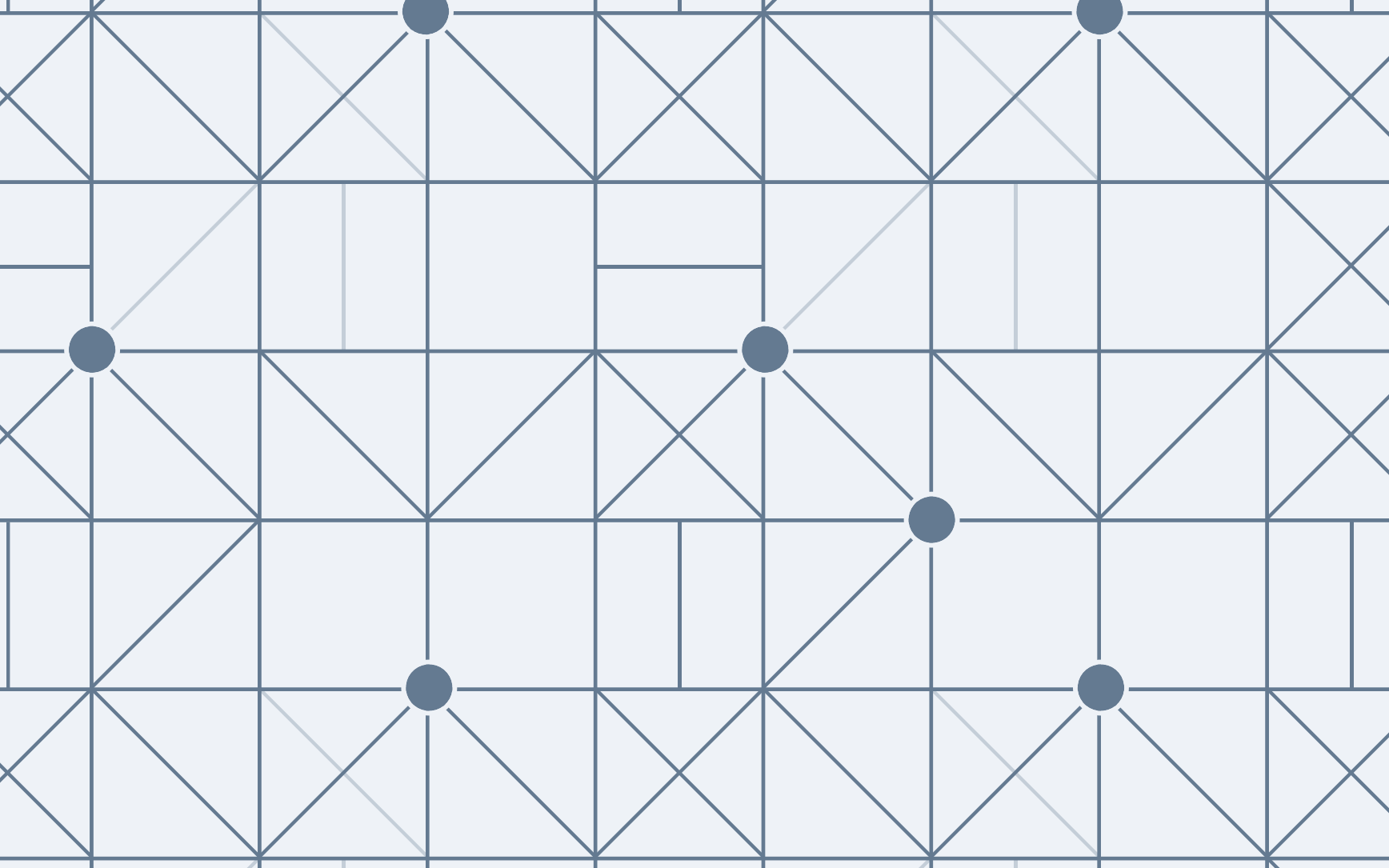


# Binary search

→ region to search

→ divide region into 2 half

→ try to eliminate one and search in another

TC: $O(\log_2 N)$ SC: $O(1)$

$N$ → length of the initial search region

# Search in a rotated Sorted Array.

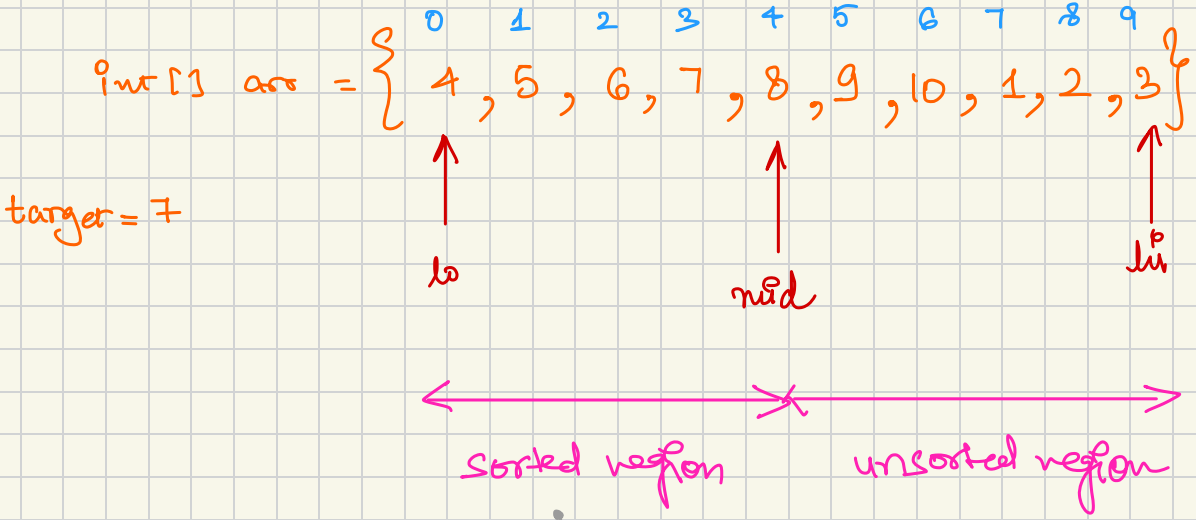
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 5 | 6 | 7 | 8 | 9 | 10 | 1 | 2 | 3 |

