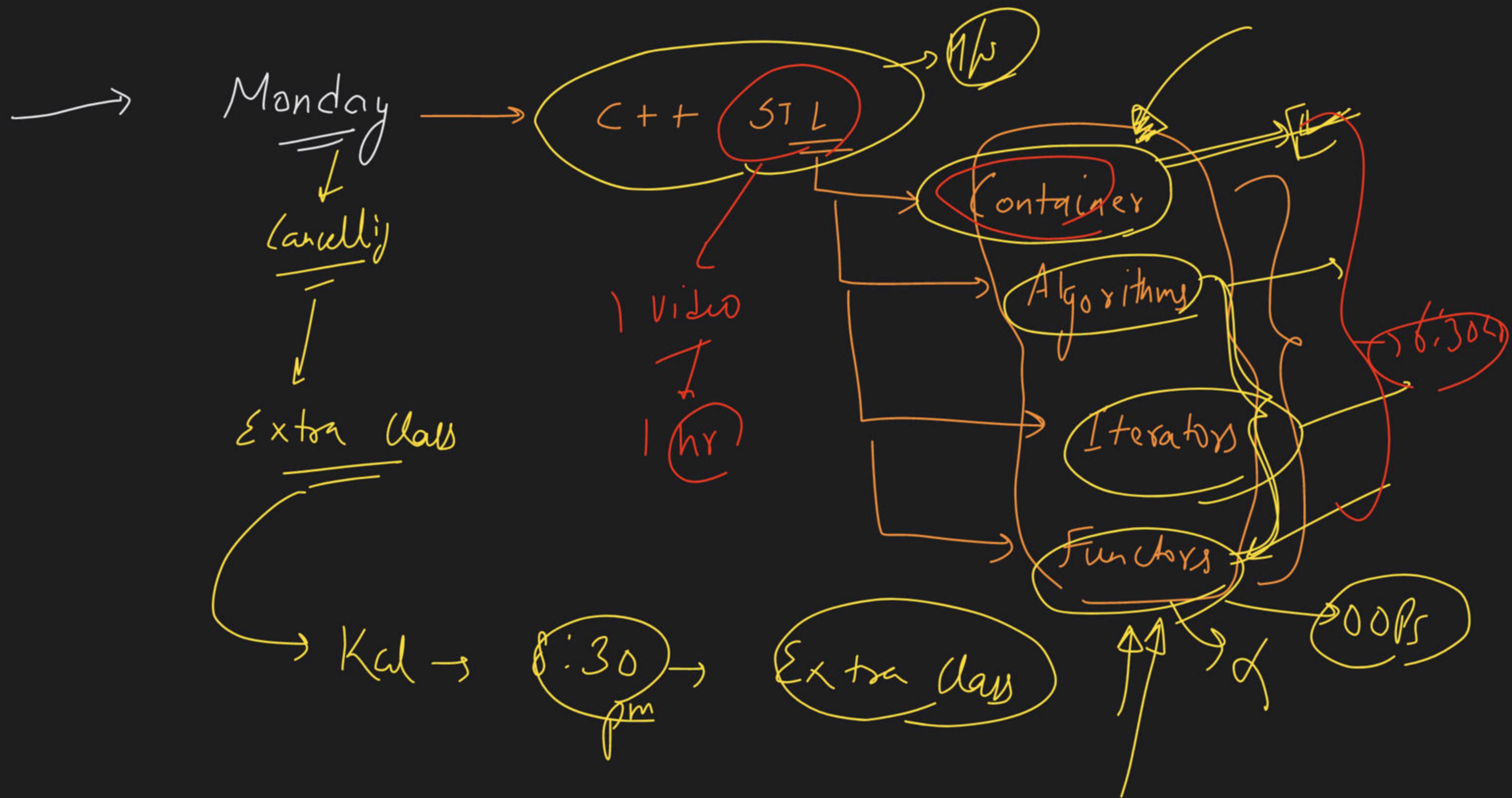
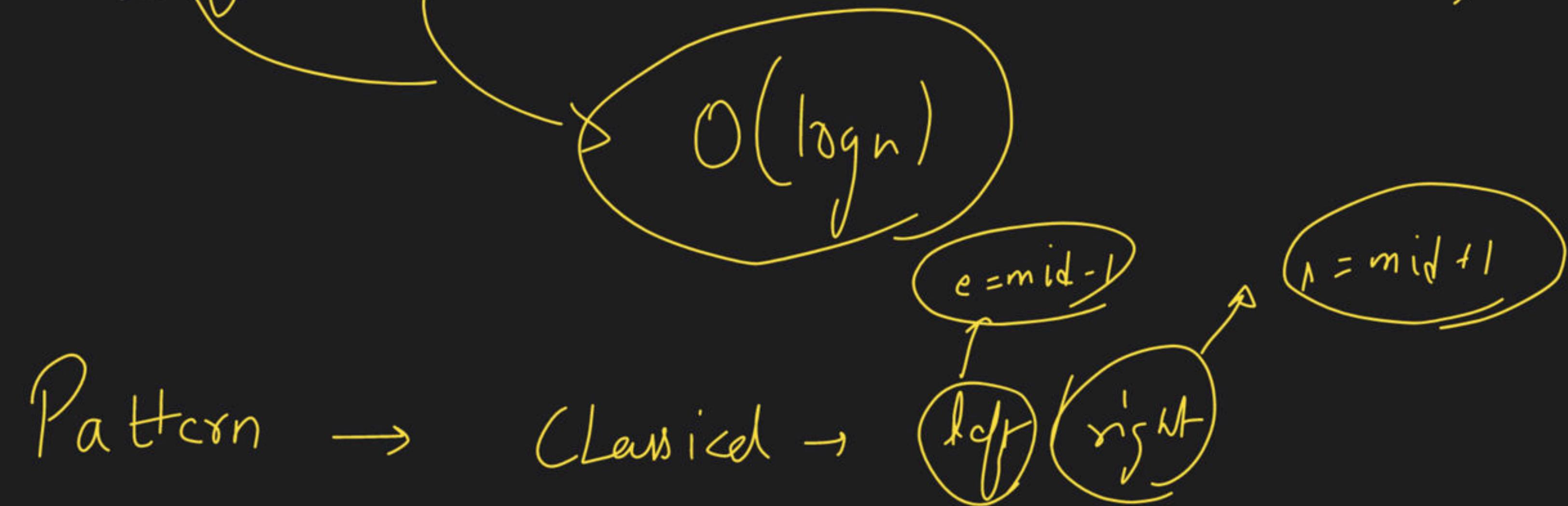


Searching and Sorting Class - 2

Special class

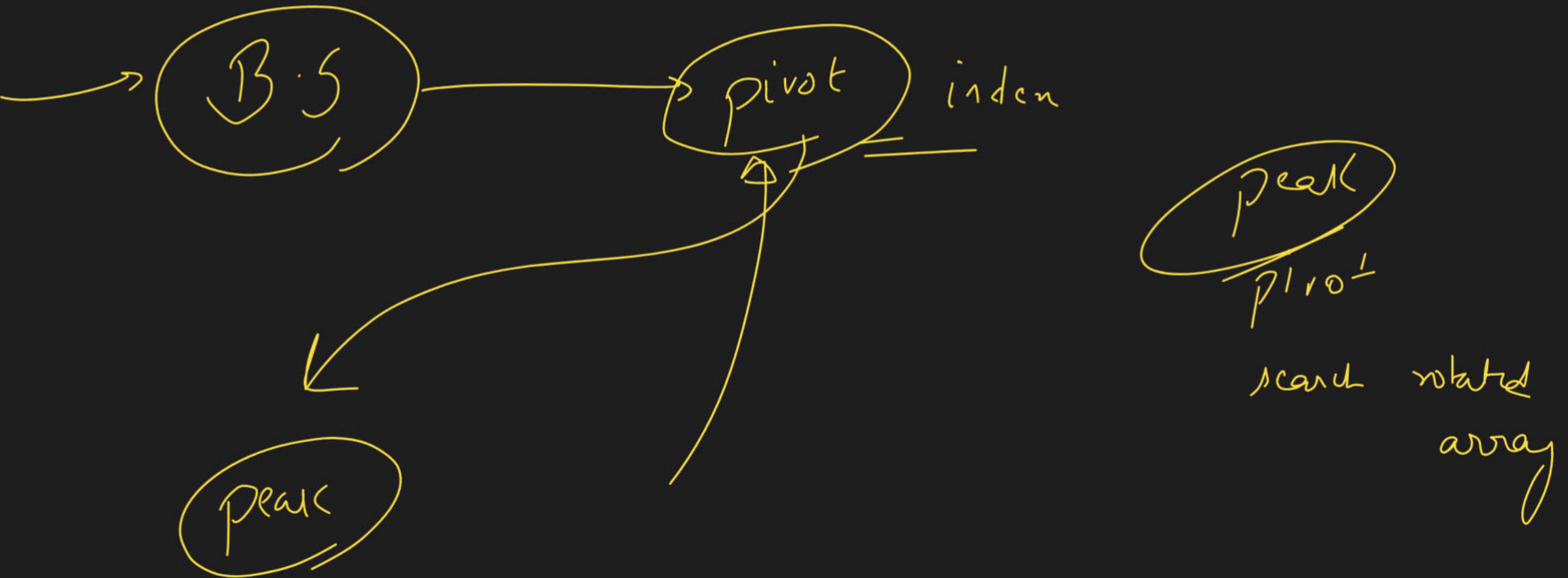


\rightarrow Binary $\underset{=}{\text{Search}}$ $\frac{L.S}{\text{C}} O(n)$

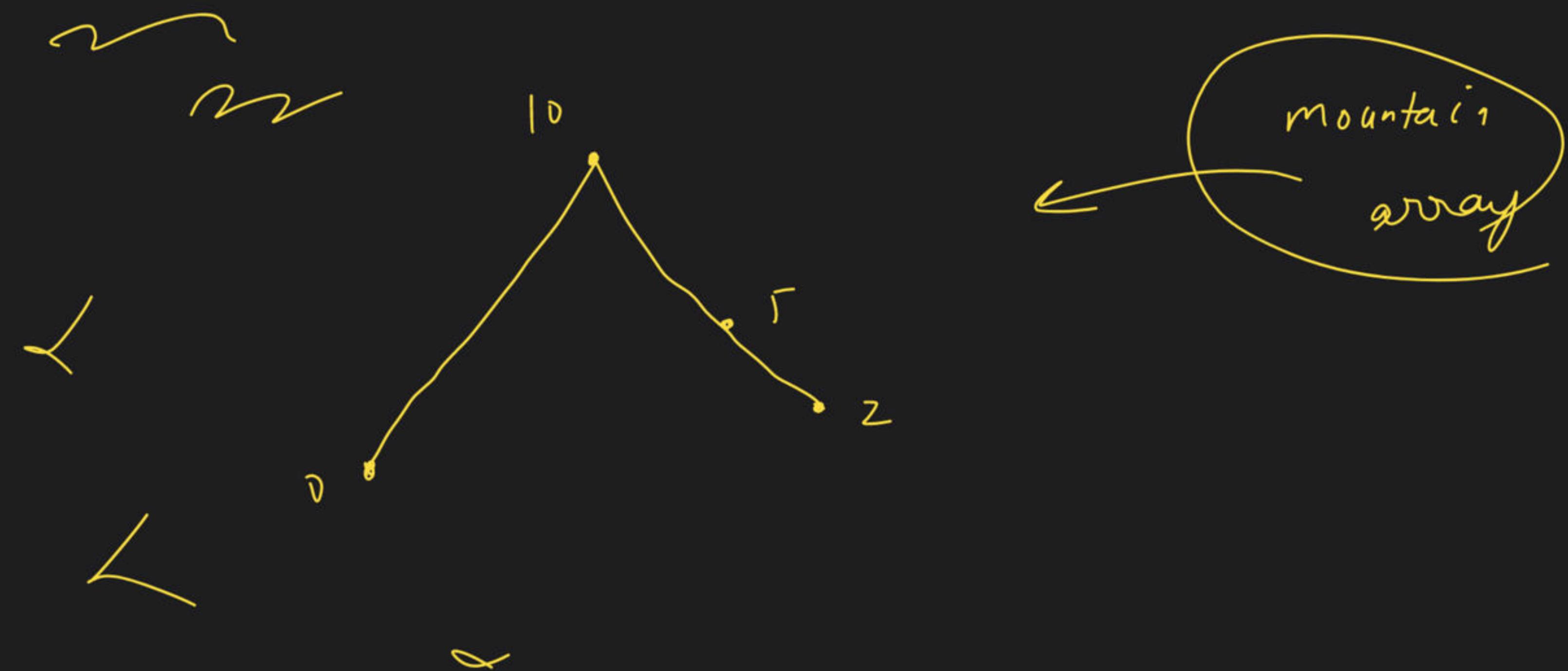


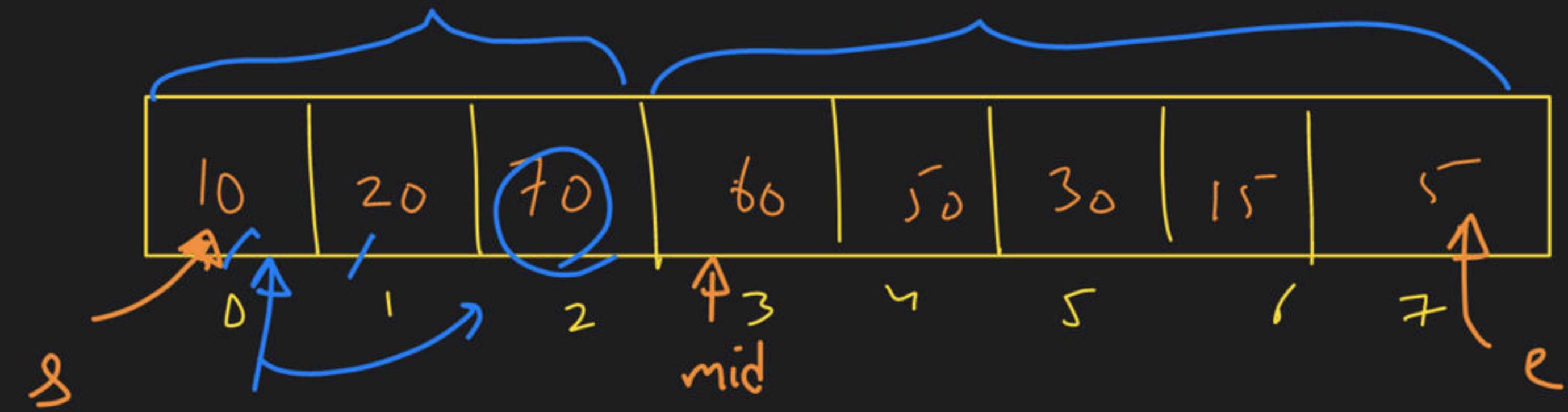
store & compute | may or may not be

$c = \text{mid} - 1$ \rightarrow $e = \text{mid}$ \rightarrow $s \leq c \leq s$ $s \leq c$



