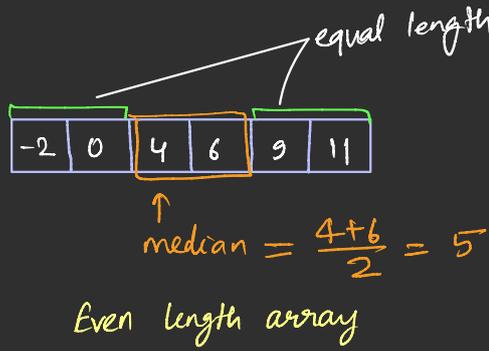
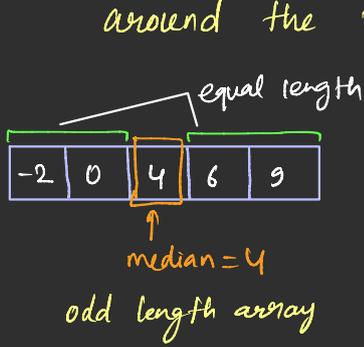


What is Median

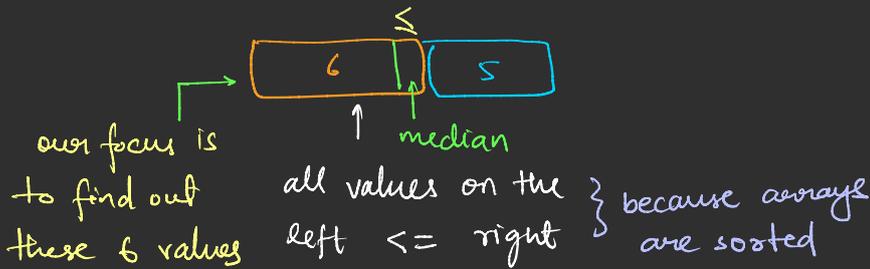
↳ left hand side and right hand side has equal length around the median.



x: $[x_0, x_1, x_2, x_3, x_4]$ $m=5$

$$m+n = \frac{11+1}{2} = 6$$

y: $[y_0, y_1, y_2, y_3, y_4, y_5]$ $n=6$



①. $m < n \rightarrow$ take $m/2$ values from x

$$m/2 = 5/2 = 2$$

$[x_0, x_1]$ | $[x_2, x_3, x_4]$

rem. ④ $\rightarrow [y_0, y_1, y_2, y_3]$ | $[y_4, y_5]$

values on left \leq values on right

$x_1 < x_2 \rightarrow \therefore x \rightarrow$ sorted

$y_3 < y_4 \rightarrow \therefore y \rightarrow$ sorted

if $\begin{cases} x_1 \leq y_4 \\ y_3 \leq x_2 \end{cases} \Rightarrow$ Good to go

Both happen simultaneously $\left\{ \begin{array}{l} x_1 > y_4 \Rightarrow x_1 \text{ should be on rhs \& } y_4 \text{ should be on lhs} \\ y_3 > x_2 \Rightarrow y_3 \text{ should be on rhs \& } x_2 \text{ should be on lhs} \end{array} \right.$

\downarrow Go left in x \downarrow Go right in y
 \downarrow Go left in y \downarrow Go right in x

x:

| | | | | |
|---|---|---|---|----|
| 0 | 1 | 2 | 3 | 4 |
| 0 | 3 | 5 | 6 | 11 |

 $m=5$

$m+n=11$

y:

| | | | | | |
|---|---|---|----|----|----|
| 0 | 1 | 2 | 3 | 4 | 5 |
| 1 | 2 | 8 | 12 | 13 | 15 |

