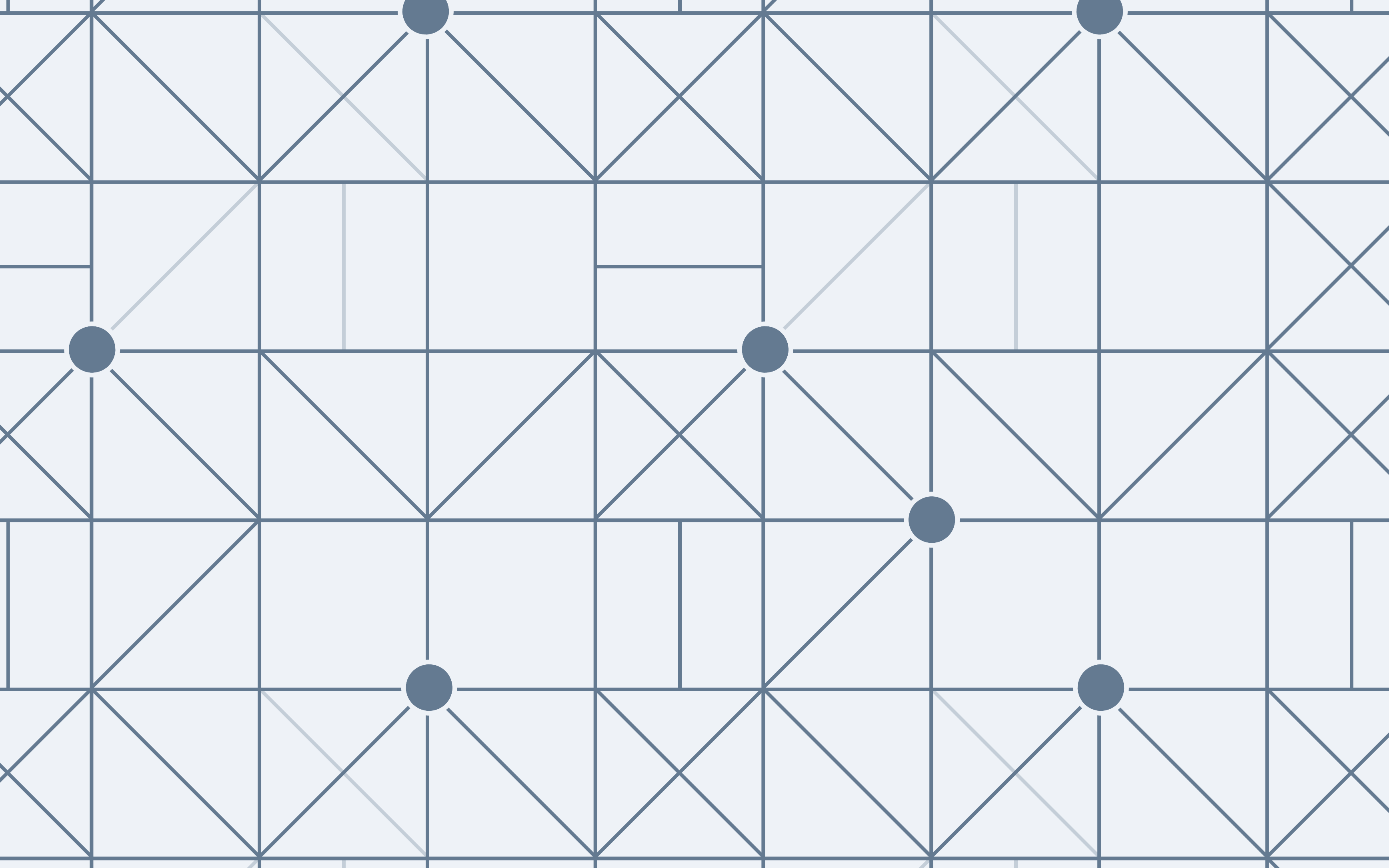
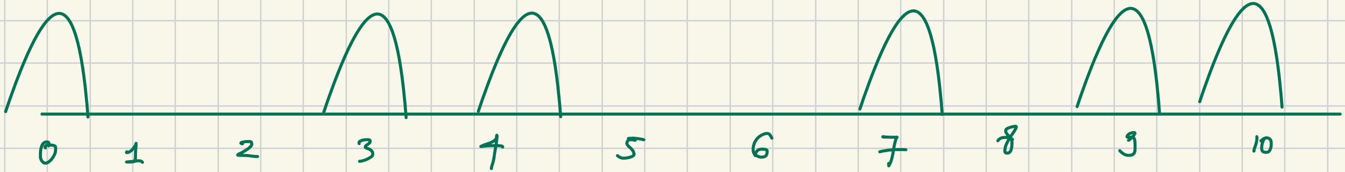


Aggressive Cows.