0		10		5		2
0	1	2	3			

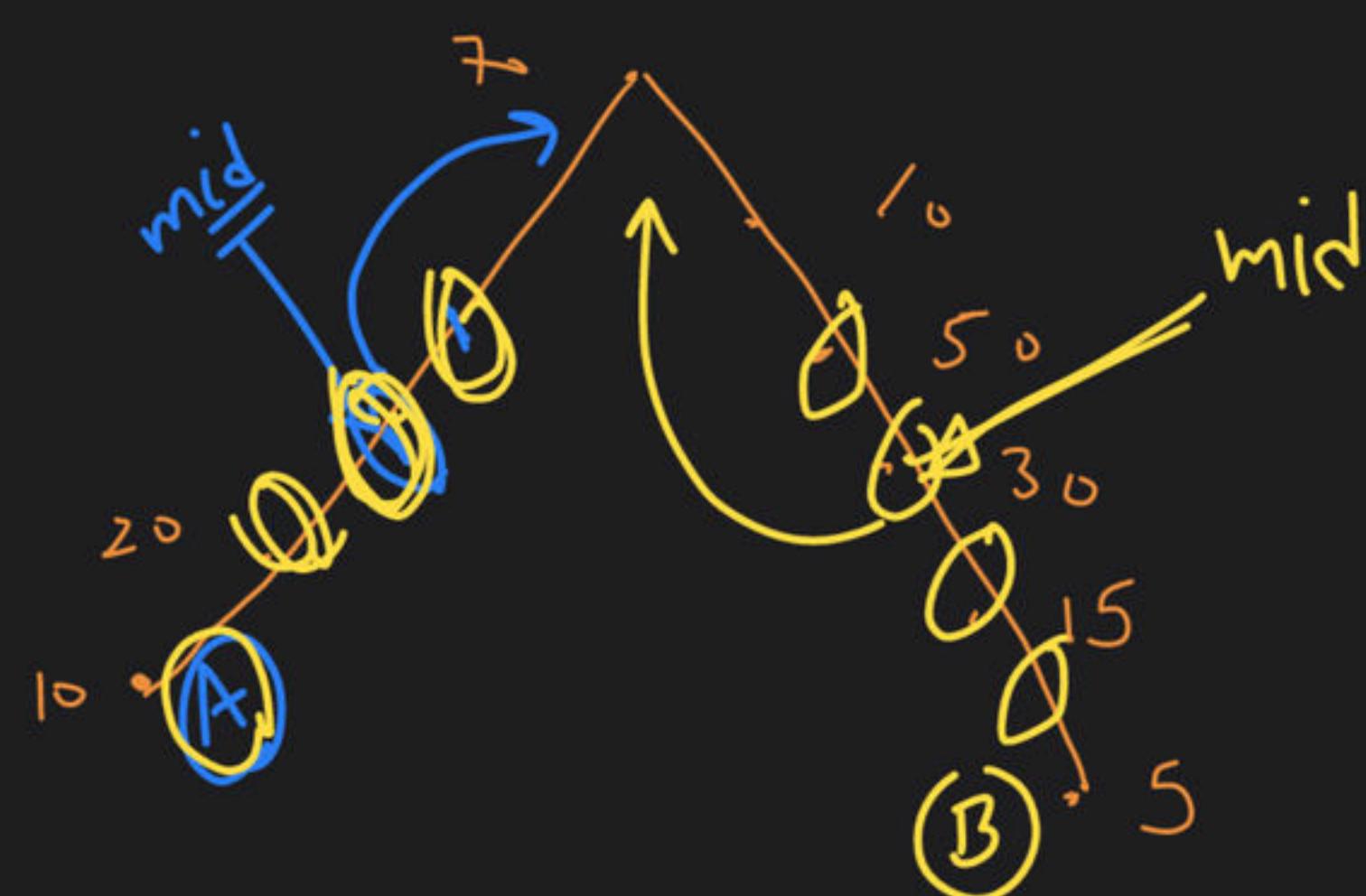




$$B = 0$$

$$C = 7$$

$$\text{mid} = 3$$



$\text{mid} \rightarrow \underline{\text{line A}}$

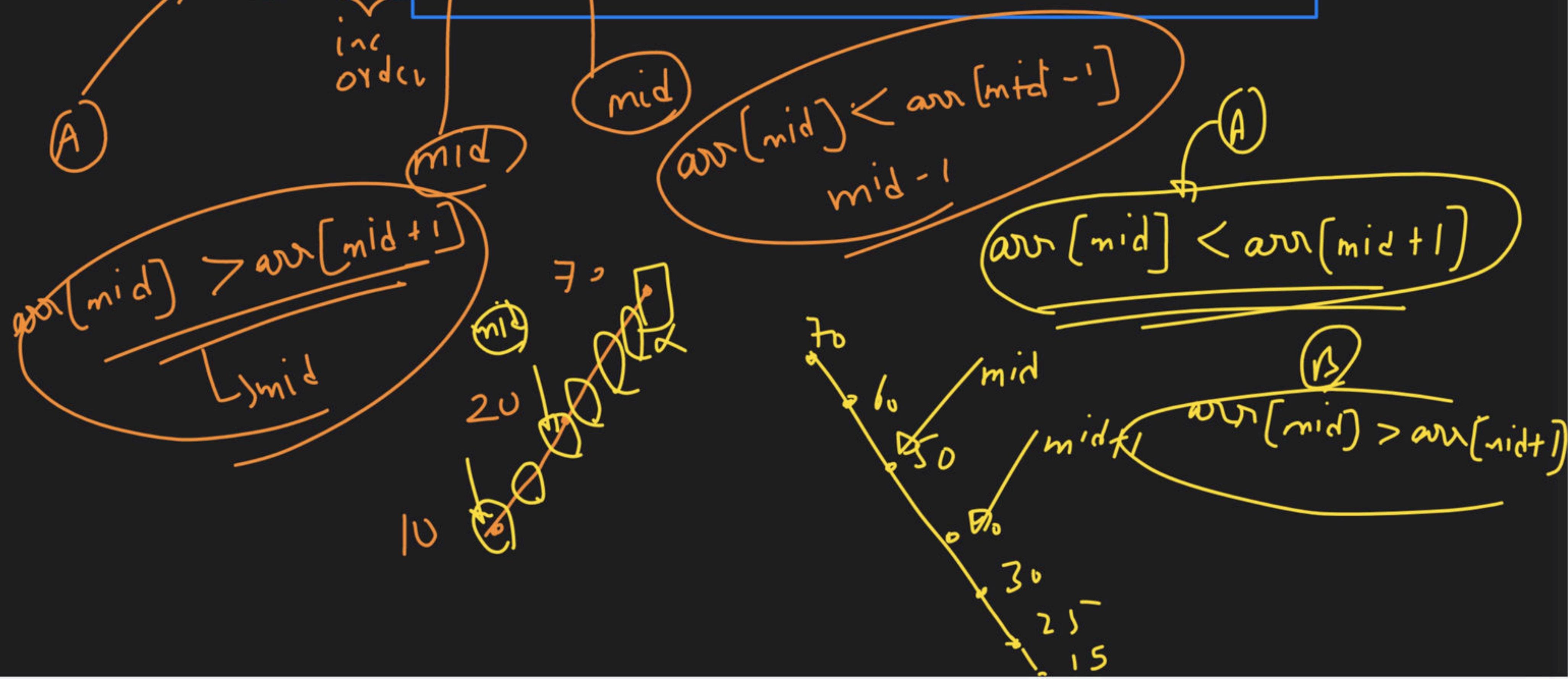
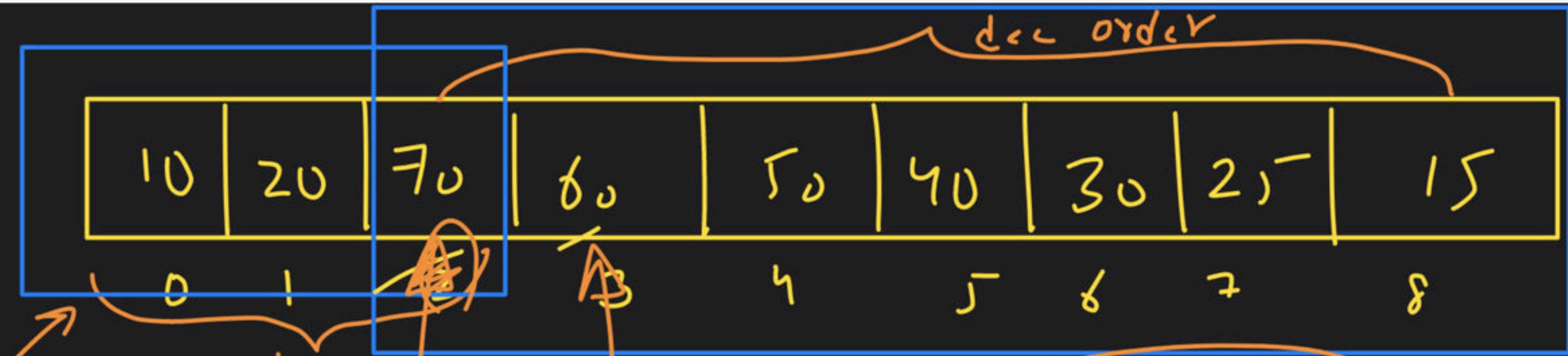
inc added

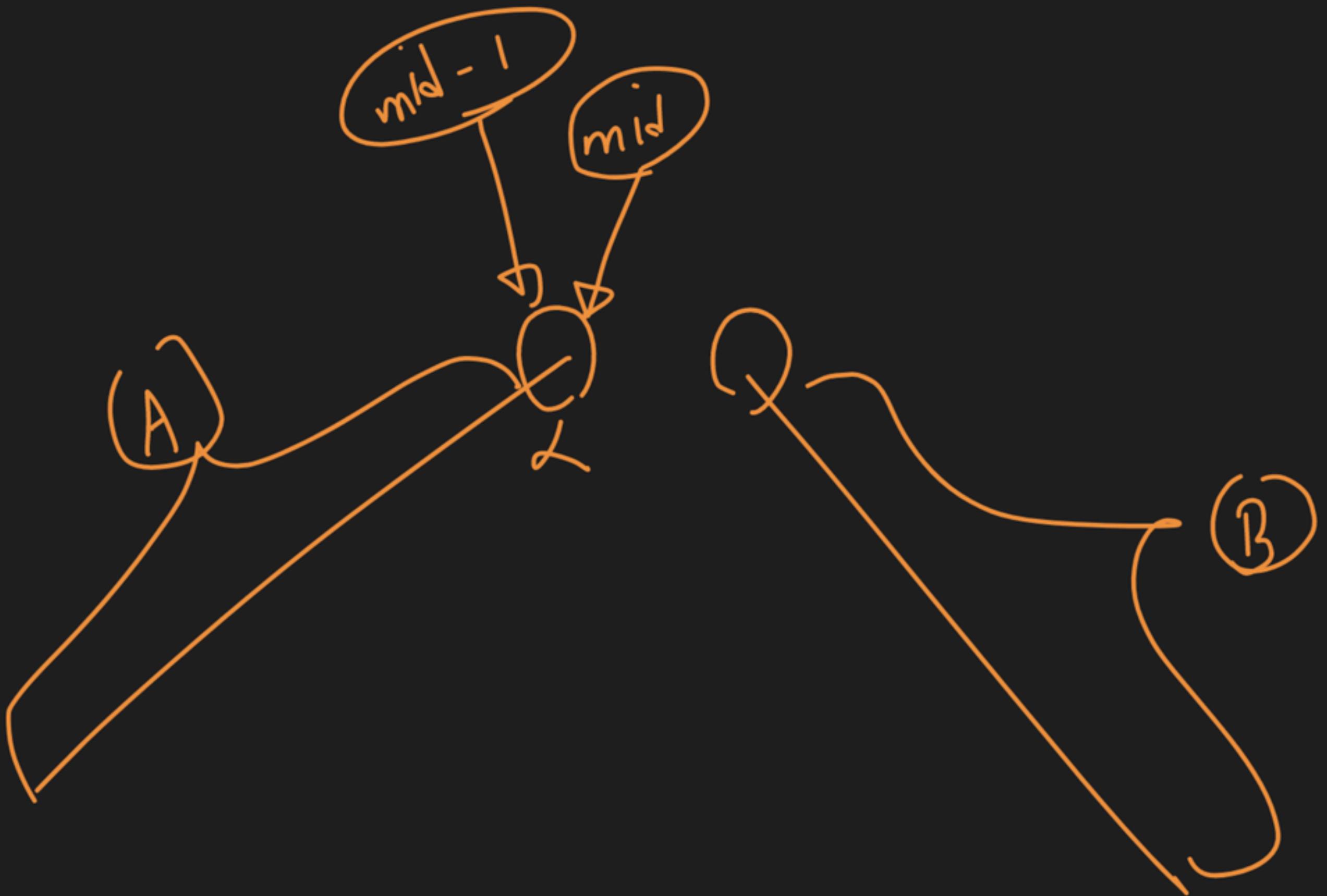
$\underline{\text{arr[mid]} < \text{arr[mid+1]}}$