 $n=6$

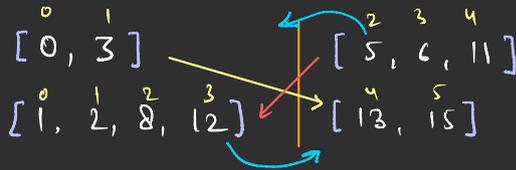
$\frac{11+1}{2} = 6 \rightarrow$ lhs

$11-6 = 5 \rightarrow$ rhs

$\frac{low+high}{2} \leftarrow$ x-partition = $\frac{0+4}{2} = 2$ elements

$6 \leq 5$

y-partition = $6-2 = 4$ elements



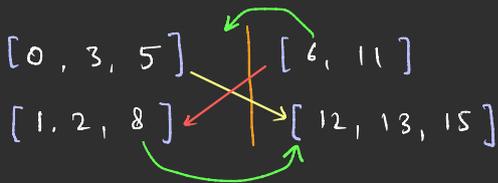
$3 < 13$

$12 > 5 \rightarrow$ y-12 should be on rhs & x-5 should be on lhs

$low = 2+1$
↑
mid

x-partition = $\frac{low+high}{2} = \frac{3+4}{2} = 3$ elements

y-partition = $6-3 = 3$ elements



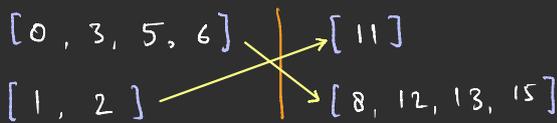
$5 < 12$

$8 > 6 \rightarrow$ y-8 should be on rhs & x-6 should be on lhs

$low = 3+1$
↑
mid

x-partition = $\frac{4+4}{2} = 4$

y-partition = $6-4 = 2$



$6 < 8$
 $2 < 11$ } good to go

DDD \rightarrow median = $\max(6, 2) \rightarrow 6$

x:

| | | | | |
|---|---|----|----|----|
| 0 | 1 | 2 | 3 | 4 |
| 0 | 8 | 11 | 12 | 13 |

 m=5

y:

| | | | | | | |
|---|---|---|---|---|---|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 2 | 4 | 5 | 6 | 7 | 15 |

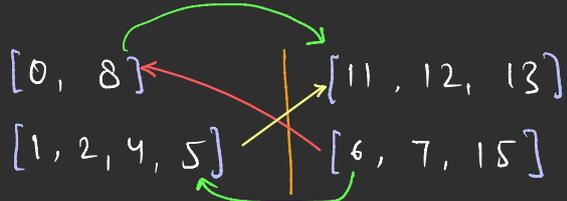
 m=7

$m+n = 5+7 = 12$

lhs = $\frac{12+1}{2} = 6$

x-partition = $\frac{low+high}{2} = \frac{0+4}{2} = 2$

y-partition = $6-2 = 4$



update high value of x

$mid-1 = 2-1 = 1$

x-partition = $\frac{0+1}{2} = 0 \rightarrow mid$

y-partition = $6-0 = 6$

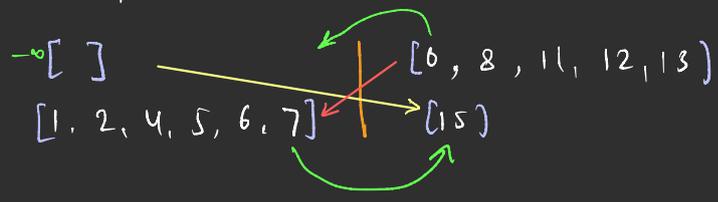
[2] m=1 $\frac{1+2+1}{2} = 2$

[1, 3] n=2 rhs=1

mid = $\frac{0+0}{2} = 0$

[] | [2]

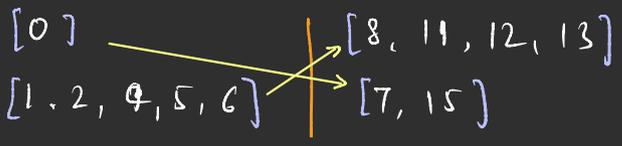
[1, 3] | []



update low value of x $\rightarrow mid+1 = 0+1 = 1$

x-partition = $\frac{1+1}{2} = 1$

y-partition = $6-1 = 5$



$0 < 7$
 $6 < 8$ } good to go

$m+n \rightarrow$ EVEN

median = $\frac{\max(lhs) + \min(rhs)}{2}$

= $\frac{6+7}{2} = 6.5$