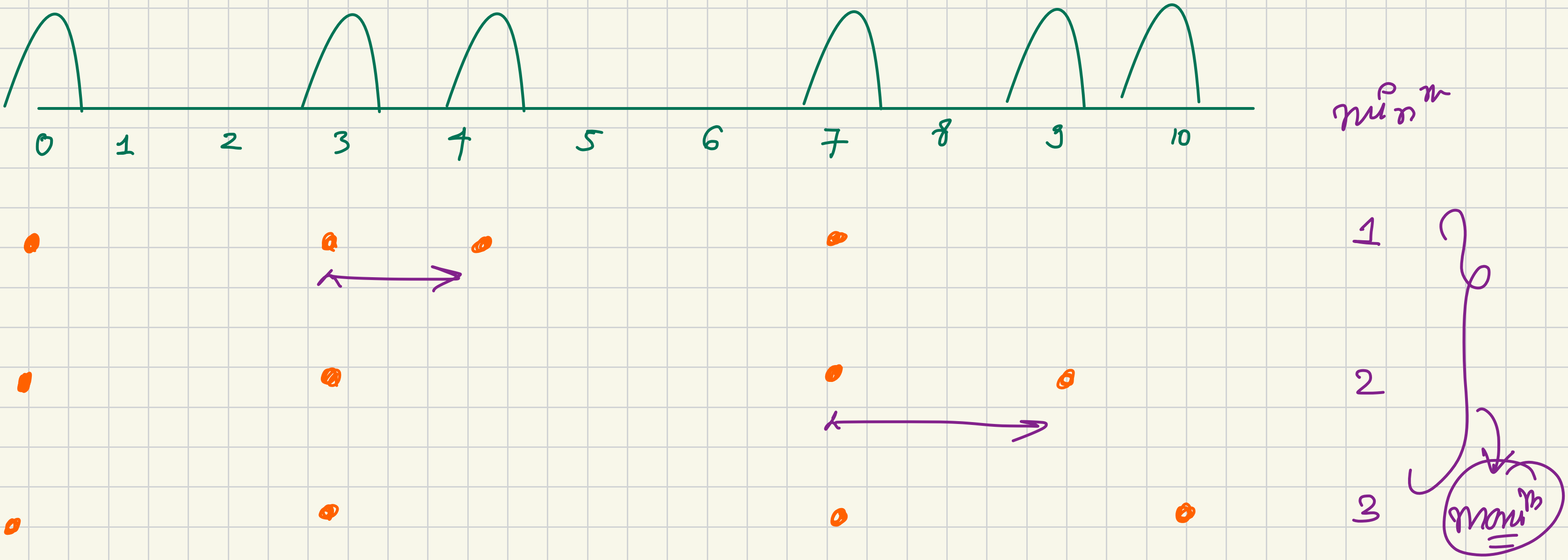
$$\text{stalls}[\,] = \{\overset{0}{0}, \overset{1}{3}, \overset{2}{9}, \overset{3}{7}, \overset{4}{10}, \overset{5}{4}\}$$

cows = 4

→ inc. distance aggressive cows.