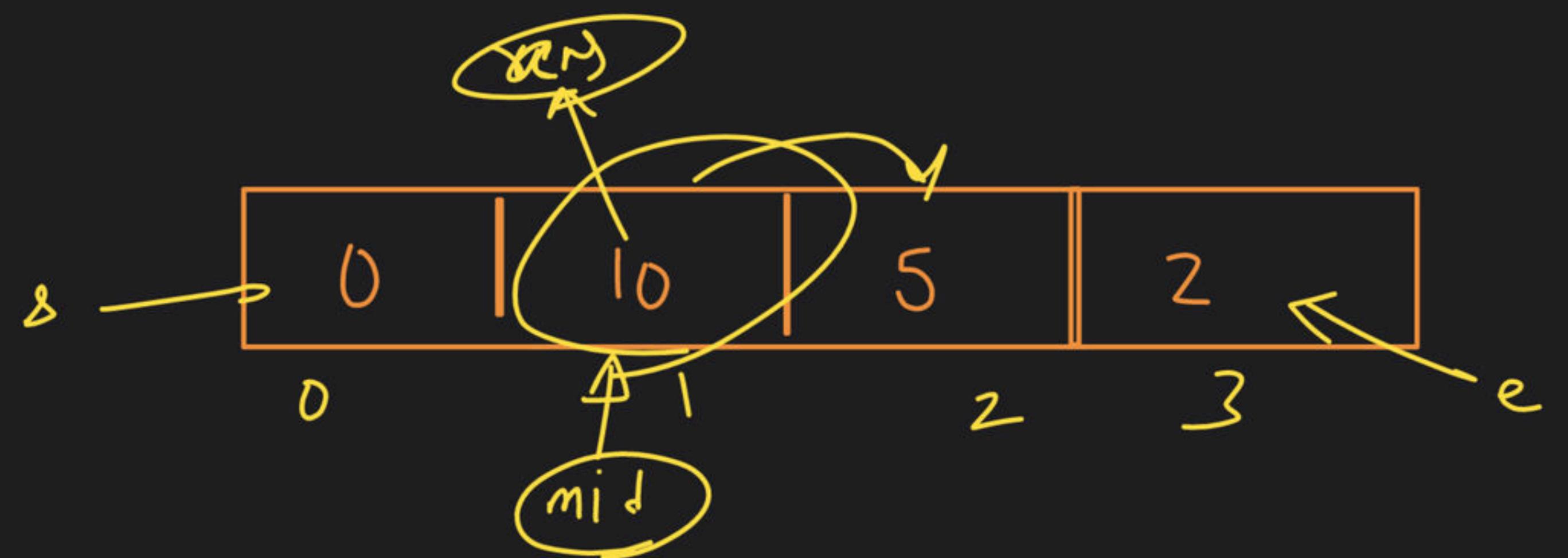
Right

$\underline{\text{arr[mid]} > \text{arr[mid+1]}}$

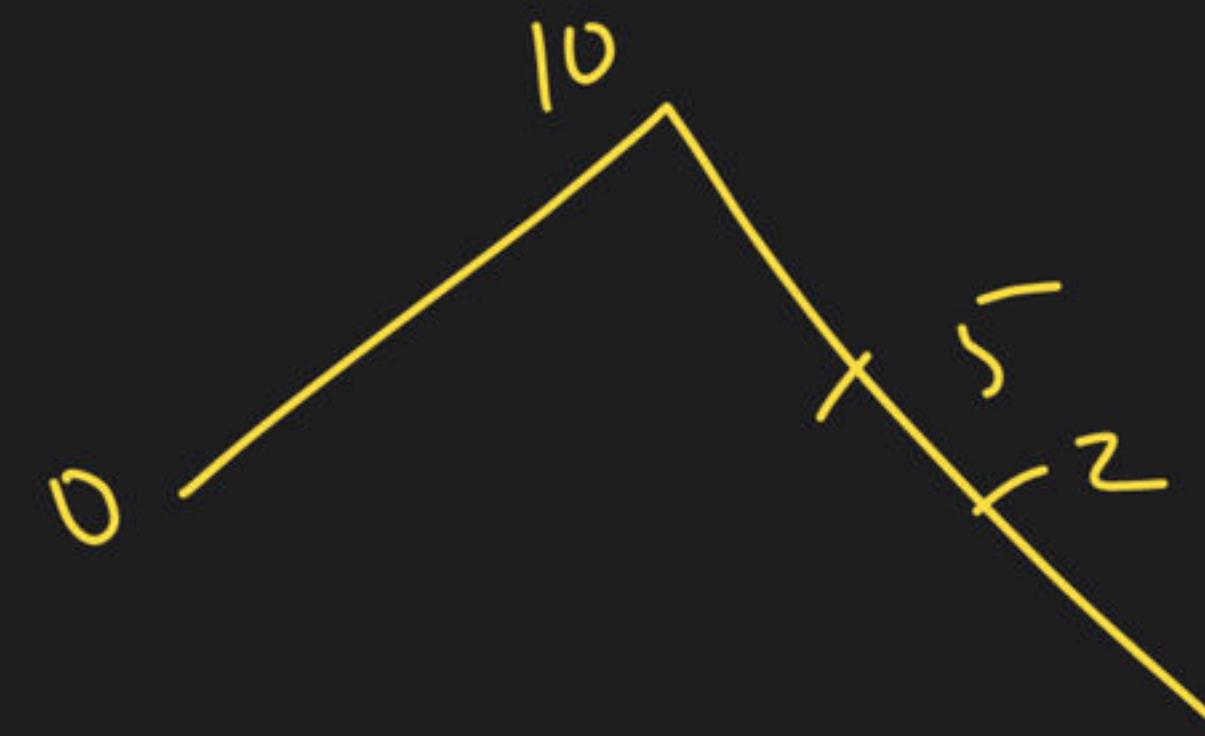
left

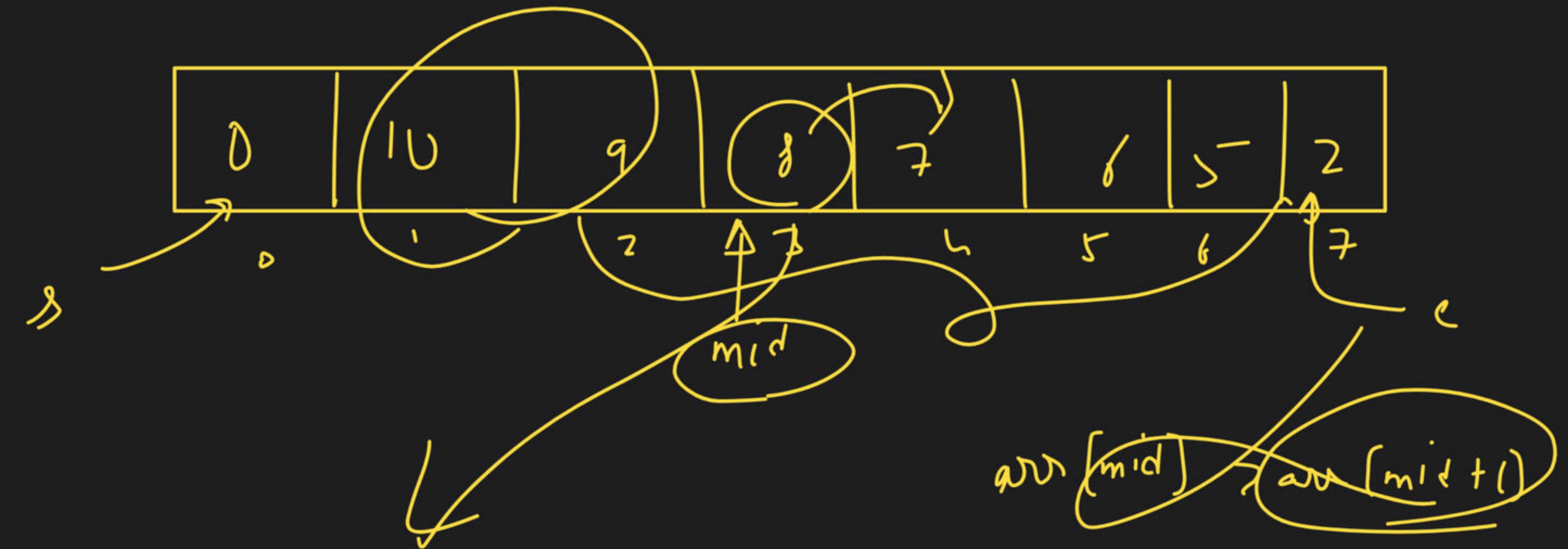


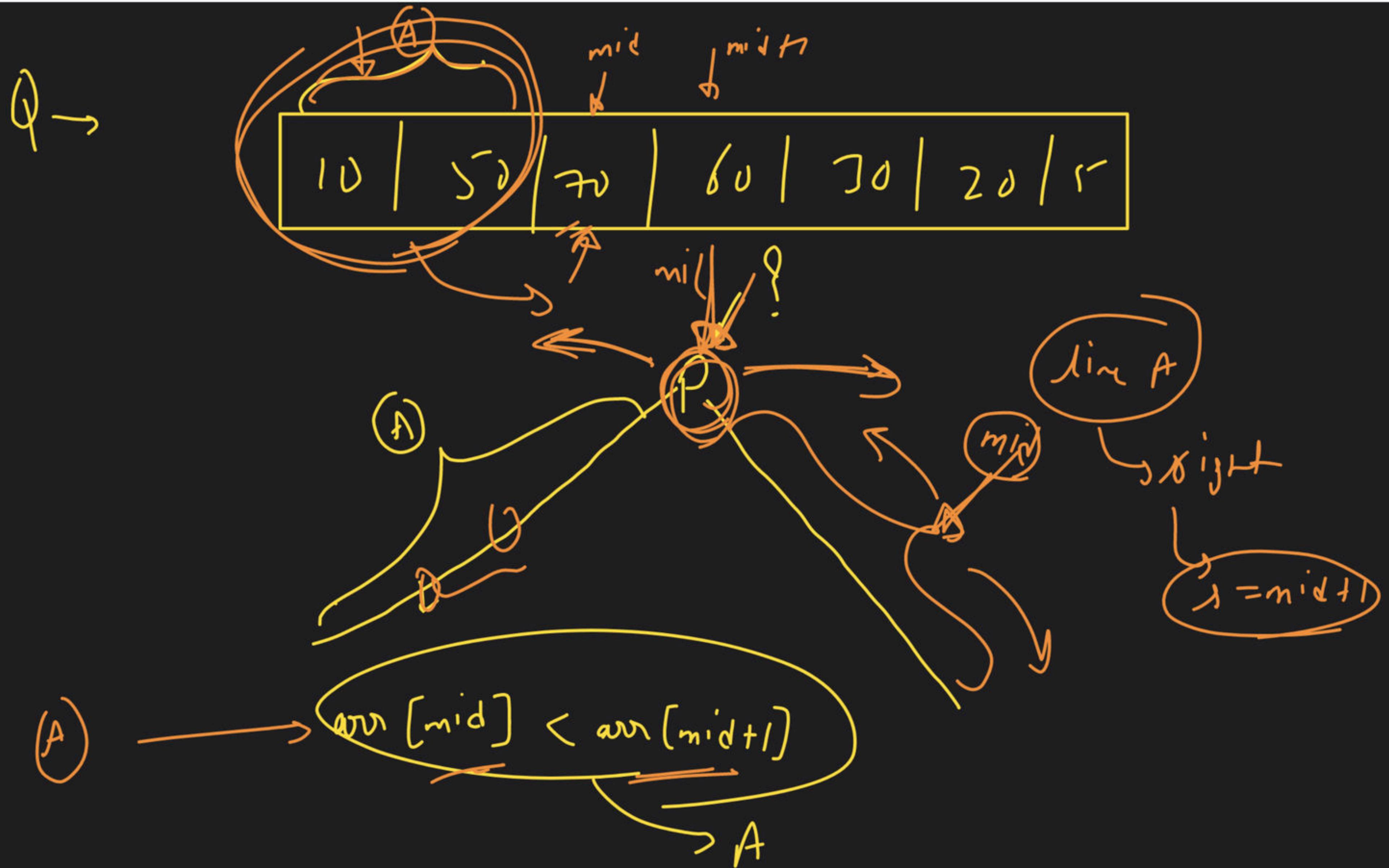




$$arr(mid) > arr[mid + 1]$$







if / $\text{arr}[\text{mid}] < \text{arr}[\text{mid} + 1]$) \rightarrow line A

{

$$g = \text{mid} + 1$$
 $e = \text{mid}$

or

 $g = \text{mid}$

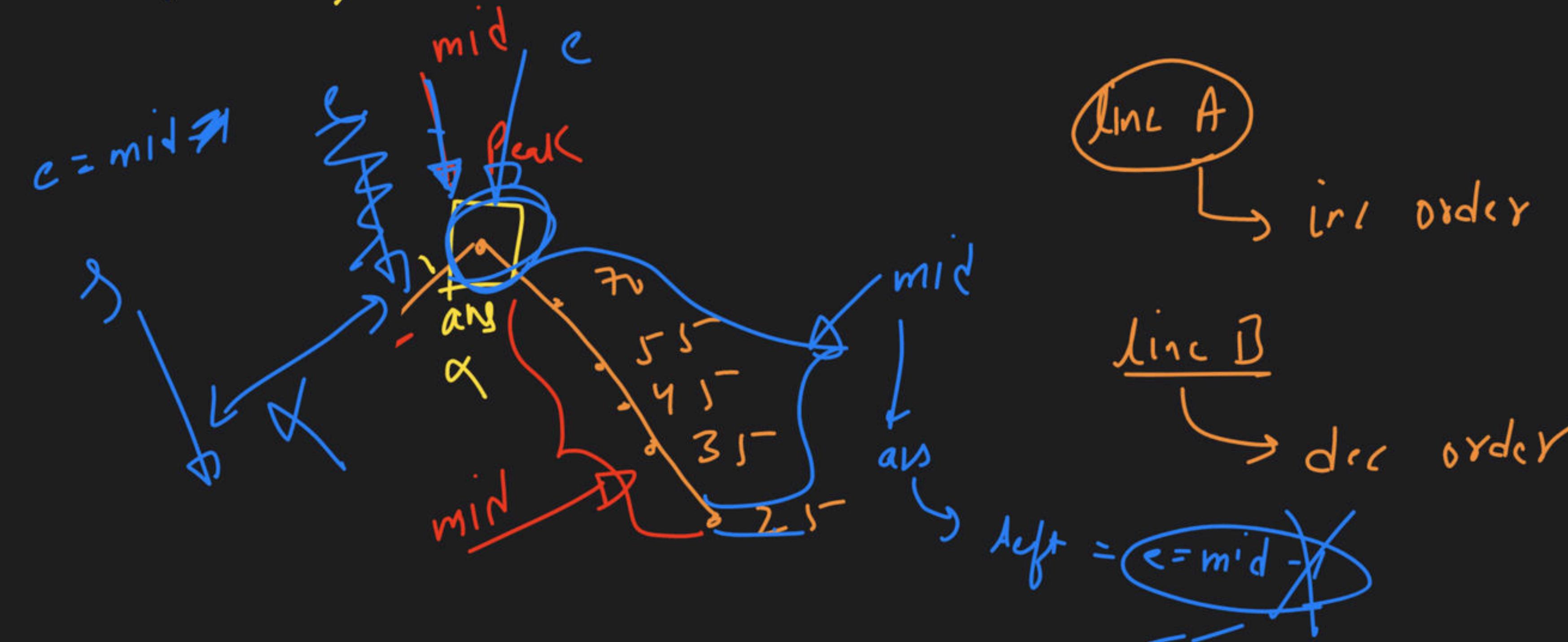
}

else

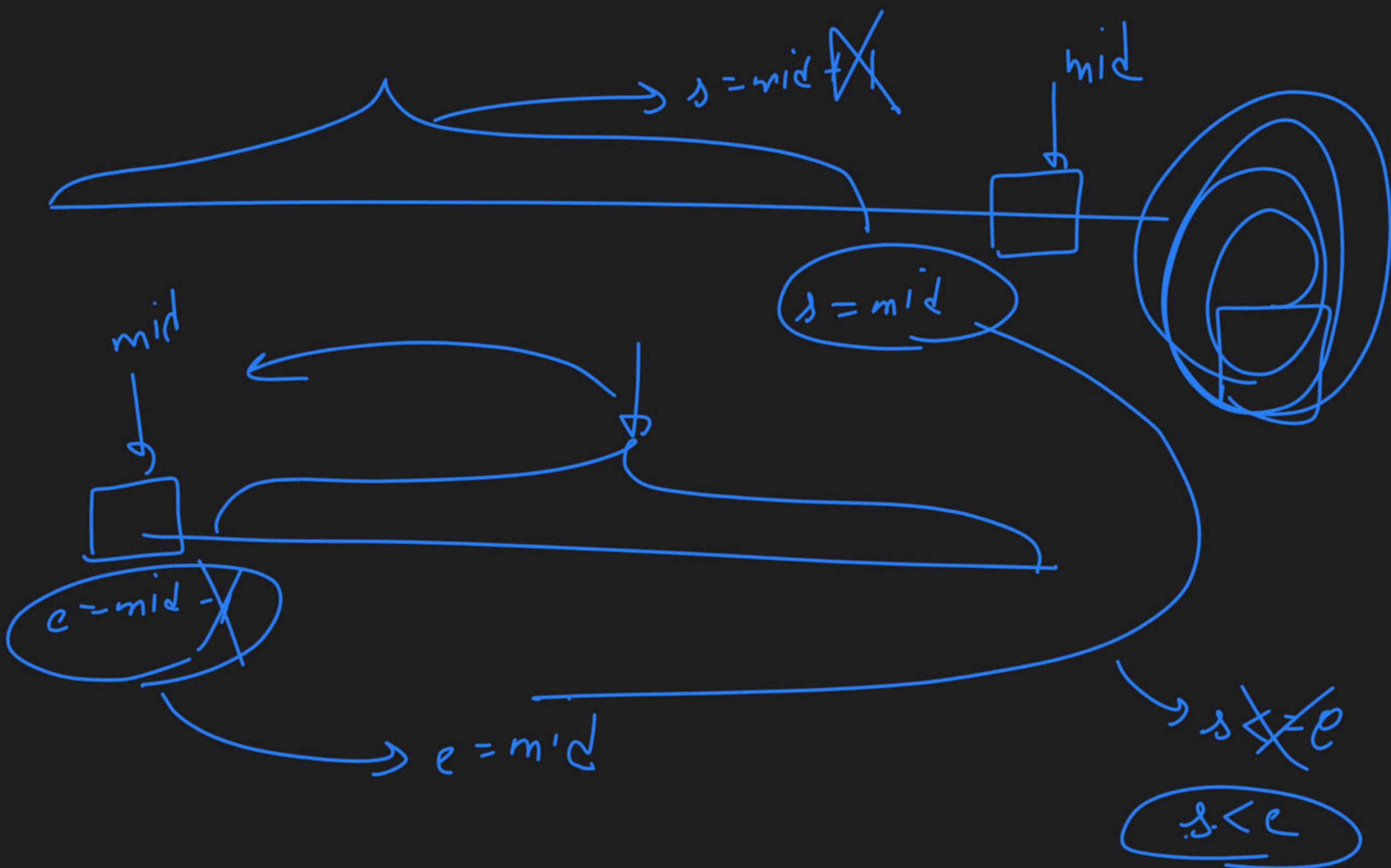
{

line B2 check mid line C mid
 arr
 $e = \text{mid}$ $c = \text{mid} - 1$ ~~$c = \text{mid} - 1$~~ $e = \text{mid}$ $c = \text{mid} - 1$ ~~$s < c$~~ $s < c$

