightarrow -3, -5, 1, 2, 4, 6$

Tc $\rightarrow O(n \log n)$ Sc $\rightarrow O(n)$

ii) Dutch National flag (2 Pointed)

$l \rightarrow$ maintain -ve

$h \rightarrow$ maintain +ve

0 1 2 3 4 5
1 | 2 | -3 | 4 | -5 | 6

$l \uparrow$

$h \uparrow$

If ($a[l] < 0$)
 $l++$

$a[l:h] > 0$
 $h--$

else ($a[h] > 0$)
 $h--$

(ii) 1 2 1 -3 4 5 6
 $l \uparrow$ $h \uparrow$

$a[l:h] > 0, a[h] > 0$

swap, $l++$, $h--$

else {
swap ($a[l], a[h]$)
 $l++$, $h--$; } y

(iii) $-5 | 2 | -3 | 4 | 1 | 6$

$arr[l] > 0$

(iv) $-5 | \underset{l=1}{\cancel{5}} | \underset{h=3}{\cancel{-3}} | 4 | 1 | 6$

$arr[l] > 0, arr[h] < 0$
Swap, $l \leftarrow l + 1, h \leftarrow h - 1$

(v) $-5 | \underset{l=3}{\cancel{3}} | \underset{h=4}{\cancel{2}} | 4 | 1 | 6$

$l \geq h \rightarrow \text{stop loop}$

while ($l \leq h$) or can be while ($l < h$)

Q) \rightarrow Find Duplicate Number

$n+1 \rightarrow \text{Integers}$
 $[1, n] \rightarrow \text{Range}$

Question - 8

Only one Repeated Number

0 → 1|3|4|2|2 → 1|3|4|2 → ~~else here~~
0 1 2 3 4 Change
the

i) Sort for 0 1|2|2|3|4
ab $arr[i+1] - arr[i] = 0$
find Number

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OR $\rightarrow \text{arr}[i] == \text{arr}[i+1]$
then return

TC $\rightarrow O(n \log n)$

Space $\rightarrow O(n)$

(ii) Negative Marking Method

$$1|3|4|2|2 \rightarrow n+1 = 5 \\ N=4$$

$$1|3|4|2|2 \\ 0 \ 1 \ 2 \ 3 \ 4 \Rightarrow \text{go } \text{No} \text{ wh} \rightarrow \text{no} \\ [1, n]$$

agar \rightarrow index
 0 to n

& index $\rightarrow [0, n]$
 length / size $\rightarrow [1, n+1]$

Numbers 1 to n

Index No
To h \rightarrow 1 1

2 2

3 3

4 4

So, Index $\rightarrow 0$
 \downarrow
extra no

Iska agaya

NH
 $\Rightarrow 1|1|3|4|2 \Rightarrow$
0 1 2 3 4 numbers $[i] \rightarrow$ index
Literate Index \rightarrow

- ② \rightarrow Marks visited
- ③ \rightarrow already visited
found Duplicate

15h125

DRVRUN \rightarrow

0 1 2 3 4

1 | 3 | 4 | 2 | 0

$i \uparrow$
 $\text{if}(\text{nums}[\text{nums}[i]] = \text{nums}[j])$
 $\hookrightarrow \text{position} \rightarrow \text{visited}$

(ii) $i \uparrow$ 0 1 2 3 4 use No ko-ve
 $-3 \uparrow$ 1 | -3 | 4 | 2 | 2
 $(-3) \text{ abs} \rightarrow 3$

(iii) $i \uparrow$ 0 1 2 3 4
 $-3 \uparrow$ 1 | -3 | 4 | 1 | -2 | 2

(iv) $i \uparrow$ 0 1 2 3 4
 $-3 \uparrow$ 1 | -3 | 4 | -2 | -2

(v) $i \uparrow$ 0 1 2 3 4
 $-3 \uparrow$ 1 | -3 | -4 | 1 | -2 | -2

$\text{nums}[\text{nums}(-3)] = \text{nums}(2) \rightarrow \text{ko negative}$

Karo \rightarrow But toh
 Negative hi already
 So, return that no.