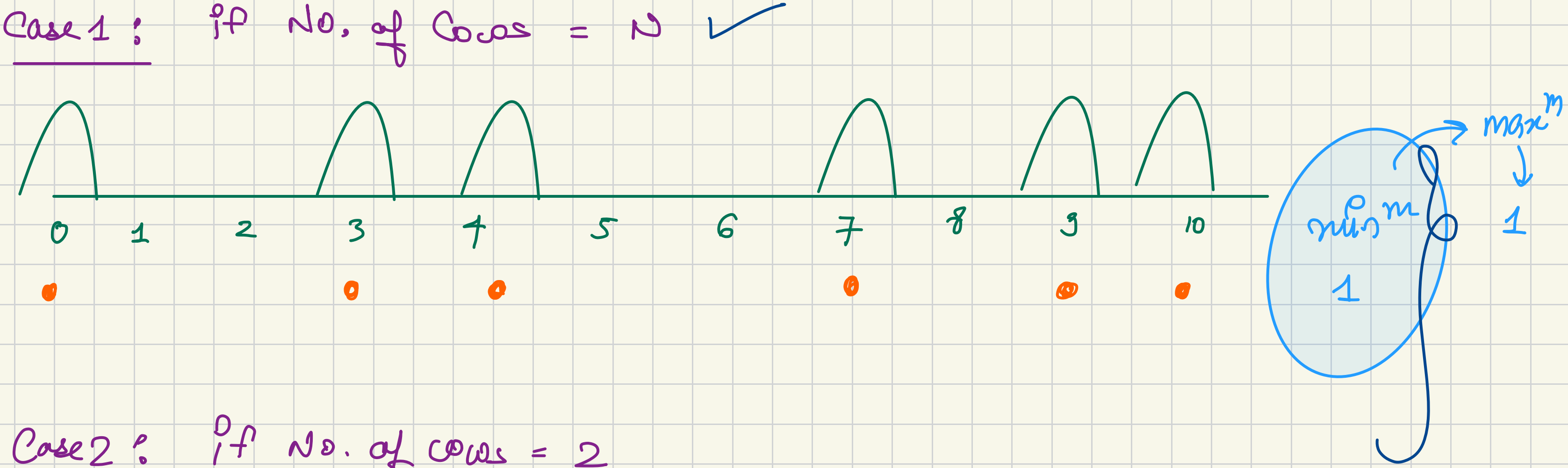
→ $\max^{m}\{\min^{m}$ distance b/w any tw cows $\}$