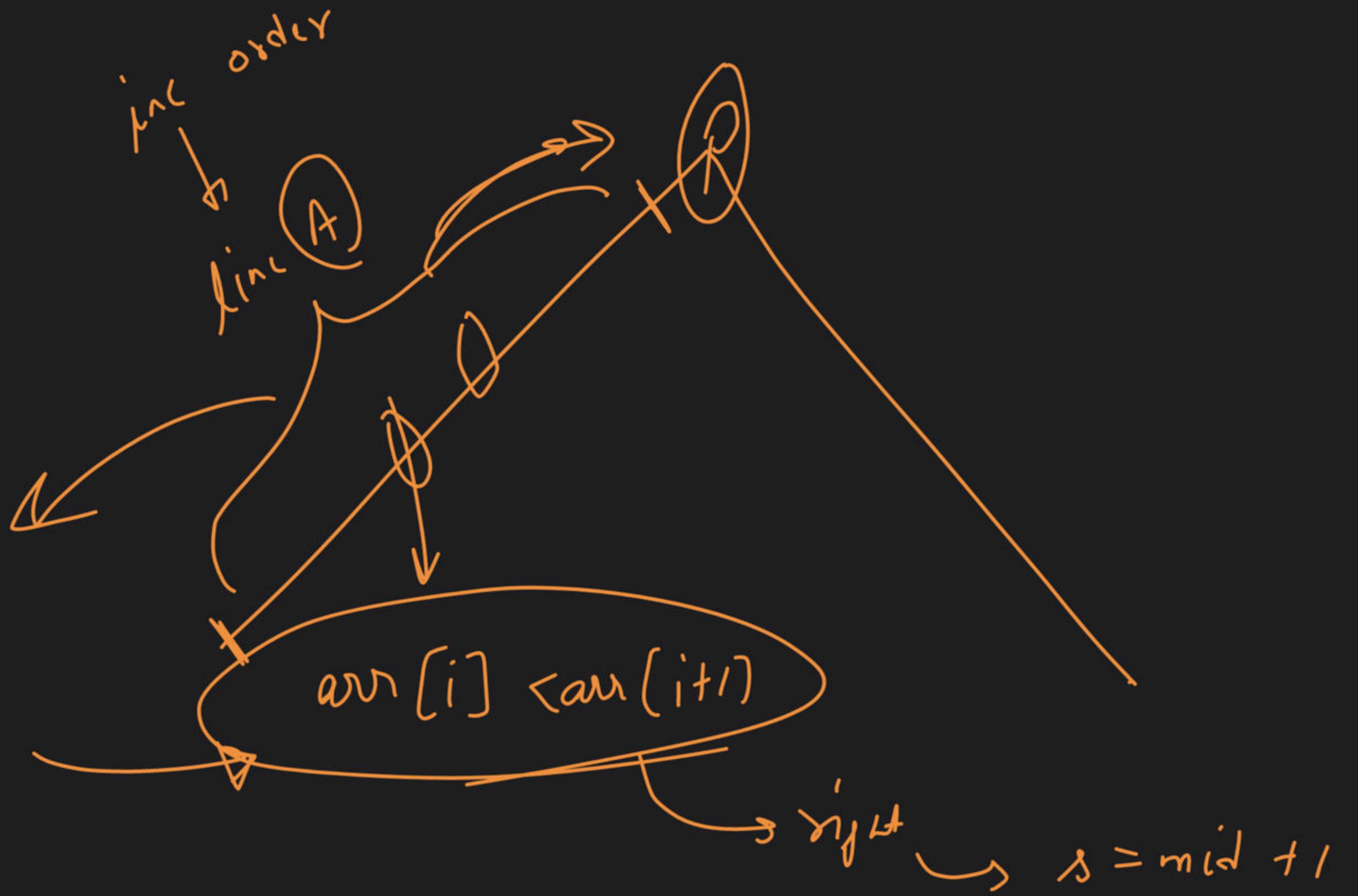
10	20	30	<u>80</u>	<u>70</u>	55	45-	35-	25-
g	p	p						

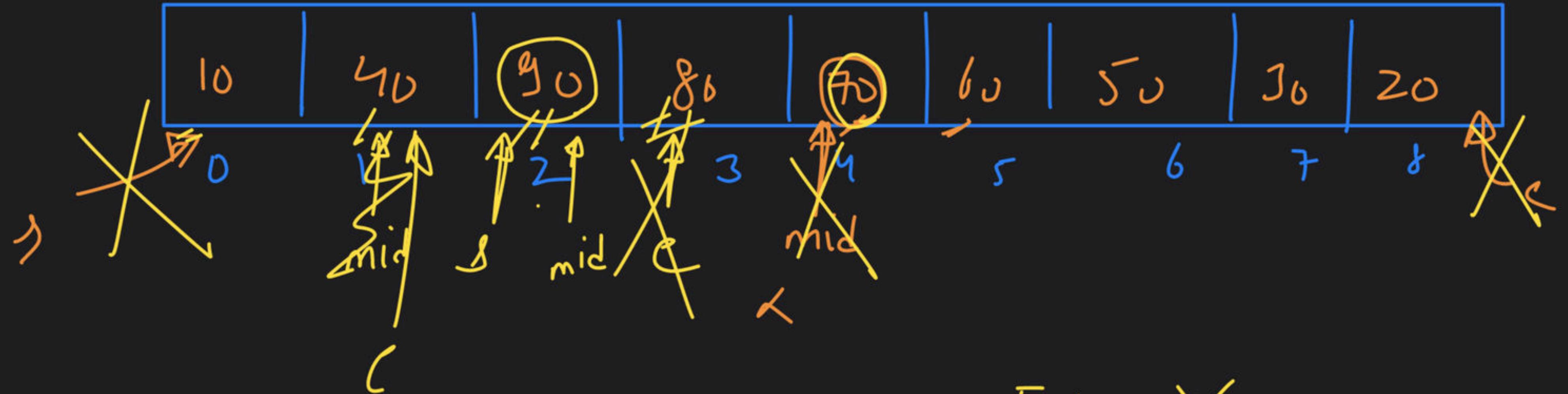


line A \rightarrow $arr[mid] < arr[mid + 1]$ \rightarrow move right $\rightarrow d = mid + 1$



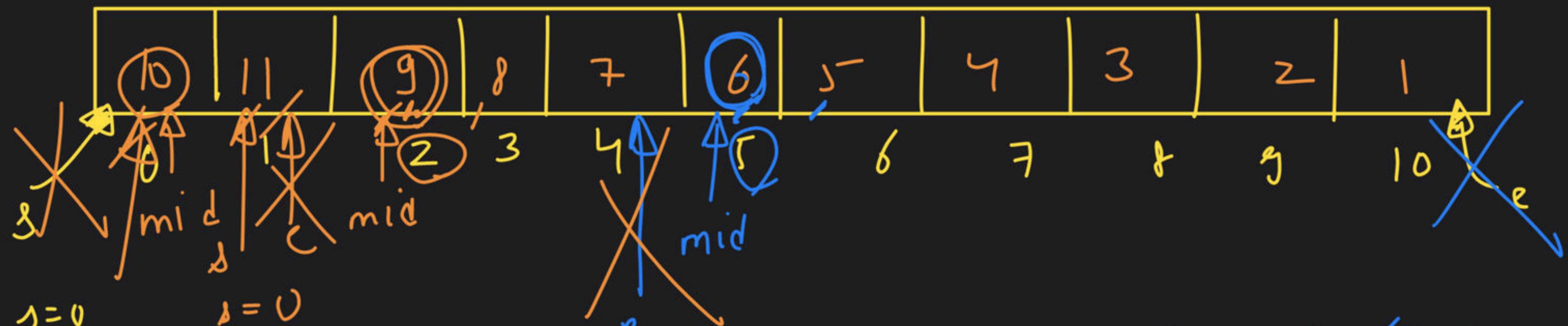
```
if (arr[mid] < arr[mid + 1])  
{  
    b = mid + 1  
}  
  
else  
{  
}  
  
}
```