$T.C \rightarrow O(n)$

space $\rightarrow O(n)$

In this we are modifying array
 But acc to question we mustn't modify array

15/4/23
(ii)

1|3|4|2|2

 $\rightarrow n+1$

↳ Normal

 $n=4$

nums [0] ∈ [1, 4]

↳ 0|1|3|4|2 → Index
↓ ↓ 2 3 4 → Noextra
elem↓ swap/Rearrange
③ 1|2|3|4 → No
↓ 0 1 2 3 4 → Index

Extra element 0 → Pe

S return index → 0
or element at 0
ajayegavaox → 3|3|3|4|2
↓ 0 1 2 3 4→ 4|1|3|3|2
↓ 0 1 2 3 4→ 2|1|3|3|4
↓ 0 1 2 3 4→ 3|1|2|3|4
↓ 0 1 2 3 4

But 3 is posi le 3

while (a[0] != a[a[0]])
swaphh so,
Don't swap
& return it

else → return a[0];

Question - 9

13/9/2013

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Date: (195)

Q → Missing Element from an Array with Duplicate Numbers

$$\stackrel{5}{1} \mid \stackrel{1}{1} \rightarrow \begin{array}{|c|c|c|c|c|} \hline 1 & 3 & 5 & 3 & 4 \\ \hline 0 & 1 & 2 & 3 & 4 \\ \hline \end{array}$$

W) \rightarrow size of Andy
at age 11, NJ

i) \rightarrow soft

Sort → karlo

Ab \Rightarrow 1 | 3 | 3) 4 | 5
Abel 0 1 2 3 4

$$TC \rightarrow O(n \log n)$$

$\Rightarrow O(n)$

If $\text{arr}[i] = i+1$

~~return \rightarrow i+1 \rightarrow that is the
No, we are missing~~

(ii) Mark visit

$1|3)5|34 \rightarrow$ No → The equal = And in
1st 2nd 3rd 4th into Negative

$$(v) \quad -3|3|-5|-3|-4$$

Check remaining Positive
No 6 index \rightarrow that is the missing No

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M-3) \rightarrow Swapping \rightarrow TC $\rightarrow O(n)$
 $C \rightarrow O(1)$

i/p \rightarrow ① 3 | 3 | 3 | 4

Let's Index 1 2 3 4 5
Start from 1

No \rightarrow ko mile index
Pe pauch do

Index \rightarrow 1 | 3 | 3 | 4 | 5
1 2 3 4 5
 \rightarrow Missing 6

W.R.Y.-RUN \rightarrow

Ques 0 1 2 3 4
5 | 3 | 3 | 3 | 1

while ($i < n$) {

index = 4

index = $a[i] - 1$

if ($a[index] \neq a[i]$)

swap

swap

(i) 1 | 3 | 3 | 3 | 5

index = 0

if ($a[0] \neq a[0]$)

\rightarrow false
 $i++$

for ($i = 0 \rightarrow n$)

(ii) 1 | 3 | 3 | 3 | 5

if ($a[i] \neq a[i+1]$)

$i \rightarrow 1$ (are)
 $i \rightarrow 2$ (3)

cout << $a[i] \ll \text{endl}$;

if ($a[2] \neq a[3]$)

\rightarrow false $\rightarrow i++$

$i = 2 \rightarrow$ same

false

\Rightarrow 1 | 3 | 3 | 3 | 4 \rightarrow return i if ($a[i] \neq a[i+1]$)

Question \rightarrow 10

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Date: 19/7

(10) \rightarrow Find first Repeating Element \rightarrow

$\rightarrow 1 | 5 | 3 | 4 | 3 | 5 | 6$

0 1 2 3 4 5 6

\downarrow return

$n \Rightarrow$ size

No element

\hookrightarrow Return - 1

i) Brute force \rightarrow LS

choose one by one element

& search it in array $i+1$

\rightarrow If any element duplicate is found then
Repeat that

Time $\rightarrow O(n^2)$

Space $\rightarrow O(1)$

for ($i = 0 \rightarrow n$)

for ($j = i+1 \rightarrow n$)
 \downarrow
 \downarrow if ($a[i] == a[j]$)

\downarrow
 \downarrow return $i+1, j$

(ii) Optimized O(n) Hashing

Hashing
 $1 \rightarrow 1$

$1 | 5 | 3 | 4 | 3 | 5 | 6$

$5 \rightarrow 2$

\rightarrow Store
 1

1

$3 \rightarrow 2$

1

\downarrow
iterate it and check

$4 \rightarrow 1$

1

\downarrow

$6 \rightarrow 1$

1

(a) \rightarrow Traverse $\rightarrow O(n)$
store

unordered map

(b) \rightarrow iterate \rightarrow each element if it has occurrence
in future

Map \rightarrow

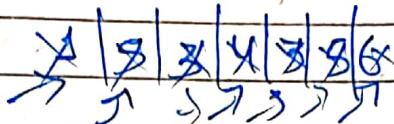
unordered map $<$ int, int $>$ hash

\downarrow
key

\downarrow
value

13/9/23 $\text{for } (i \rightarrow n)$

$\text{hash}[a[i]]++;$



$\text{for } (i=0 \rightarrow n)$

$\text{if } (\text{hash}[a[i]] \geq 1)$
return hash[$a[i]$]