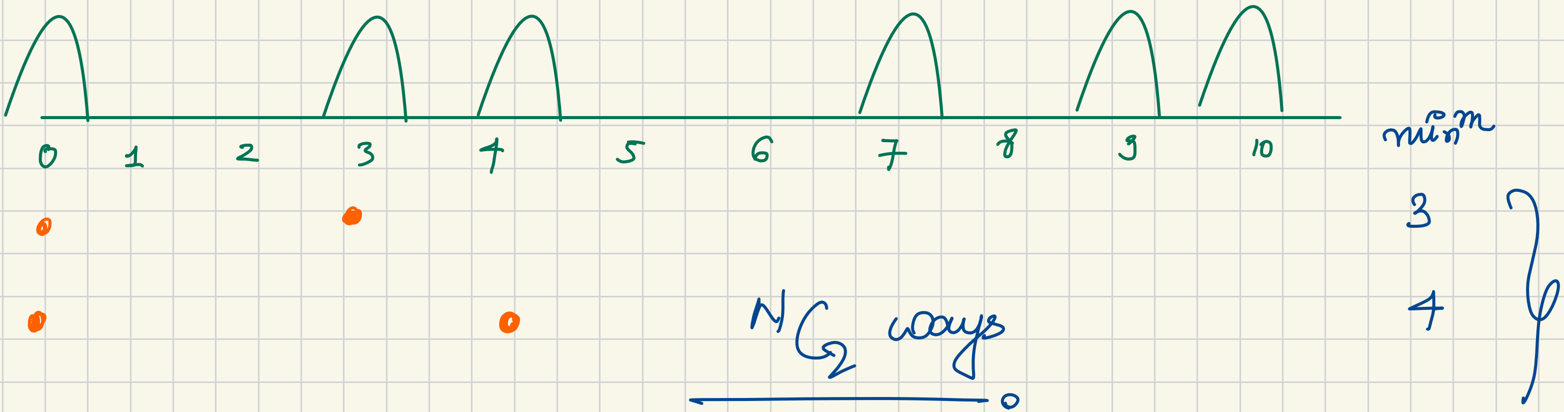
$^{N}C_{m}$ ways to store cows

0

Case 1 : if No. of Cows = N ✓



Case 2 : if No. of cows = 2

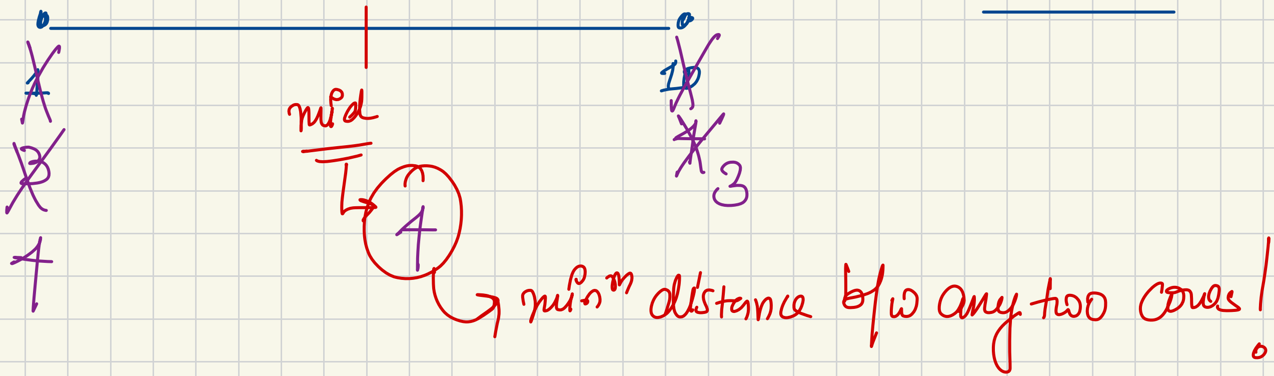


$^NC_2$ ways

got our range

0

cows = 4

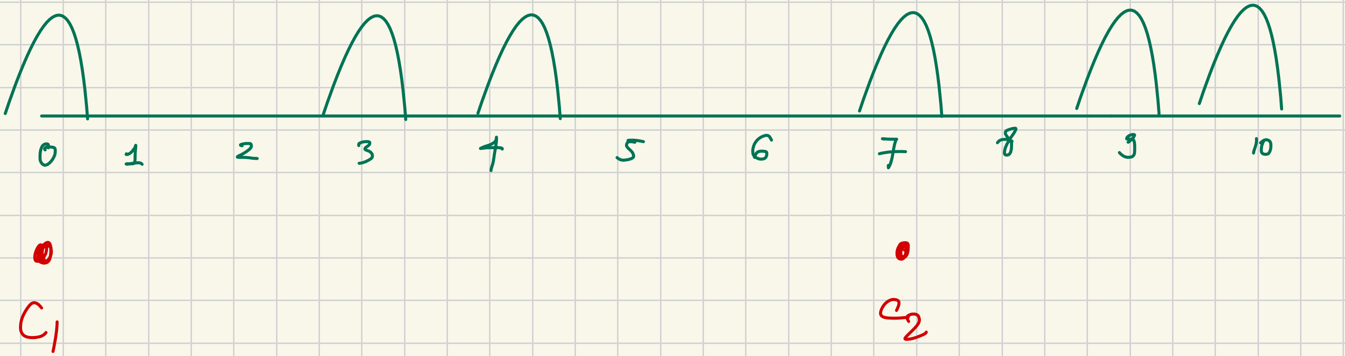


pans = ~~4~~ 3

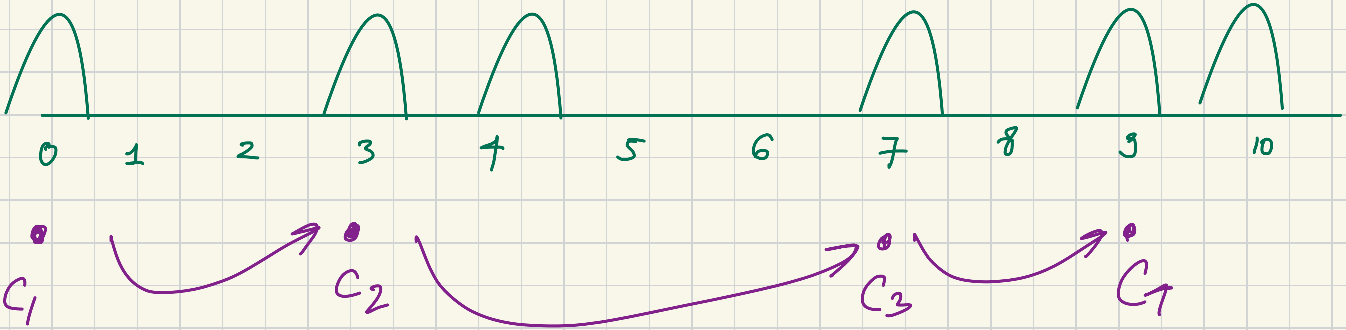
$$\boxed{ans = 3}$$

TC: $O(N \log_2 N)$

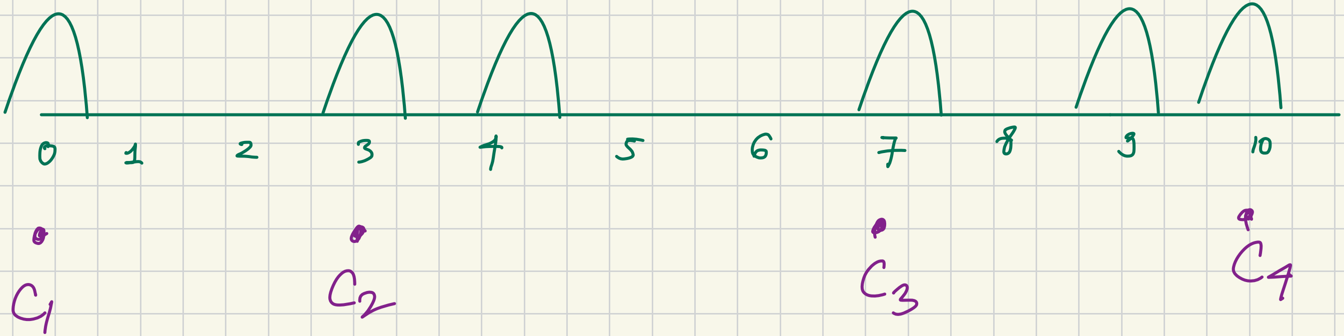
SC: $O(1)$



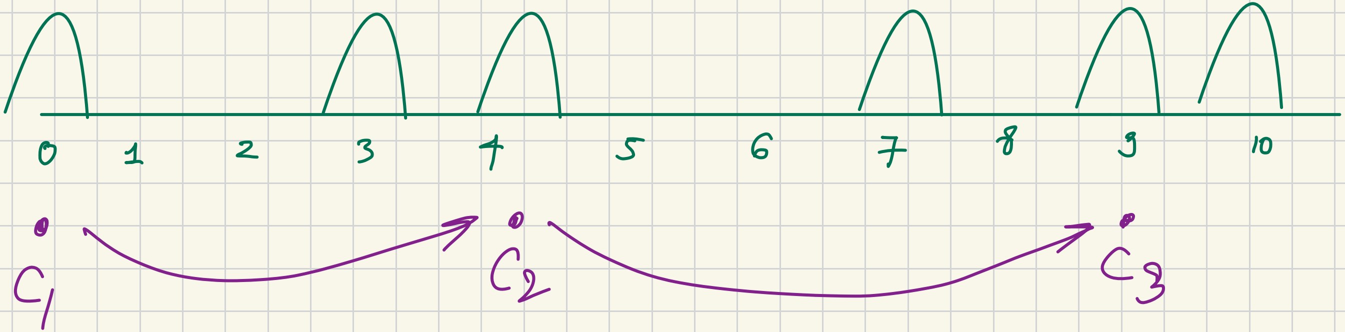