$s > c$

match



$s = 0$

$e = 10$

$mid = 5 \quad mid = 2$

$s = 0$

$e = 4$

$s = 0$

$e = 1$

$mid = 0$



$s = 1$

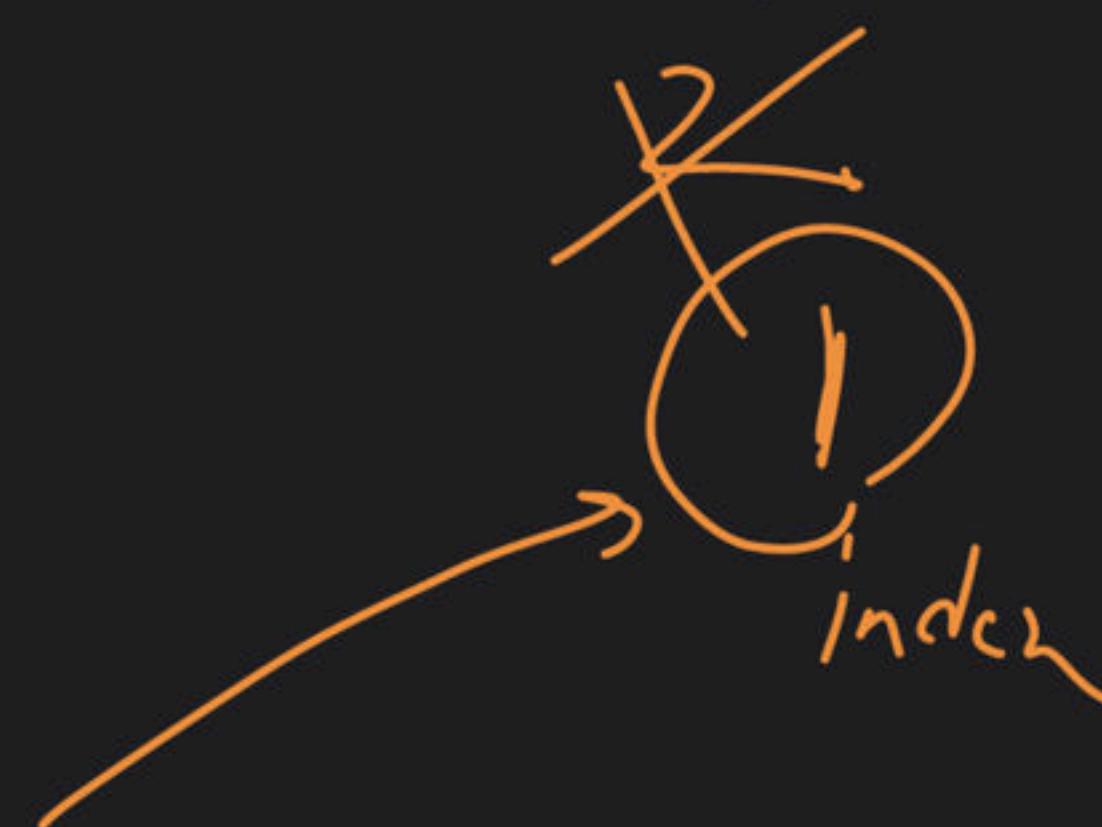
$e = 1$

$mid = 1$

$anIndex =$

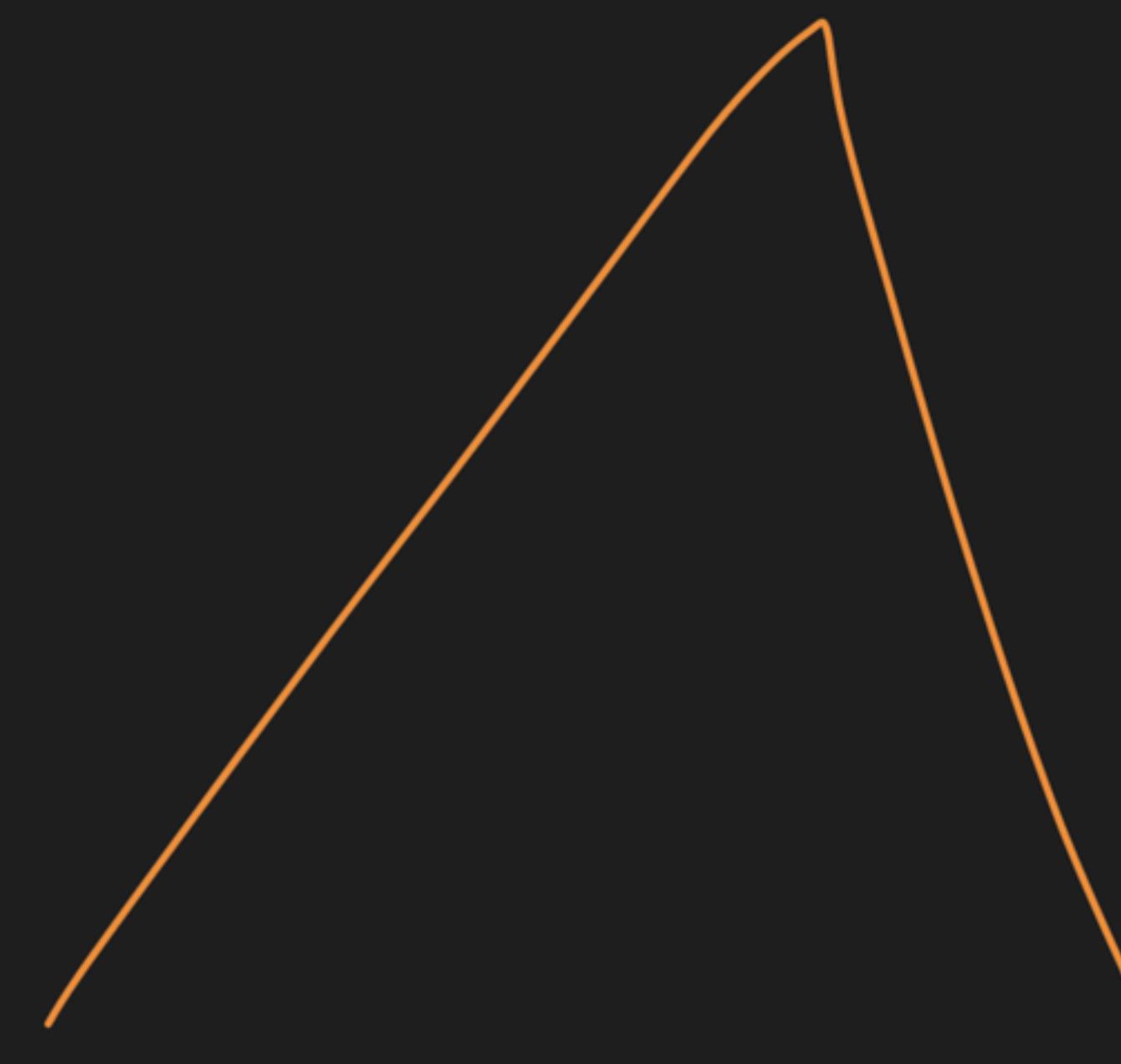


$8 > e \rightarrow \text{wK jatz hn}$

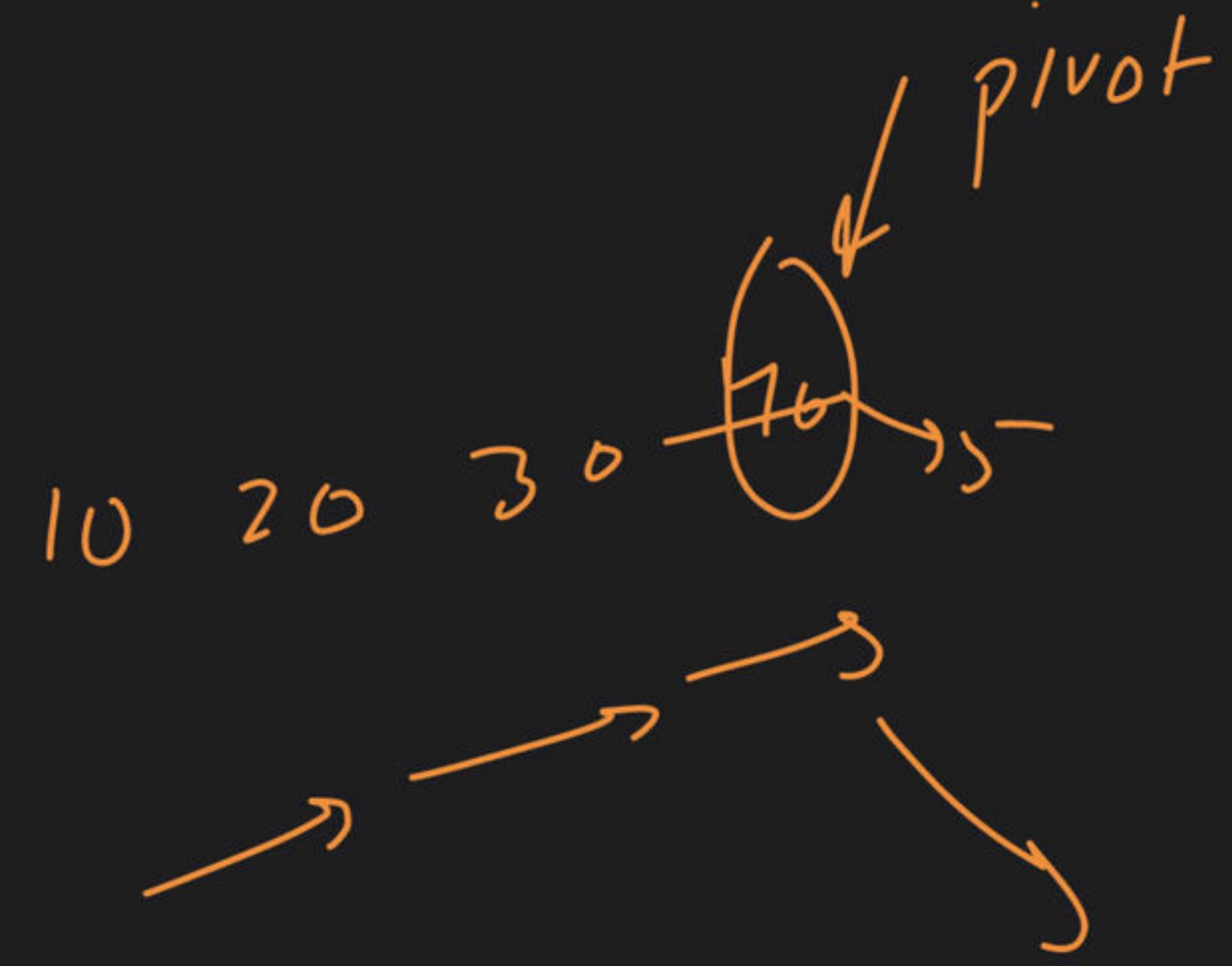


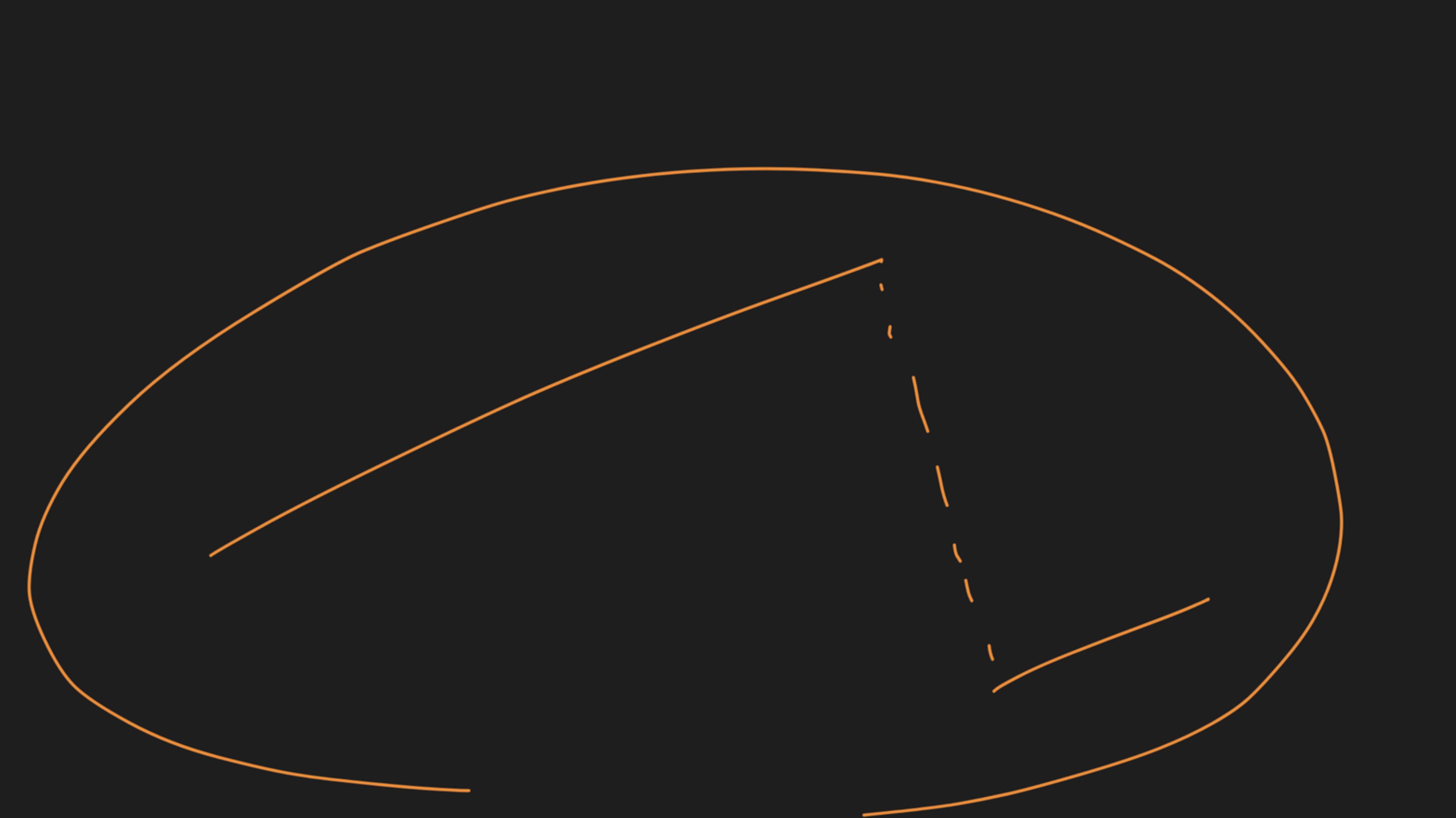


multiple peaks/mountains



→ find pivot index





→

sorted

[10, 20, 30, 40, 50, 60, 70]

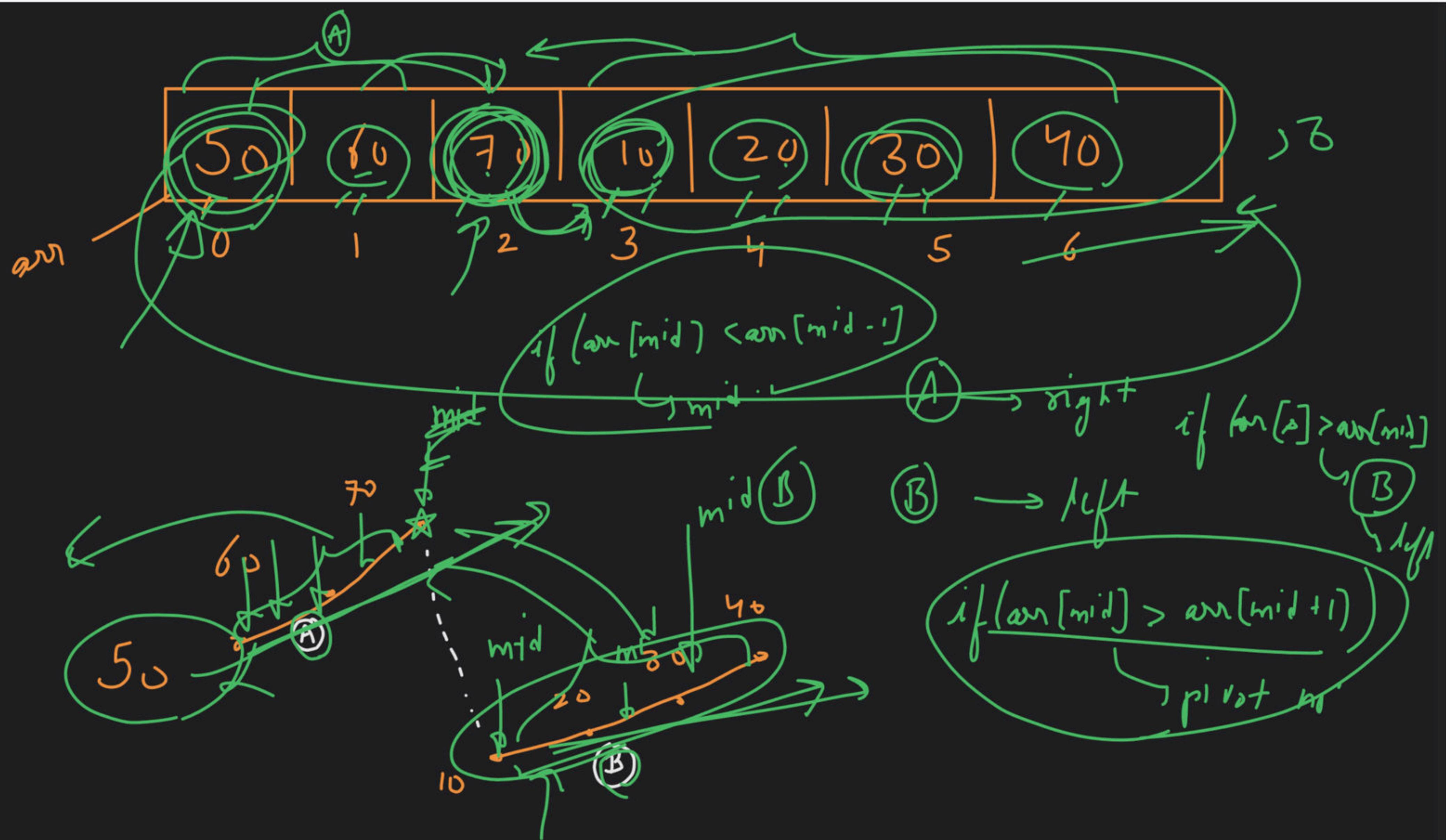
70, 10, 20, 30, 40, 50, 60

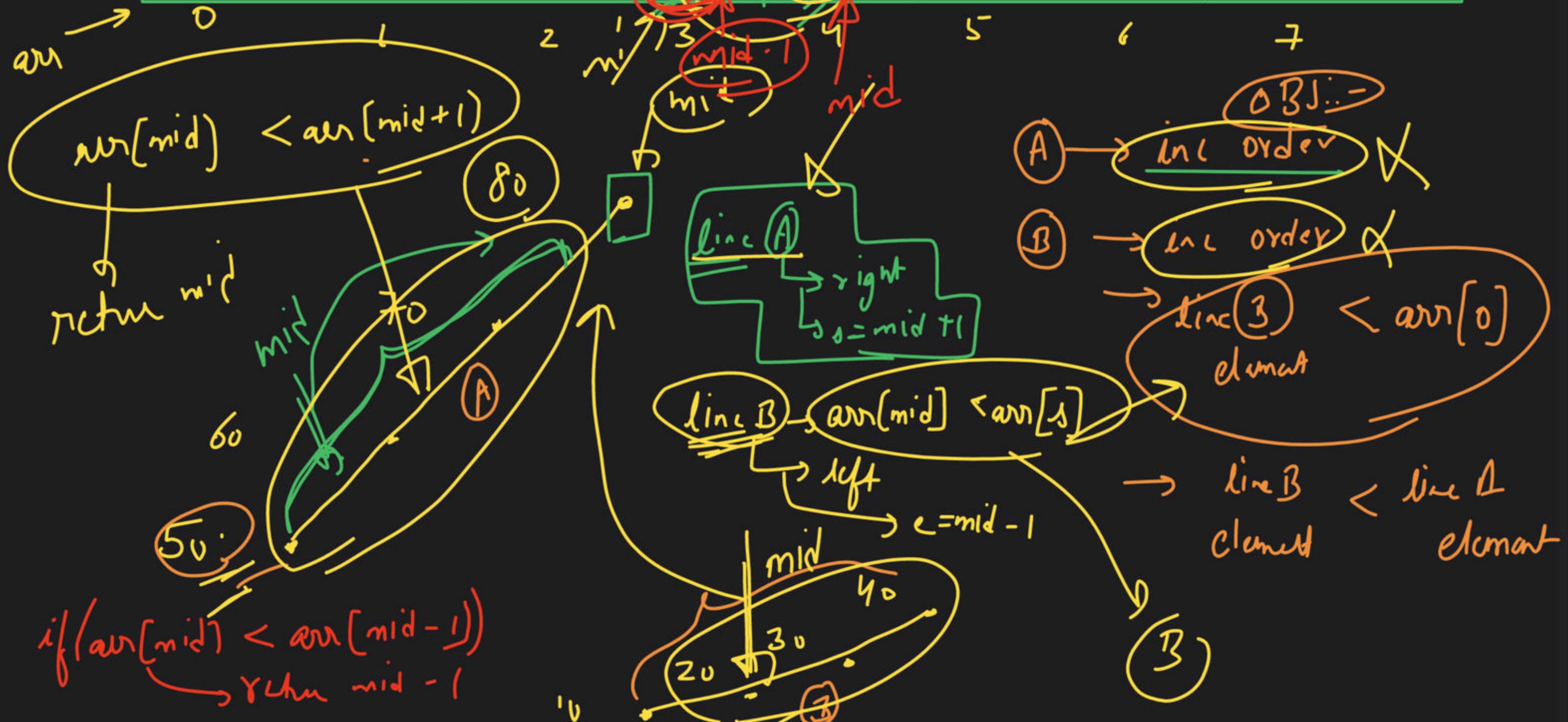
pivot

60, 70, 10, 20, 30, 40, 50

50, 60, 70, 10, 20, 30, 40

Sorted &
rotated
way



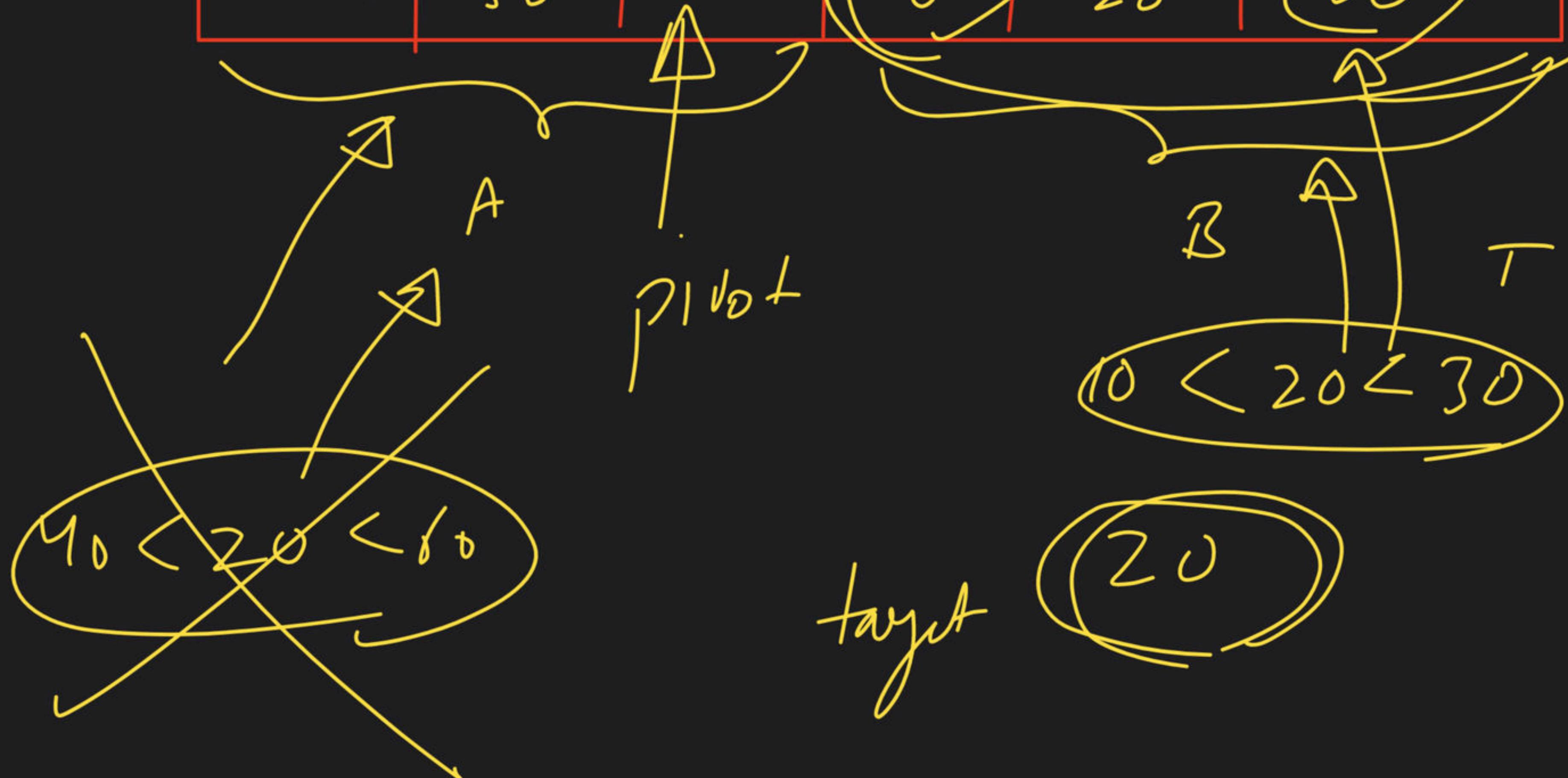
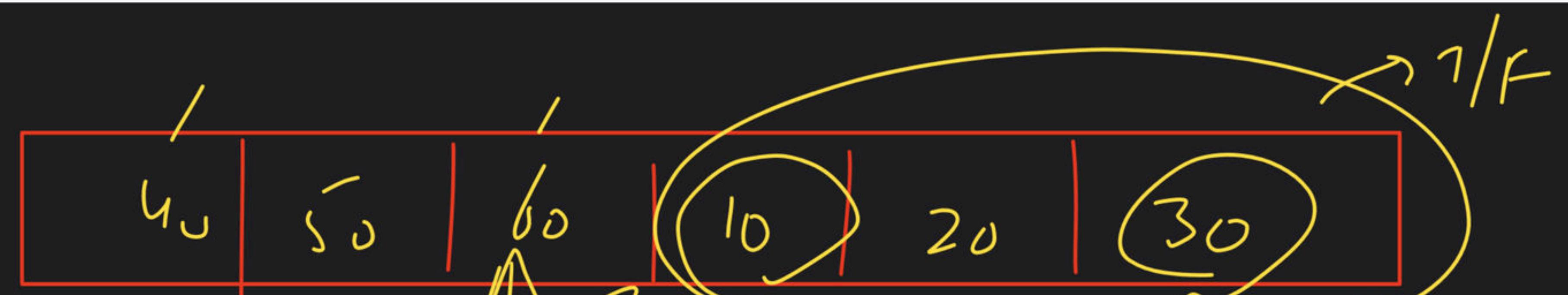