$a[i] \leftarrow \text{int}$	int
1	1
5	2
3	2
1	1
2	1
1	1

TC $\rightarrow O(n)$

SC $\rightarrow O(n)$

How to make khud ka hash jisse function

arr $\rightarrow [0|1|5|2|3|4|3|5|6]$

↓
find max element

↳ Make Array of that Element

int hash[maxElement+1] = {0};

hash \rightarrow correctly name

↳ This means initializing with zero

$[0|1|0|0|0|0|0|0]$

$i=0, \text{index}=1$

$1 > 0 \rightarrow \text{false}, ++$

$i=1, \text{index}=2, 1 > 0 \rightarrow \text{true}, ++$

$i=2, \text{index}=3, 0 > 0 \rightarrow \text{false}, ++$

return

$\text{for } (i=0 \rightarrow n)$

$\text{if } (\text{hash}[i] = a[i])$

$\text{if } (\text{hash}[i] > 0)$

return i

else

$\text{hash}[i] += 1;$

Question → 11

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Date: 19/9

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11 → Common Elements in 3 Sorted Array

A → 1 5 10 20 40 70 → i
B → 6 17 20 80 100 → j
C → 3 14 15 100 180 70 180 100 → k

If $(A[i] = B[j] = C[k]) \rightarrow$ Common

else if $(A[i] < B[j]) \leftarrow i++$

else if $(B[j] < C[k]) \leftarrow j++$

else $\rightarrow k++$; ($C \rightarrow$ value chota h)

O/p → 20, 80

→ Stop if any of array complete

↳ why → because Main loop end hogya

phir bhi loop chal rha → lekin B or C me common → milgya hume → Nhi chahiye

A → 3 3 3

B → 3 3 3

C → 3 3 3

This fail lgive

output → 3, 3, 3
but we want → 3

To solve, This use Set

ye kya karta h phle bar 3

lagrni but second 3 nhi lagta dono take
Duplicated

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Syntax →

set <int> st;
set::insert (app)

for (auto i : st)

ans.push_back (i);

copying
into
vector

→ Can we do it without using set?



A →

B →

C → Remove Duplicates first

then → use first Approach

Question 4
(Refer)

Question → 1a

1Q

→ Write First a Matrix

0	1	2	3	4
1	5	6	7	8
2	9	10	11	12

dp → 159 2610 3211
48 12

even odd even odd

Row → Col → 0 1 2 3
TB BT TB BT

Col → even → TB

Col → odd → BT

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Date: 9/01

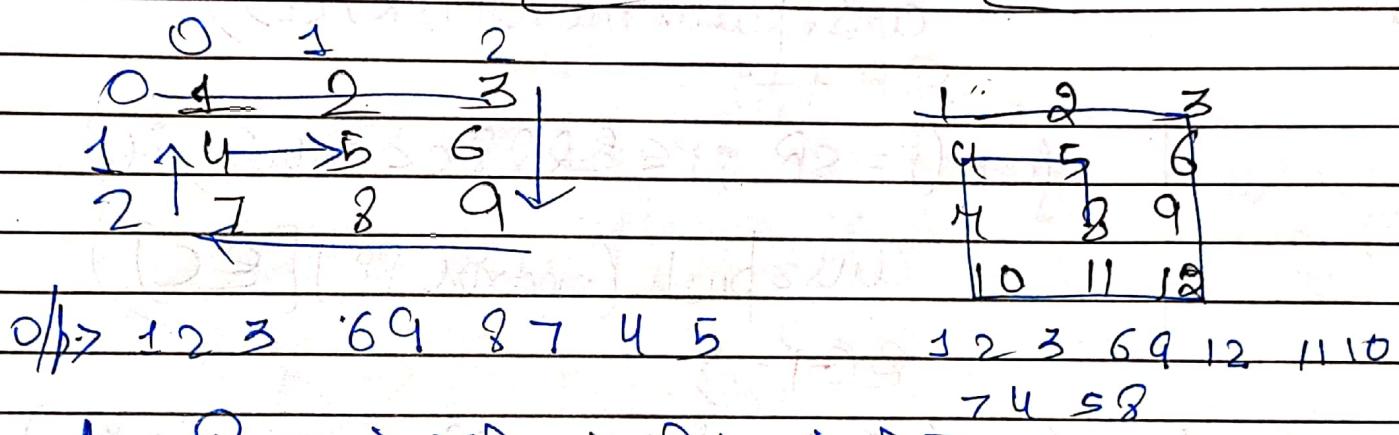
```

for (i → col)
    for (j → row)
        if (col % 2 == 0)
            cout << arr[i][j]
        else → odd
            for (j = row - 1; j > 0; j--)
                cout << arr[i][j]

```

| Question 13 |

13) → Spiral Print in A Matrix



L R → TB → RL → BT

\nearrow Starting → (SR) Starting Row (L R) : 0 1 2
 \searrow (ER) Ending Col (TB) : 5 6 3
 \nearrow (ER) Ending Row (R L) : 4 3 2
 \searrow (SC) Starting Col (B T) : 1 2 2