int[] arr = {4, 5, 6, 7, 8, 9, 10, 1, 2, 3}

target = 7

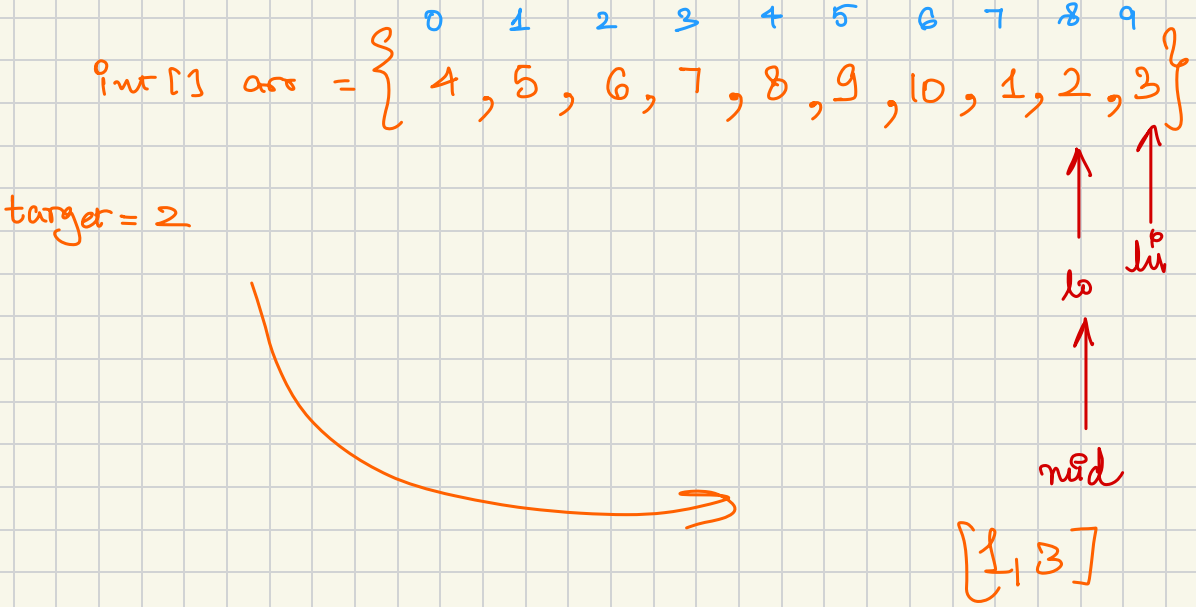
## Brute Force

- linear Search TC: O(N) SC: O(1)




range [arr[lo], arr[mid]]

Because of range I can make decision to take or eliminate


0 1 2 3 4 5 6 7 8 9
int[] arr = { 4, 5, 6, 7, 8, 9, 10, 1, 2, 3 }
target = 2
lo
hi
mid
[1, 3]