if ($\text{arr}[\text{mid}] < \text{arr}[\text{s}]$)
 ↳ $\text{left} \rightarrow \ell = \text{mid} - 1$

else
 ↳ $\text{right} \rightarrow \text{s} = \text{mid} + 1$

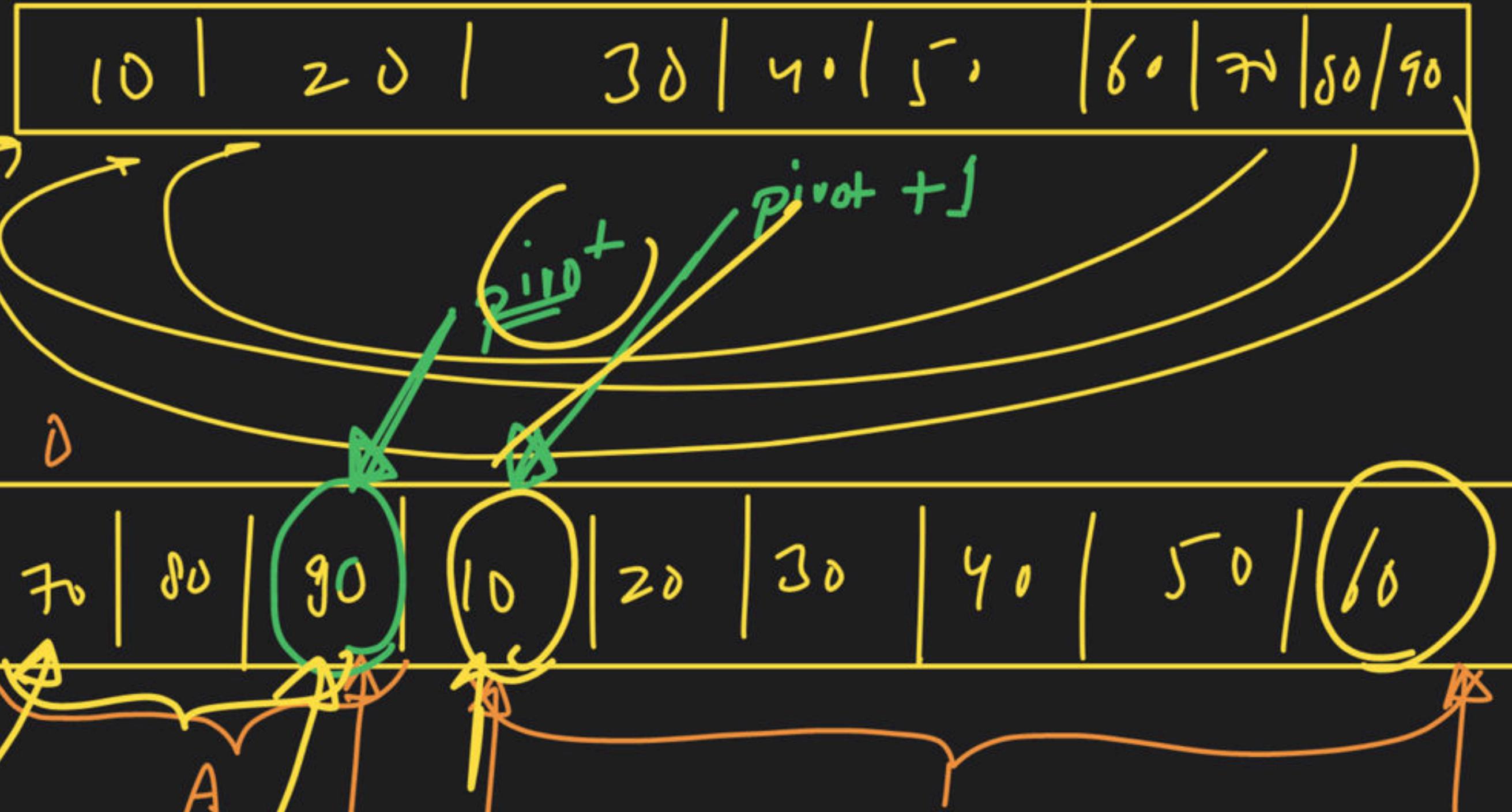
if ($\text{arr}[\text{mid}] \geq \text{arr}[\text{mid} + 1]$)
 ↳ return mid

if ($\text{arr}[\text{mid}] < \text{arr}[\text{mid} - 1]$)
 ↳ $\text{return mid} - 1$