minCap = 5



mid cap = 2



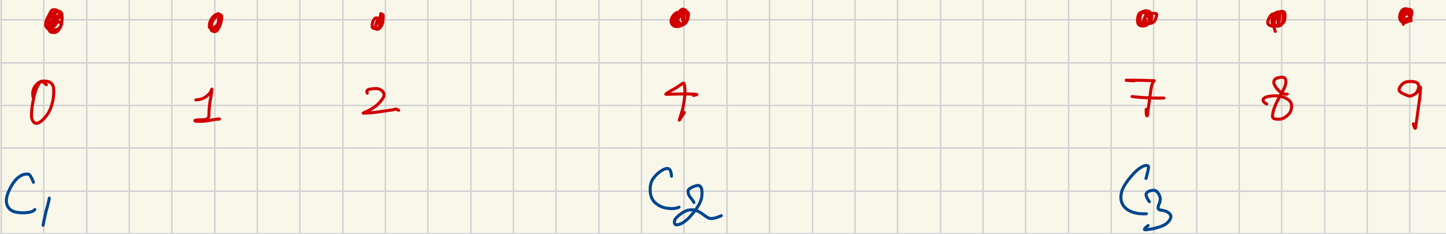
maxcap = 3



maxcap = 4

Binary Search ✓

impossible ✓



$min^{m} = 3$

→ lastPositionPlaced = ~~0~~ ~~4~~ 7

{0, 1, 2, 5, 7, 9, 10, 14}

min^m dist = 4

no. of cows placed = ~~0~~ ~~1~~ ~~2~~ ~~3~~ 4 ✓

last position placed = ~~-1~~ ~~0~~ ~~5~~ ~~9~~ 14

TC: O(N)

ispossible function !

Binary Search Overs Sol^n

→ find the range → eleminate

→ is possible fu^n → TC: O(N) ?