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

else if (left side is sorted)
    if (you are in the range)
        move left
    else
        move right
else
    if (you are in the range)
        move right
    else
        move left
```

int[] arr = { 4, 5, 6, 7, 8, 9, 10, 1, 2, 3 }

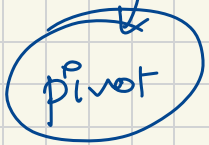
0 1 2 3 4 5 6 7 8 9

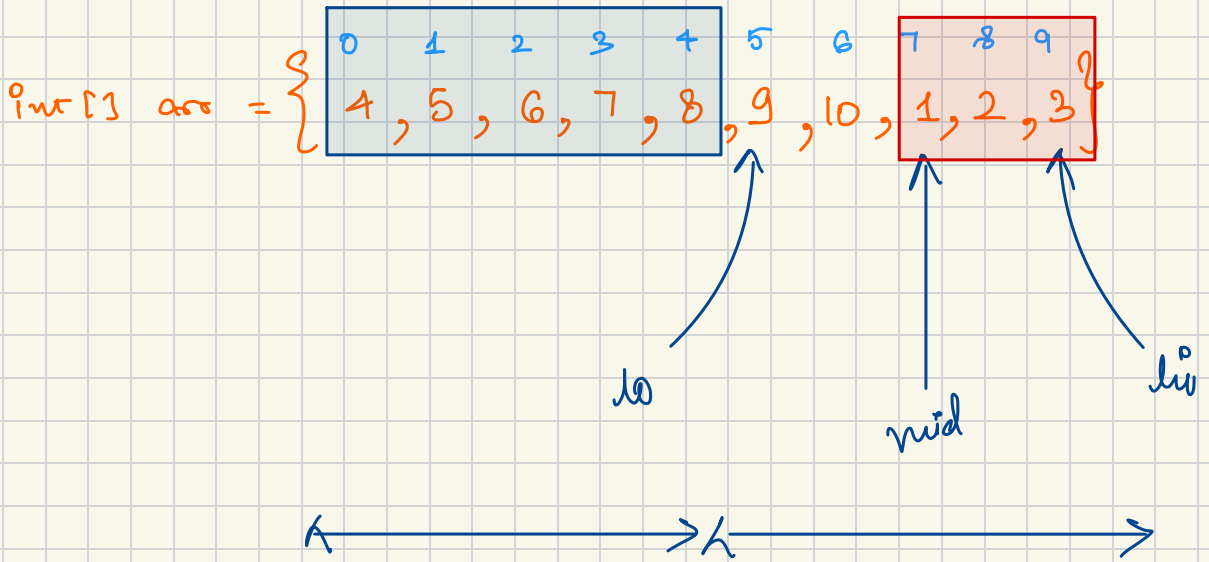
target = 10

# Find Pivot Index in a Rotated Sorted Array.

## Find min^m value in a rotated sorted Array.