① Pivot

inp → sorted & rotated array



target = 50
 $O(\log n)$ → B-S

? ?
X(0) → pivot
③ pivot + 1 → (n-1)
B-S, O/p

$\text{if } (s == c)$

$\rightarrow \text{return } 0$

10

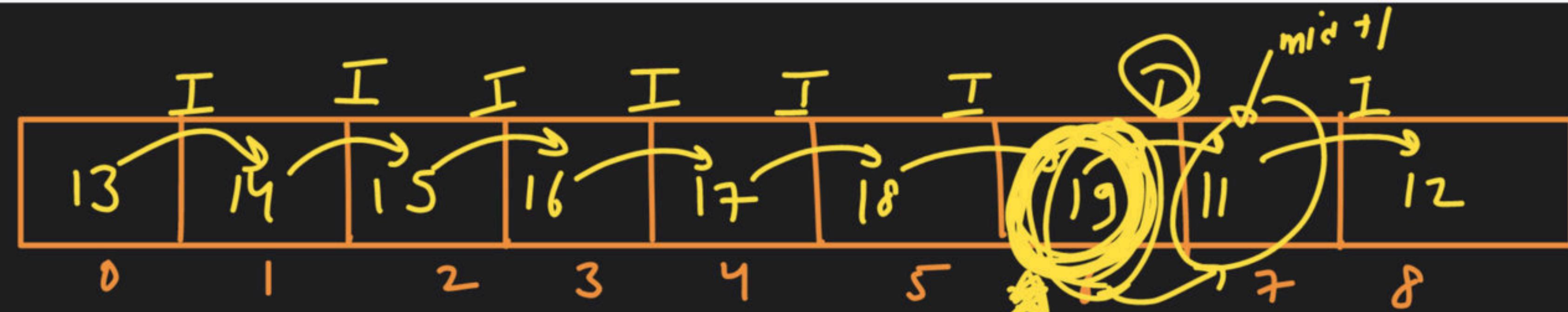
9

s

$\text{pivot} = -1$

$\rightarrow \text{return } s$

9



if $\text{arr}[\text{mid}] > \text{arr}[\text{mid} + 1]$
 return mid

mid

mid

line A → right
 line B → left

ans → return mid

13

14

15

16

17

18

19

R

mid

12

11

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

mid

else
 $\{ s = \text{mid} + 1 \}$

line A

line B

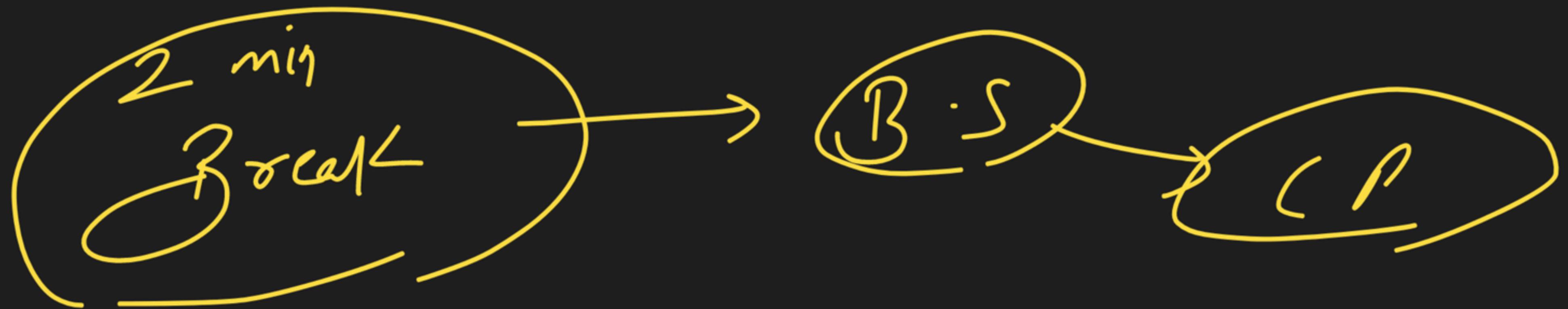
→ Peak Index

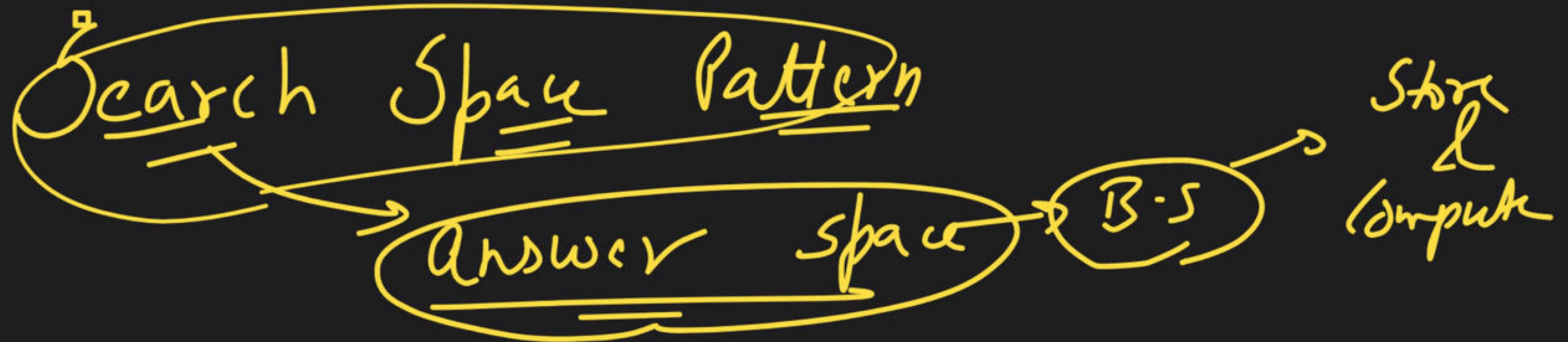
→ pivot Index

→ search in rotated

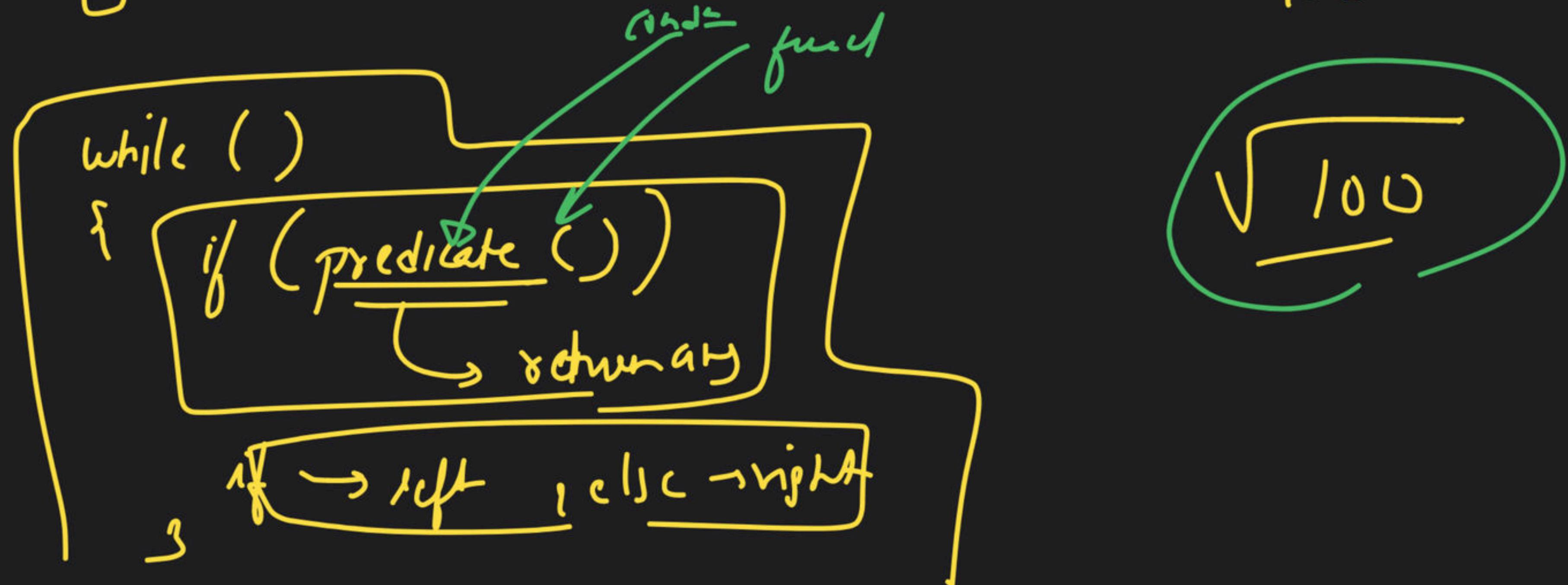
3 Bars
cyclic
Array

Code

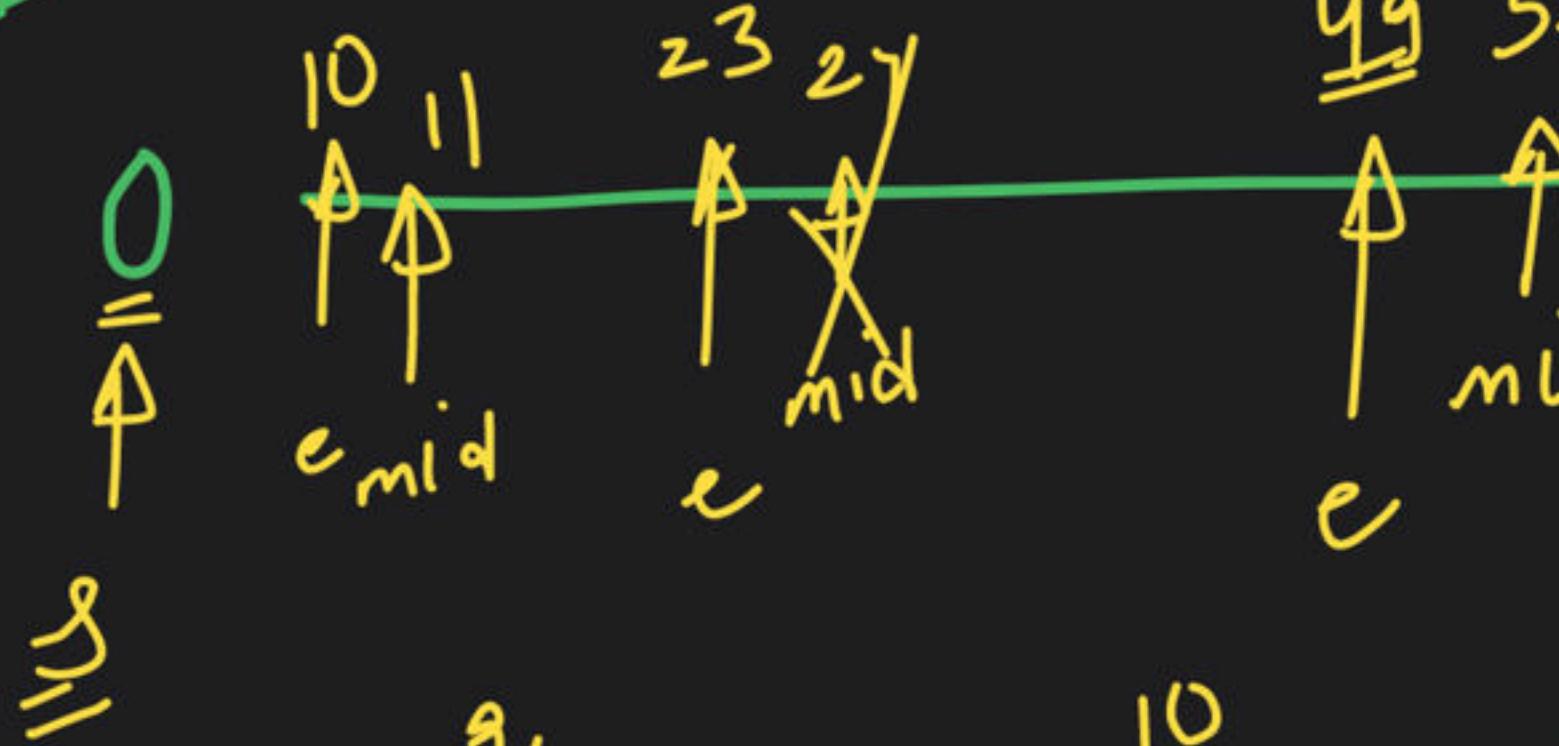




0 → 100



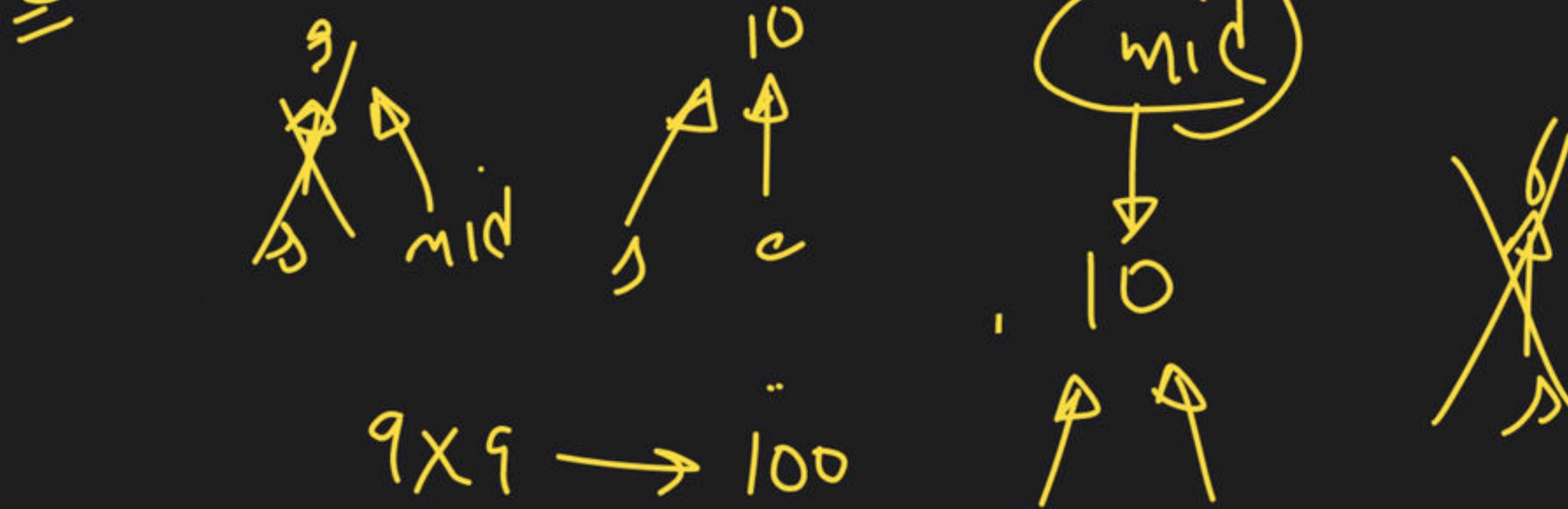
$$\textcircled{1} \quad \sqrt{100} = 10$$



\approx

$$\text{an} \quad \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{array}$$