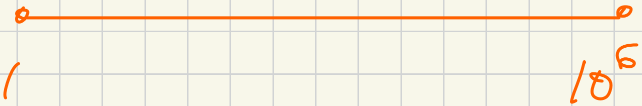
$$\left.\begin{aligned}
\log_2(10^8) &= 8 \times \cancelto{3}{\log_2 10} &&= 24 \\
\log_2(10^4) &= 4 \times \cancelto{3}{\log_2 10} &&= 12 \\
\log_2(100) &= 2 \times \cancelto{3}{\log_2 10} &&= 6
\end{aligned}\right\}$$

i io

dist →

$\min^m$ dist = 1 {adjucent to each other}

$\max^m$ dist = 10^6 {far apart}



- Sorted Array
- Rotated Sorted Array
- Mountain Array
- Infinite Array

✓ **Binary Search!**

Binary Search .

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

→ define Range!

→ remove half .

TC: $O(\log_2 N)$

SC ! $O(1)$

Search region

$N \longrightarrow \frac{N}{2} \longrightarrow \frac{N}{4} \text{ ———— ——} \longrightarrow 1$

Suppose,

you got a infinite sorted array!

$$\left\{ 1, 3, 10, 11, 15, 17, 20, 25, \ldots \ldots \overset{\text{infinite ele.}}{\infty} \right\}$$

target = 1014

Bruteforce

Linear Search

$$\left\{ \begin{array}{cccccccccccc} 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & & 16 \\ 1, & 3, & 10, & 11, & 15, & 17, & 20, & 25, & 30, & 35 & \ldots\ldots & 103 & \infty \\ & & & & & & & & & \uparrow & & \uparrow \\ & & & & & & & & & lo & & hi \end{array} \right\}$$

target = 90

Range $[0, 1] \overset{\times}{\rightarrow} 2$ $\quad \{ arr[lo] <= target <= arr[hi] \}$

Range $[2, 2] \rightarrow 1 \rightsquigarrow 2^0$

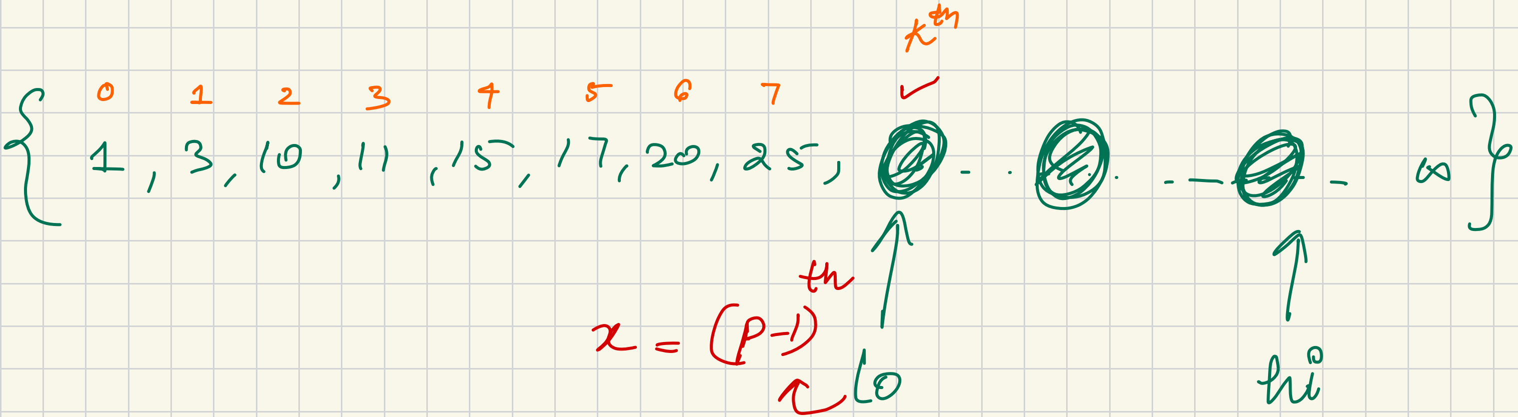
Range $[3, 4] \rightarrow 2 \rightsquigarrow 2^1$

Range $[5, 8] \rightarrow 4 \rightsquigarrow 2^2$

Range $[9, 16] \rightarrow 8 \rightsquigarrow 2^3$

$lo = hi + 1$

$hi = 2 * hi$



p^{th} index

$lo = x + 1 = p$

$hi = 2 * x = 2(p-1)$

$O(\log_2 p)$

No. of Ele = $2(p-1) - p + 1 = (p-1)$ Elements

1st Range $= 2$

2nd Range $= 1 = 2^0$

3rd Range $= 2^1$

4th Range $= 2^2$

,

,

,

.