```
int[] arr = { 4, 5, 6, 7, 8, 9, 10, 1, 2, 3 }
            0  1  2  3  4  5  6  7  8  9
```





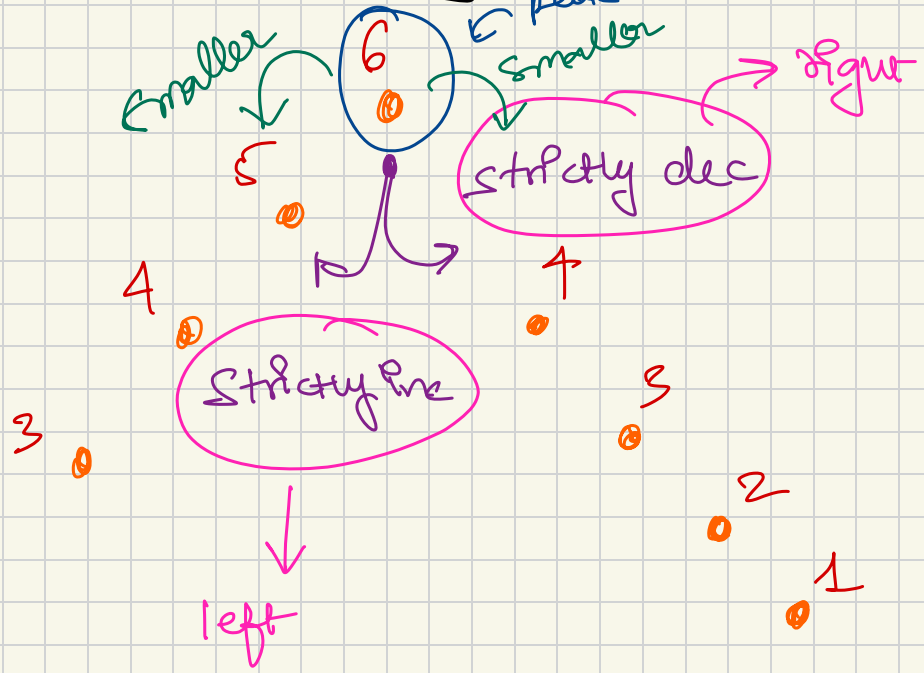

ans = ~~1~~

TC : O(log$_2$N)

SC : O(1)

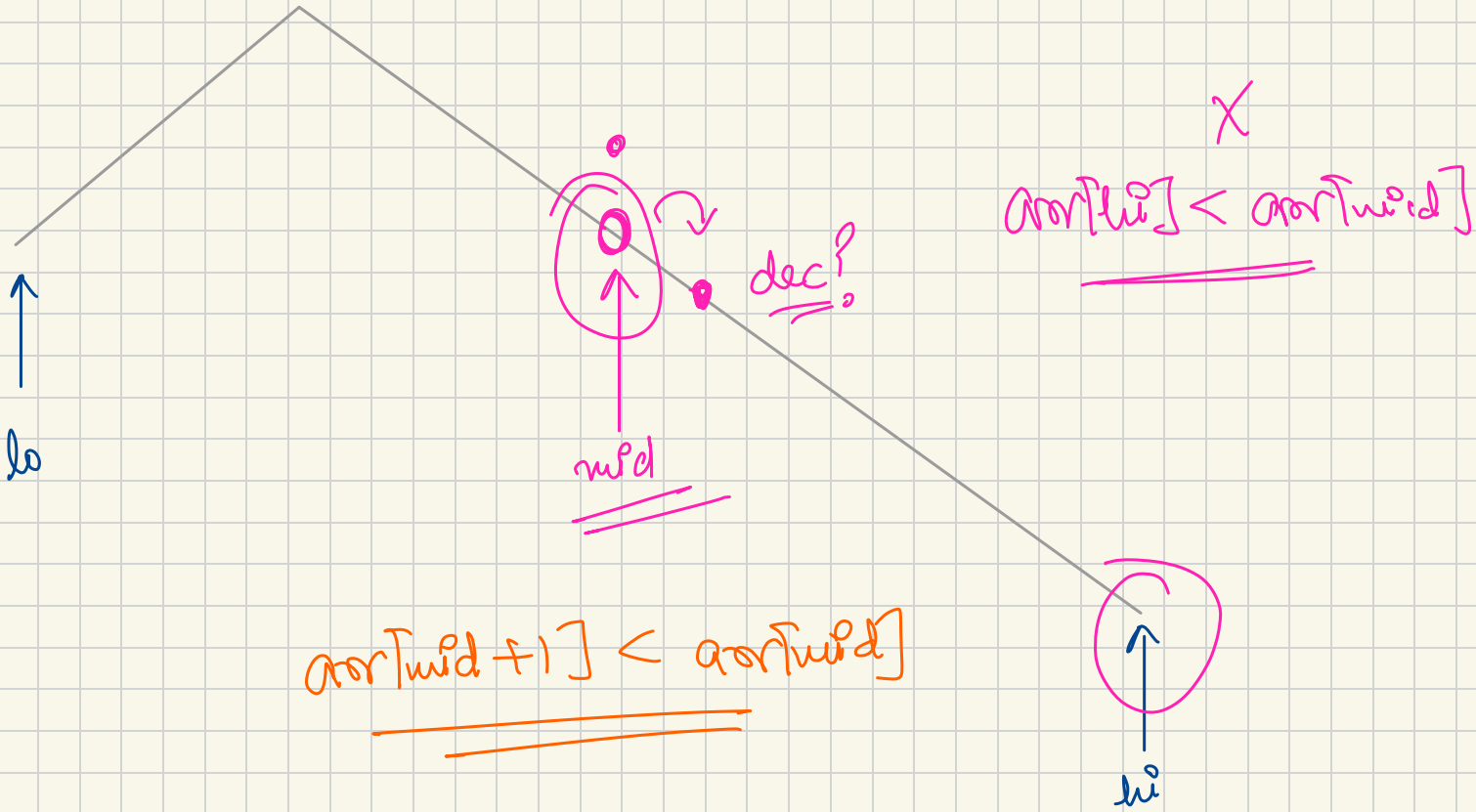
# Peak in a Mountain Array

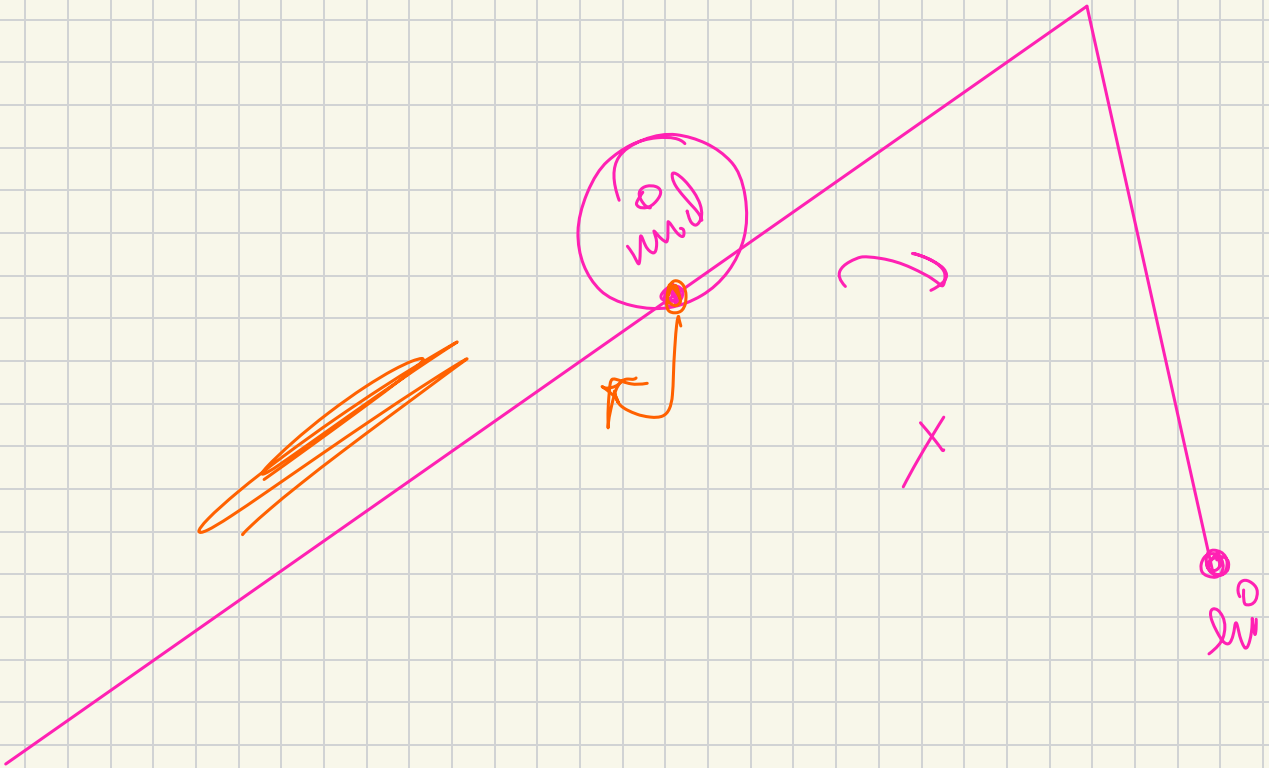
{ 3, 4, 5, 6, 4, 3, 2, 1 }




if (arr[x-1] < arr[x] and arr[x+1] < arr[x]) {

x ⟶ peak.

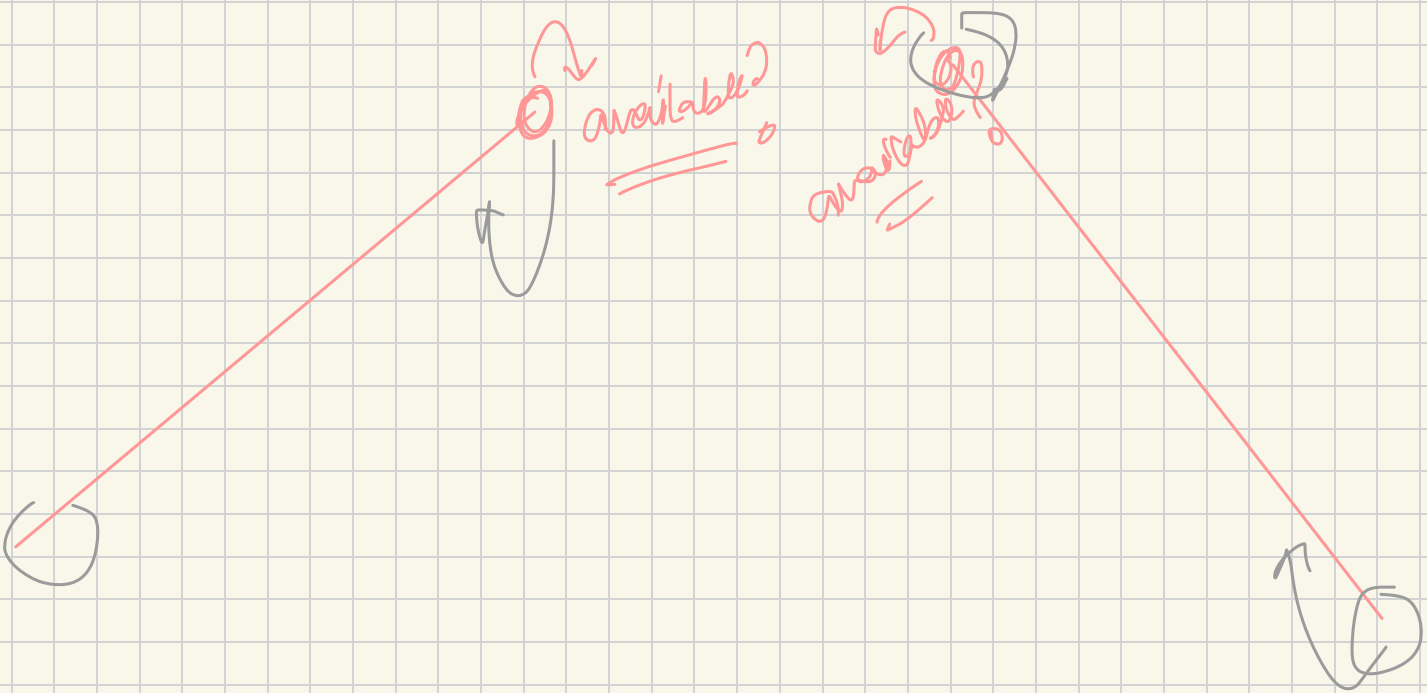

① decrease region
X
arr[lo] < arr[mid]
lo
mid
dec?
arr[mid+1] < arr[mid]
hi