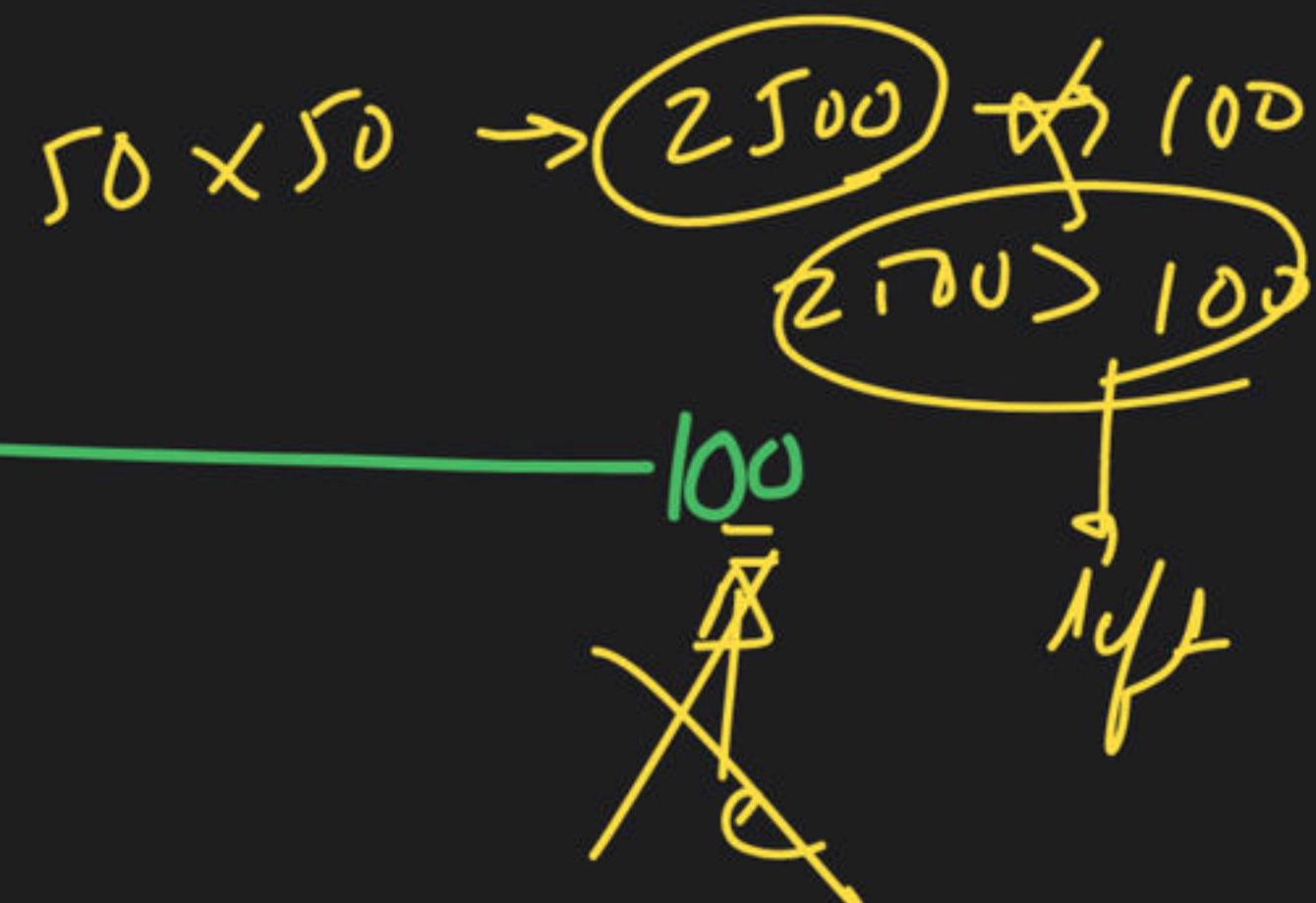
$\text{an} \quad \text{an}$



$$9 \times 9 \rightarrow 100$$

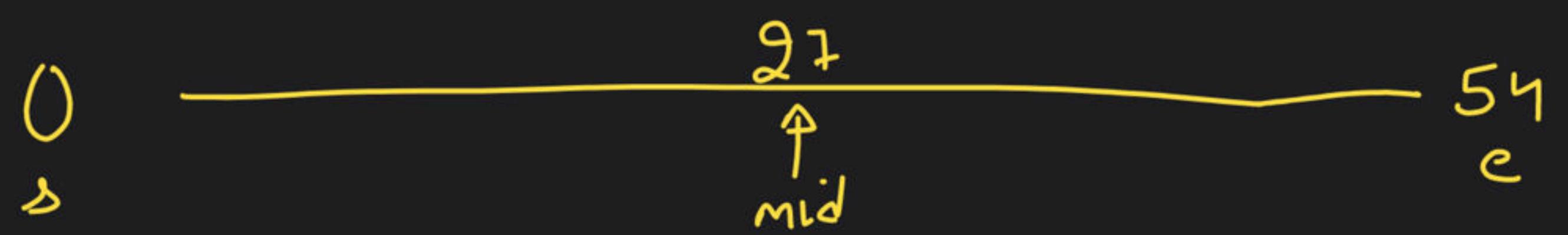
< . - p

$$10 \times 10 = 100$$



$$8 \quad 9 \quad 10 \\ \text{mid} \quad \text{mid} \quad \text{mid}$$

$8 \times 8 \rightarrow 64 < 100$



$$27 \times 27 = 54$$

$c = mid - 1$ → left

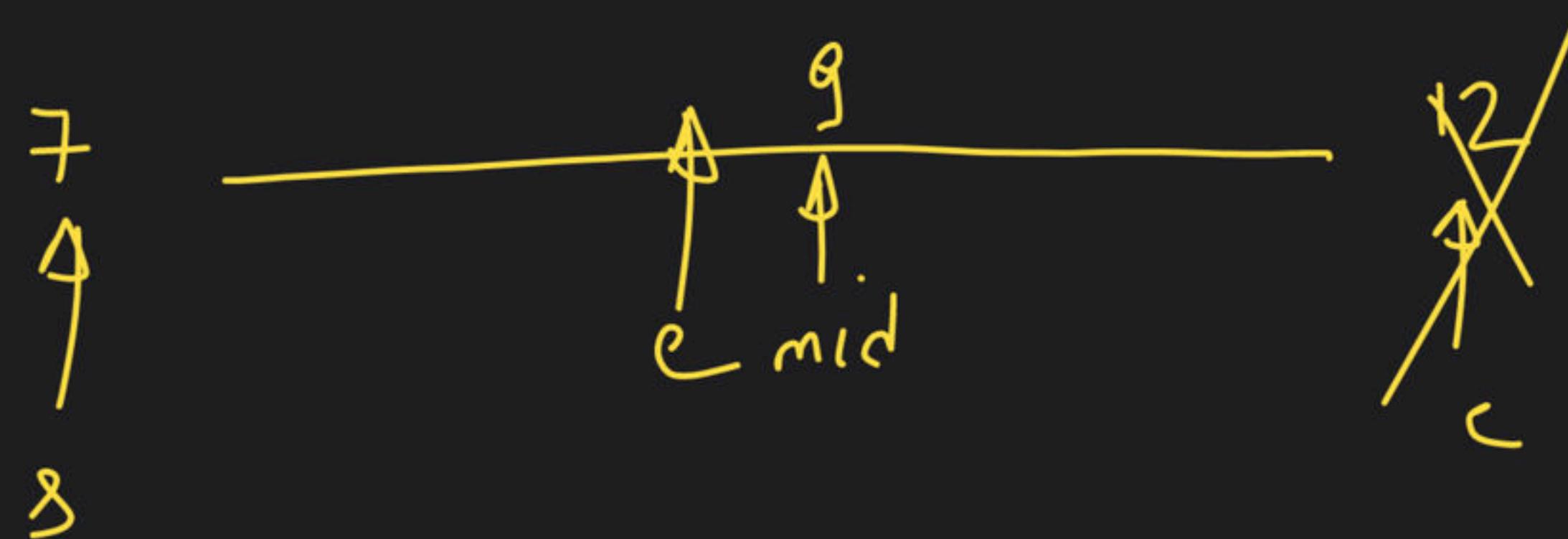
$\sqrt{54}$
 $\sqrt{4 \cdot 34}$



$$13 \times 13 = 169 > 54 \rightarrow \text{left}$$

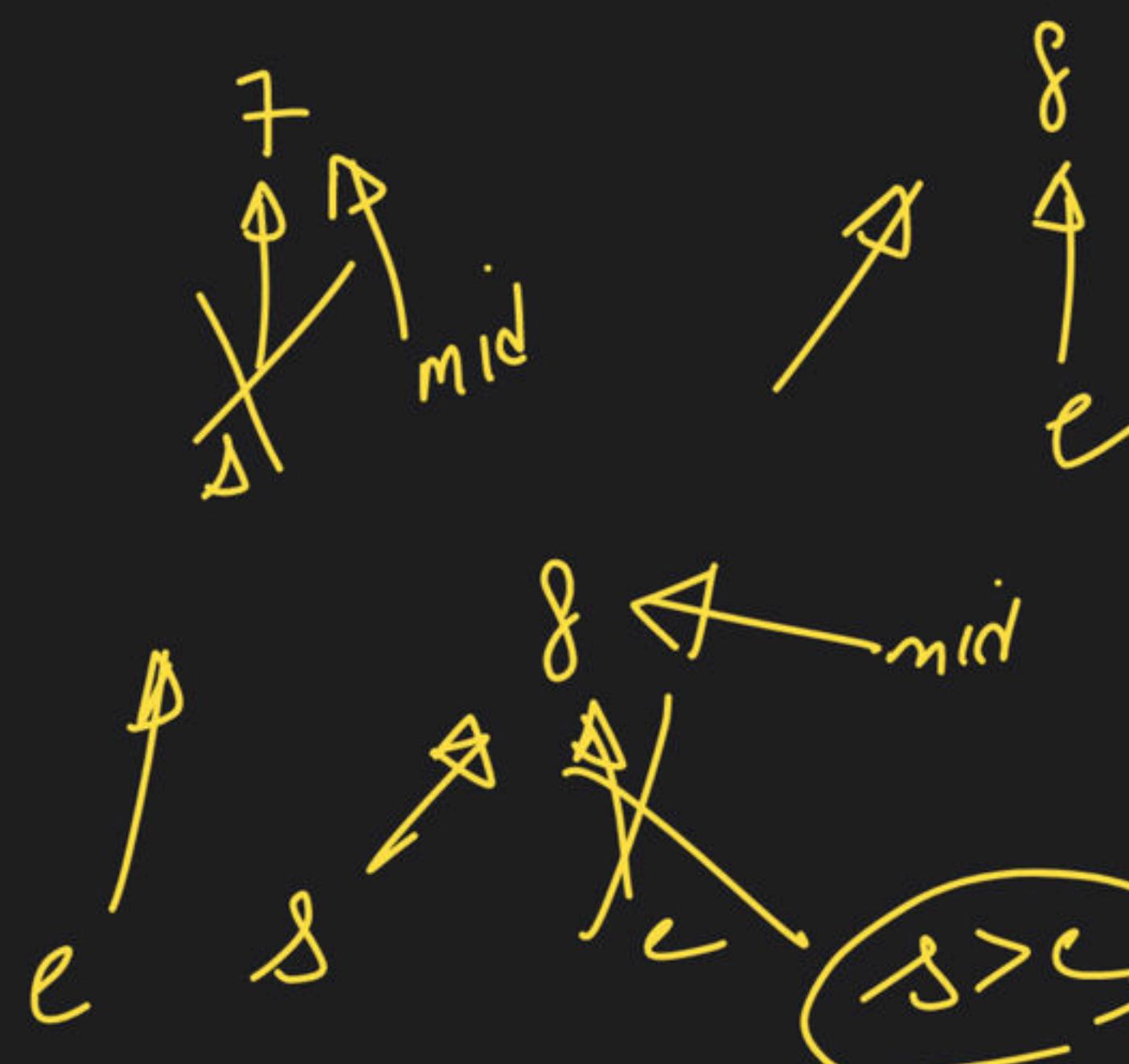


~~$36 < 54$~~
 $6 \times 6 = 36 = 2 < 54$



$$7 \times 9 = 54$$

Q → left

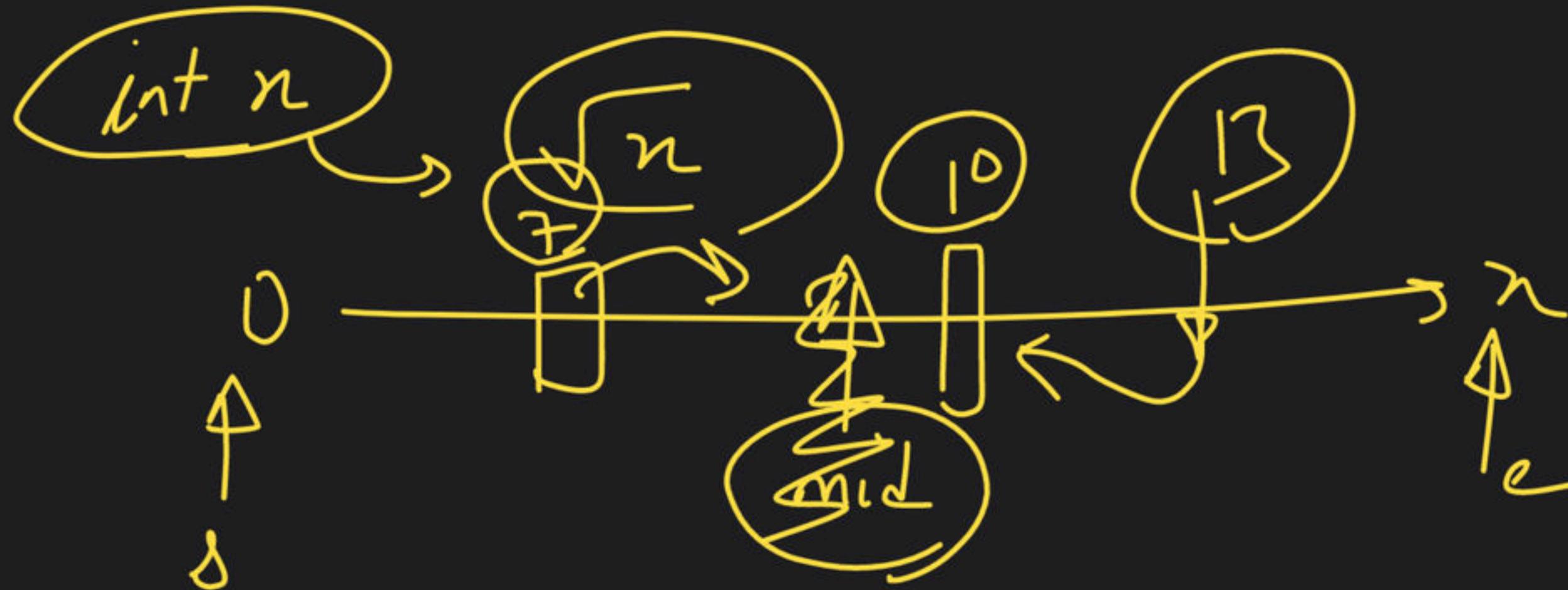


$$7 \times 7 = 49 < 54$$



$$8 \times 8 = 64 > 54$$

s > c → right



Kal

Xtra (law)

while ($s \leq e$)

{

if ($mid * mid = n$)

return mid

if ($mid * mid > n$)

left , $e = mid - 1$

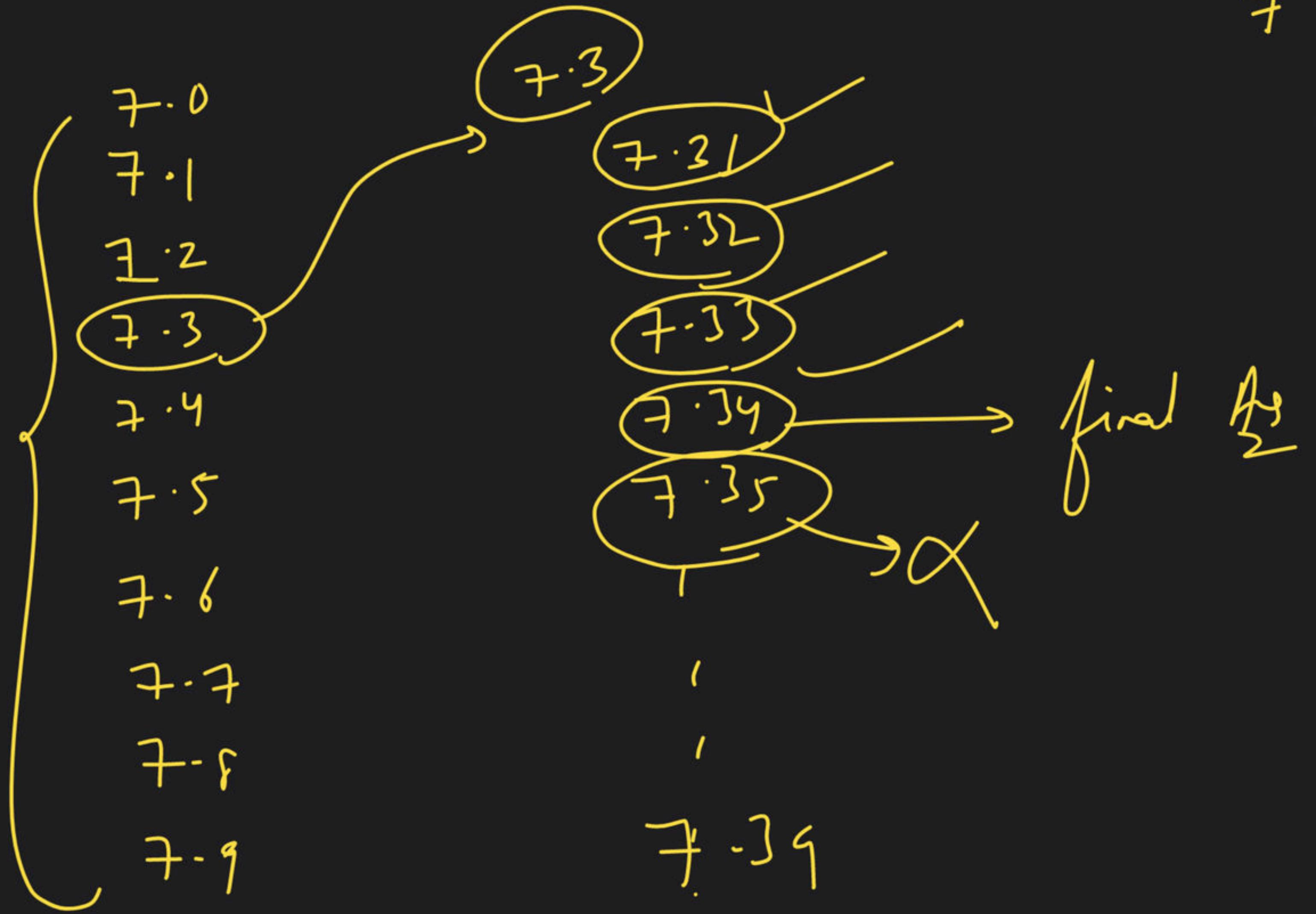
else

right - , $s = mid + 1$

}

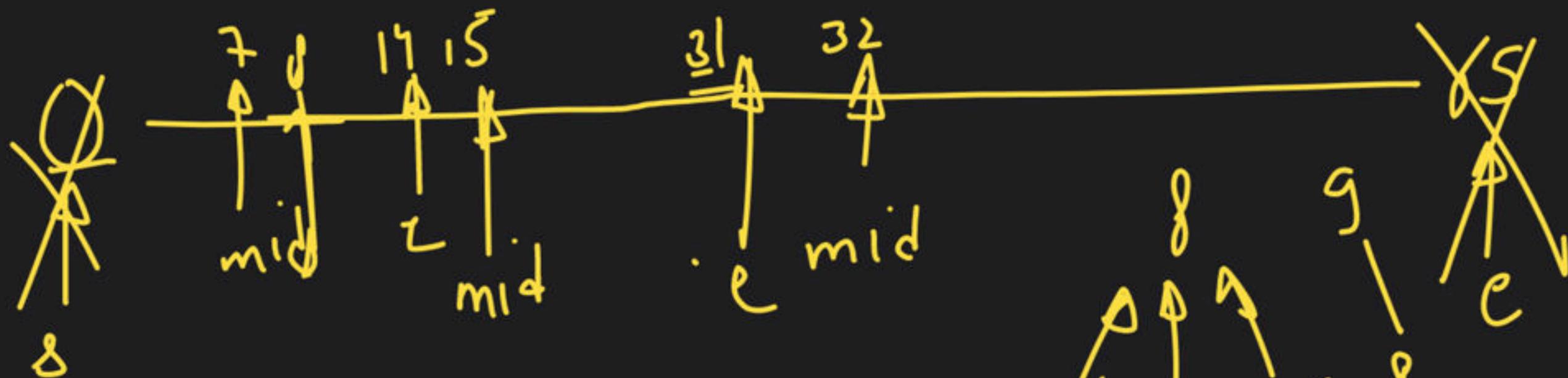
$$\sqrt{54} = \sqrt{9 \cdot 6}$$

$$7 \cdot 34$$

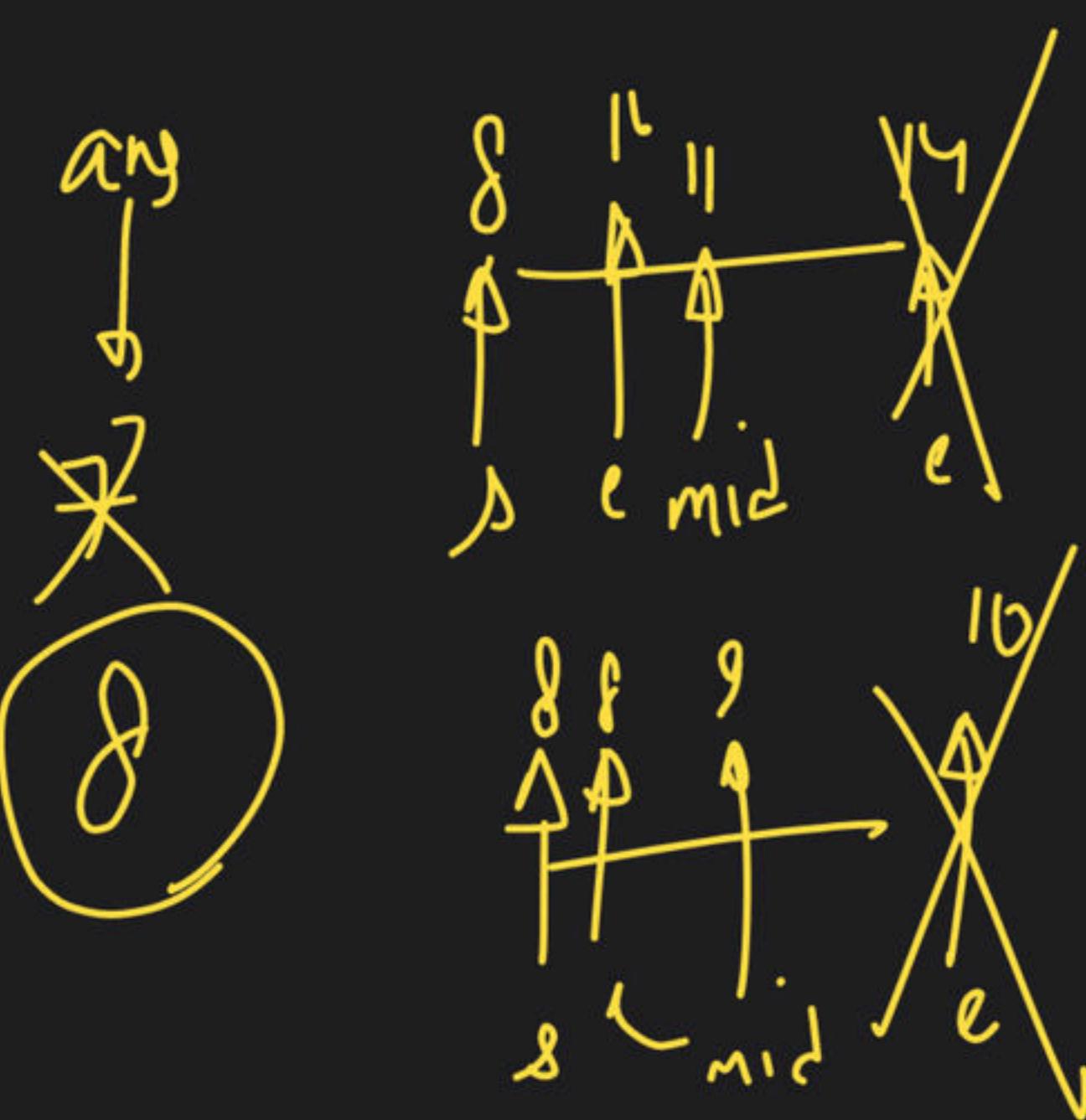


$$7 \xrightarrow{\quad} \sqrt{5^4}$$

$$O(\log n)$$



$$\sqrt{65}$$



\rightarrow left $\rightarrow c = \min - 1$

$15 \times 15 \text{ or } 65$
 $\geqslant \text{left} \rightarrow e = m(\sqrt{-1})$

$$7 \times 7 = 49 = \sqrt{49}$$

19 < 81

$$1 \times 5 = 5$$

$$11 \times 11 = 68$$

$$9 \times 9 < 65$$

\rightarrow 2D Array $O(\log n)$

$$O(\log(n \times \text{col}))$$

$2D \rightarrow 1D$

$$[c \star i + j]$$

$\text{rows} \rightarrow y$
 $\text{cols} \rightarrow x$

$$\text{mid} = 6$$

$$i = \frac{\text{mid}}{c} = \frac{6}{4} = 1$$

$$j = \text{mid} \% c = 6 \% 4 = 2$$

$$3$$

0	1	2	3
0	10	20	30
1	50	70	80
2	90	100	110
3	130	140	150

$1D \rightarrow 2D$

$$i = \frac{\text{mid}}{c}$$

$$j = \text{mid} \% c$$

$$\text{target} = 110$$

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160

Kal ->

8.30

Extom Ular

2D \rightarrow 1D \rightarrow $(\star i + j)$

1D \rightarrow 2D mid index pr
standard Kruskal

$$\text{rowIndex} = \frac{\text{mid}}{\text{columns}}$$

$$\text{colIndex} = \frac{\text{mid} \% \text{columns}}{\text{columns}}$$