Kth Range $= 2^{(k-2)}$

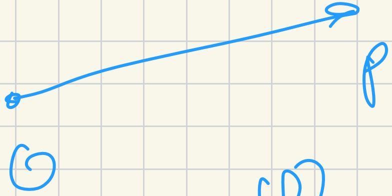
$$2^{(k-2)} = p - 1$$

$$\cancelto{K}{(k-2)} = \log_2(\cancelto{p}{p-1})$$

✓ $K = \log_2(p)$

Time Complexity

$O(K) + O(\log_2 P)$



$O(P)$

$O(\log_2 P) + O(\log_2 P)$

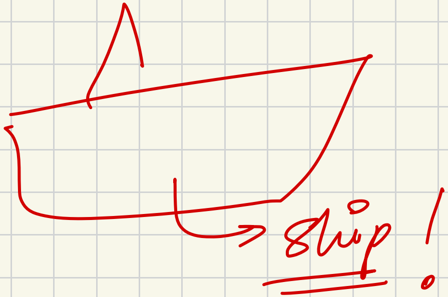
order of ans.

TC: $O(\log_2 P)$ ✓

Capacity of Ship packages within B days.

$$\begin{array}{cccccc} 0 & 1 & 2 & 3 & 4 & 5 \\ 3, & 2, & 2, & 4, & 1, & 4 \end{array}$$

int[] A = { 3, 2, 2, 4, 1, 4 }   days = 3



min^{m} { max^{m} capacity ship to deliver these packages within B days }

$$\text{int[] } A = \{\overset{0}{3}, \overset{1}{2}, \overset{2}{2}, \overset{3}{4}, \overset{4}{1}, \overset{5}{4}\}$$

$$\longrightarrow$$

Min^m Unit of Balls in A Bag

$$arr[\,] = \{ \overset{0}{2} , \overset{1}{4} , \overset{2}{8} , \overset{3}{2} \}$$

opt = 4

$$\min \{ \max^m \text{ Balls in a Bag} \}$$

$$arr[\,] = \{ \overset{0}{2}, \overset{1}{\boxed{4}}, \overset{2}{8}, \overset{3}{2} \}$$

opt = 4

way 1 ·

$\boxed{4} \rightarrow$ (3,1) (2,2)

opt 1

$\{2, 3, 1, \boxed{8}, 2\}$

$\boxed{8} \rightarrow$ (1,7) (2,6) (3,5) (4,4)

opt 2

$\{2, 3, 1, 3, \boxed{5}, 2\}$

$\boxed{5} \rightarrow$ (1,4) (2,3)

opt 3

$\{2, 3, 1, 3, 2, \boxed{3}, 2\}$

$\boxed{3} \rightarrow$ (1,2)

opt 4

$\{2, 3, 1, 3, 2, 1, 2, 2\}$

$\downarrow$

$max^m = 3$

$arr[\;] = \{\overset{0}{2}, \overset{1}{4}, \overset{2}{8}, \overset{3}{2}\}$

Case 1 $opt = \infty$

$\{1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1\}$

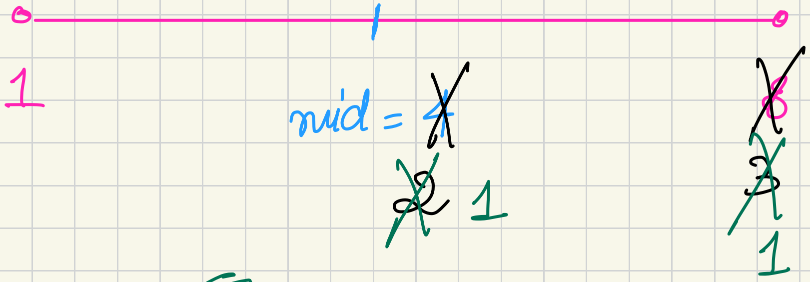
$\max^m = 1 \rightarrow \min$

Case2 $opt = 0$

$\{2,4,8,2\}$

$\max^m = 8 \rightarrow \min$

opt = 4



pans = ~~4~~ 2

$$arr[\;] = \{\underset{\cancel{\uparrow}}{\overset{0}{2}},\ \underset{\cancel{\uparrow}}{\overset{1}{4}},\ \underset{\cancel{\uparrow}}{\overset{2}{8}},\ \underset{\uparrow}{\overset{3}{2}}\}$$

maxCap = 4

(4, 4)

opt = 1

$$arr[\;] = \{\underset{\cancel{\uparrow}}{\overset{0}{2}},\ \underset{\cancel{\uparrow}}{\overset{1}{4}},\ \underset{\cancel{\uparrow}}{\overset{2}{8}},\ \underset{\uparrow}{\overset{3}{2}}\}$$

maxCap = 2

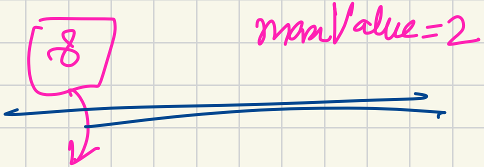
(2, 2) (2, 6)