Case 1 — mid is peak

Case 2 — left side is inc.
move right

Case 3 — right side is dec
move left


available?
available?

# Allocate Minimum Numbers of Pages.

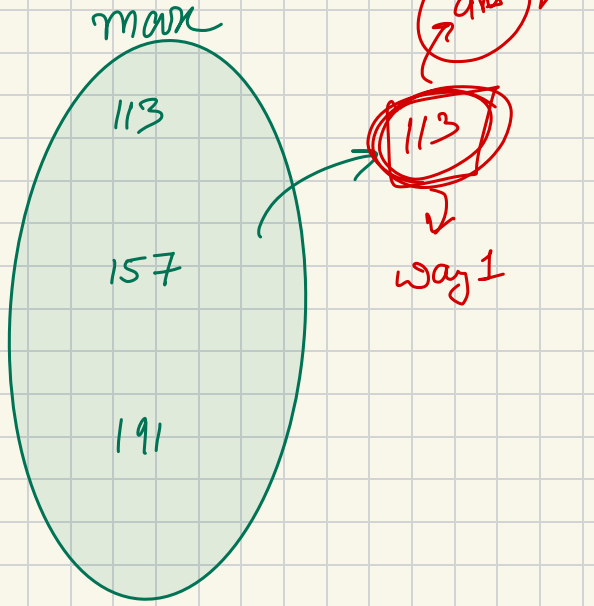
books [ ] = { 12 (0), 34 (1), 67 (2), 90 (3) }  students = 2

- distribute these N Books to M students
- Each student should get min of 1 Book
- Book distribution should be contigeneous

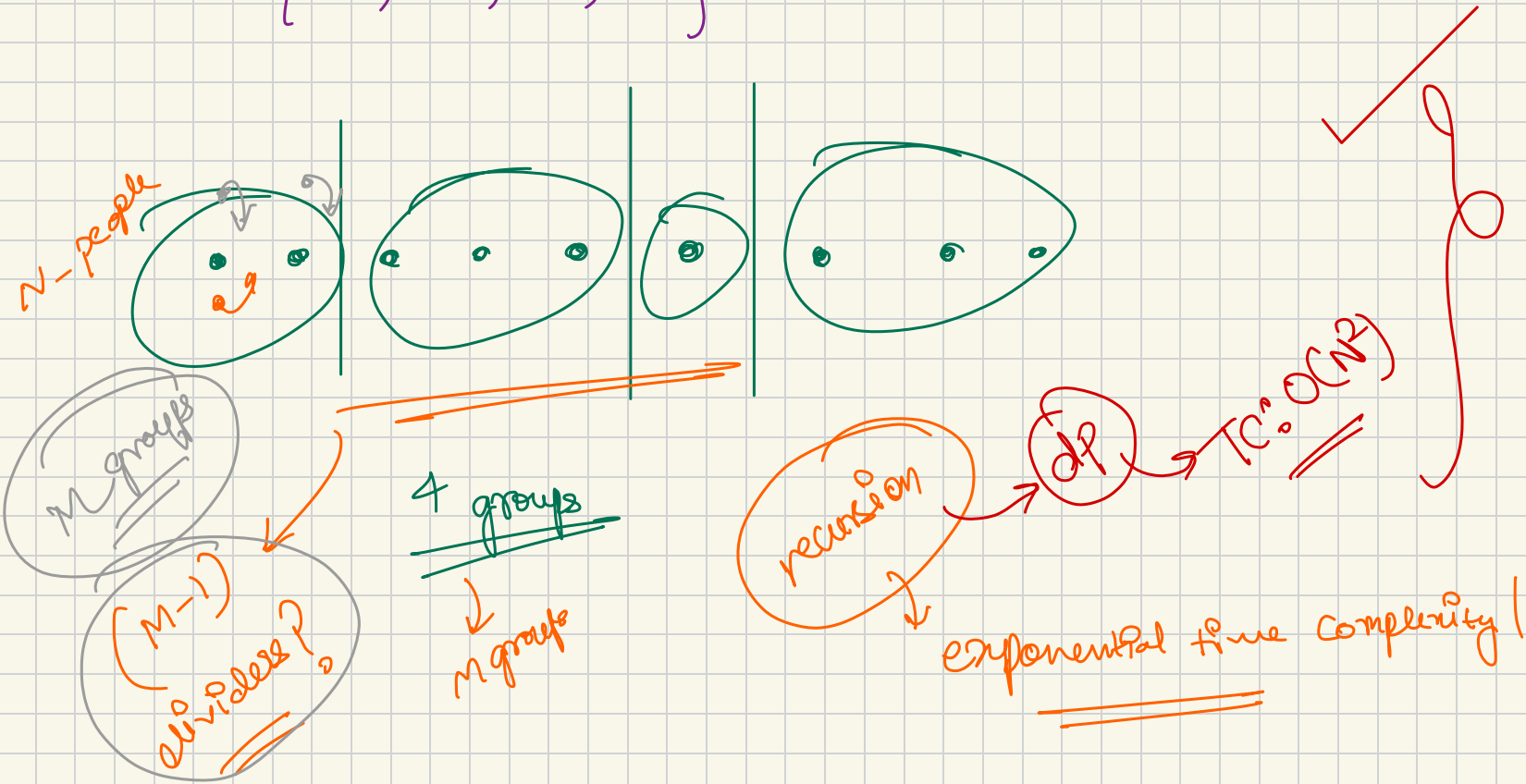
books [ ] = { 12, 34, 67, 90 }  (0, 1, 2, 3)

Students = 2

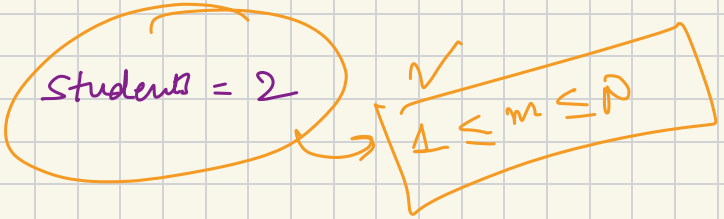