0	1	2	3	4	5	6
7	8	9	10	11	12	
13	14	15	16	17	18	
19	20	21	22	23	24	
25	26	27	28	29	30	

$$m \times n = 5 \times 6 = 30$$

$m = \text{matrix} \circ \text{size}()$
 $n = \text{matrix}[0] \circ \text{size}()$

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int startRow = 0;

int EC = n - 1;
ER = m - 1;

SC = 0;

int count = 0;
while (count < Total) {

Starting Row → for (i = SC; i ≤ EC && c < Total; i++)
ans.push(matrix[SR][i])

SR++;

Ending Col [for (i = SR; i ≤ ER && c < Total; i++)
ans.push(matrix[i][EC])

EC--;

Ending Row [for (i = EC; i ≥ SC && c < Total; i--)
ans.push(matrix[ER][i])

ER--;

Starting Col [for (i = ER; i ≥ SR && c < Total; i--)
ans.push-back(matrix[i][SC])

SC++;

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Question → 14

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14) → factorial of a large Number →

Factorial → $5! \rightarrow 1 \times 2 \times 3 \times 4 \times 5 \rightarrow 120$

$\rightarrow 120 \leftarrow$ store it in int

Q) Add Two Numbers
Represented by array

A → 9 | 5 | 4 | 9 → i carry = 0
 $\text{int}x = a[i] + b[j]$

B → 0 | 2 | 1 | 4 → j +
 carry

Output → | | | 6 | 3 | |

(0)
vector

int digit = $x \% 10$
 carry = $x / 10$

o. push_back(digit);

$$i) n = 9 + 4 + 0 = 13$$

$$\text{digit} = 13 \% 10 = 3$$

$$\text{carry} = 13 / 10 = 1$$

$$(ii) n = 4 + 1 + 1 = 6$$

$$\text{digit} = 6, \text{carry} = 0$$

$$(iii) n = 5 + 2 + 0 = 7$$

$$\text{digit} = 4, \text{carry} = 0$$

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(iv) $x = 9 + 0 + 0 = 9$

base bktm

\rightarrow while ($i \geq 0 \ \& \ j \geq 0$) {

$$x = a[i] + b[j] + \text{carry}$$

int digit = $x \% 10$

ans.push_back(digit)

$$\text{carry} = x / 10$$

$i--$, $j--$

a &
b have
same length

But a
checkng

a have elements
more

↓

may
b have
more elements

maybe
carry for
you

while ($i \geq 0$) {

$$x = a[i] + 0 + \text{carry}$$

(similar)

$i--$

while ($j \geq 0$) {

$$x = 0 + b[j] + \text{carry}$$

(similar)

$j--$

If (carry) {

ans.push_back(carry);

ans \rightarrow [3 6 4 7] \rightarrow But we want \rightarrow 7983

All reverse \Rightarrow reverse (ans.begin(), ans.end())

String

return ans;

Note \rightarrow while (ans.size() - 1) == 60]
ans.pop_back(1),

12/01/23

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Factorial \rightarrow vector / arr \rightarrow [| | | | |]

ex: $7! \rightarrow$ start \rightarrow Push it in vector
 $i = 2$

$$\text{int } x = \text{ans}[j] * i + \text{carry}$$

$$\text{ans}[j] = 21^{\circ}/10^{\circ}$$

$$\text{carry} = x/10$$

$$i=3, \text{int } x = 2*3+0=6$$

$$\text{ans}[j] = 6^{\circ}/10^{\circ}=6, \text{carry} = 6/10=0$$

$$i=4, x = 6*4+0=24$$

$$\text{ans}[j] = 24^{\circ}/10^{\circ}=24, \text{carry} = 0 \quad \text{if (carry) push it}$$

$$i=5, x = 4*5+0=20$$

$$\text{ans}[j] = 20^{\circ}/10^{\circ}=20$$

$$\text{carry} = 2^{\circ}/10^{\circ}=2$$

$$j=1 \quad x = 20*5+2=12$$

$$\text{ans}[j] = 12^{\circ}/10^{\circ}=12$$

$$\text{carry} = 1 \rightarrow \text{push } i-1$$

1	2	0
$\downarrow \times 7$		

1	5	1	4	1	0
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for ($i=2 \rightarrow \leq N$)

for ($j=0 \rightarrow < \text{ans.size()})$

$$x = \text{ans}[j] * i + \text{carry}$$

$$\text{ans}[j] = x^{\circ}/10^{\circ}, \text{carry} = x/10^{\circ}$$

while (carry)

ans.push_back(carry % 10);
 $\text{carry} /= 10^{\circ}$