↳ (2, 4)

↳ (2, 2)

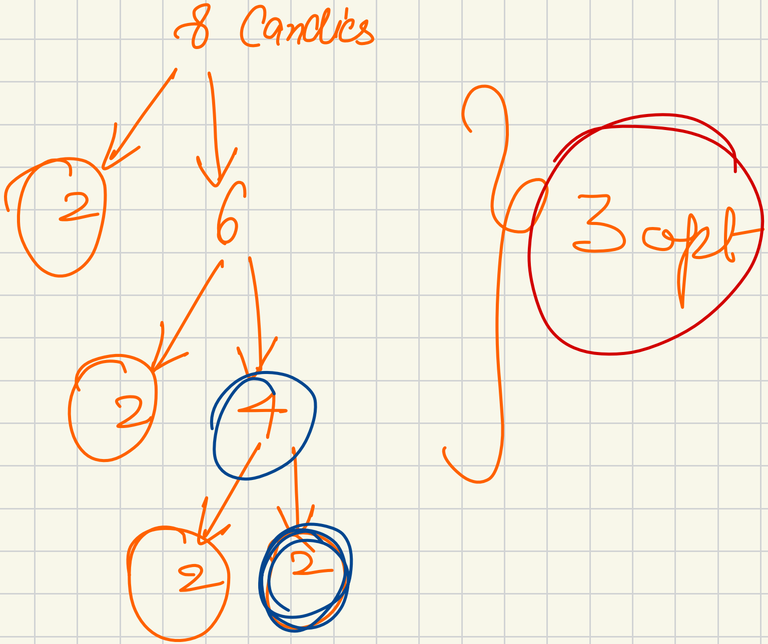
opt = ~~1~~ 4

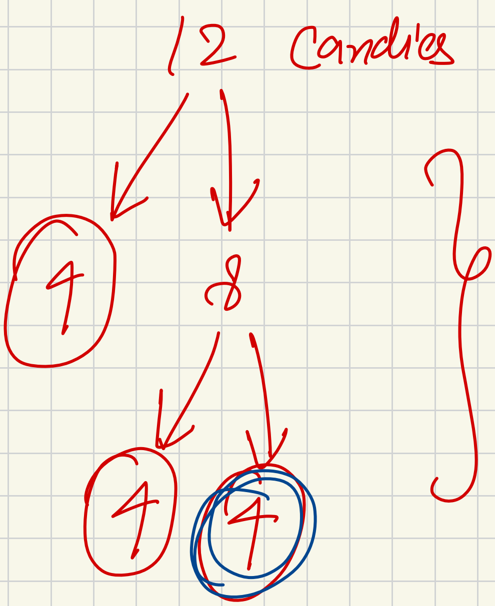
max^m 2 Candies



min^m opt ?

$$\left\{\frac{8}{2} - 1\right\}$$



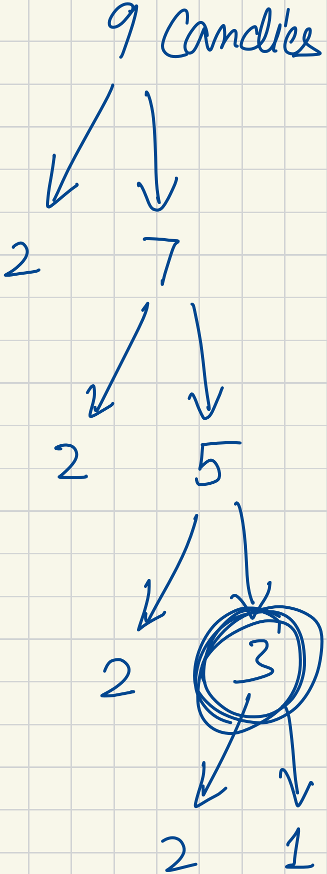


maxValue = 4

$\boxed{opt = 2}$

$$\left\{ \frac{12}{4} - 1 \right\}$$

$$\boxed{\text{No. of opt} = \frac{\text{Balls}}{\text{maxValue}} - 1 \checkmark}$$



maxValue = 2

$9/2 = 4$ ✓

$$\text{opt} = \frac{\text{Balls}}{\text{Max Value}}$$