| | s1 | s2 |
|---|---|---|
| way 1 | 12, 34, 67 (113) | 90 (90) |
| way 2 | 12, 34 (46) | 67, 90 (157) |
| way 3 | 12 (12) | 34, 67, 60 (191) |



books [ ] = { 12 (0), 34 (1), 67 (2), 90 (3) }  students = 2



books [ ] = { 12 (0), 34 (1), 67 (2), 90 (3) }

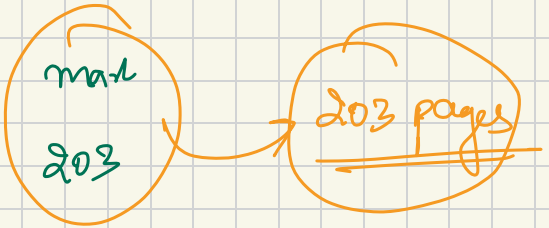



Case 1 :

Students = 1

S1

way 1 → 12, 34, 67, 90 → 203

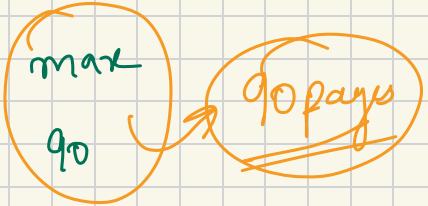


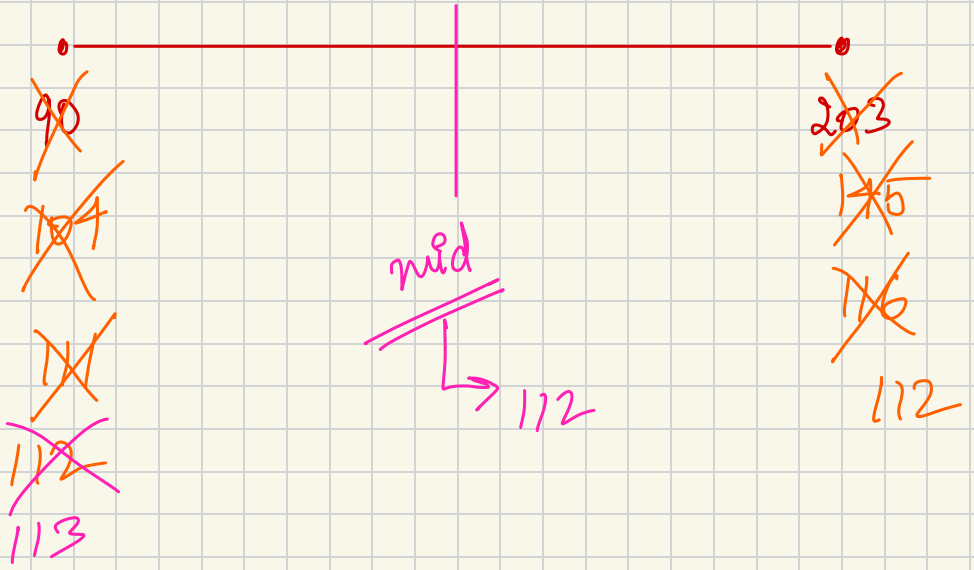

Case 2 :

Students = N { 4 }

| S1 | S2 | S3 | S4 |
|---|---|---|---|
| 12 | 34 | 67 | 90 |

way 1






Stud = 2

pans = 116

113

Ans !

books [ ] = { 12 , 34 , 67 , 90 }
0 1 2 3

$max^m = 146$

S1 ⟶ 12 + 34 + 67
S2 ⟶ 90

books [ ] = { 12 , 34 , 67 , 90 }
0 1 2 3

$max^m = 117$

S1 ⟶ 12 + 34 + 67
S2 ⟶ 90

$$\text{books}[\,] = \left\{ \overset{0}{12}, \overset{1}{34}, \overset{2}{67}, \overset{3}{90} \right\}$$

$\max^m = 103$

$S1 \rightarrow 12 + 34$

$S2 \rightarrow 67$

$S3 \rightarrow 90$

3 stud!

$$\text{books}[\,] = \left\{ \overset{0}{12}, \overset{1}{34}, \overset{2}{67}, \overset{3}{90} \right\}$$

$\max^m = 110$

$S1 \rightarrow 12 + 34$

$S2 \rightarrow 67$

$S3 \rightarrow 90$

books [ ] = { 12 , 34 , 67 , 90 }
0 1 2 3

max^m = 113

S1 → 12 + 34 + 67
S2 → 90

books [ ] = { 12 , 34 , 67 , 90 }
0 1 2 3

max^m = 111

S1 → 12 + 34
S2 → 67
S3 → 90

books [ ] = { 12 , 34 , 67 , 90 }
0 1 2 3

mid = 1/2

S1 → 12 to 34
S2 → 67
S3 → 90

$$\{x_1, x_2, x_3, x_4, x_5, x_6\}$$

$\max^m = y$

Student = $\cancel{0x_1 + x_2}$

$0 + x_3$

Student Num = $\cancel{1}$

$2$