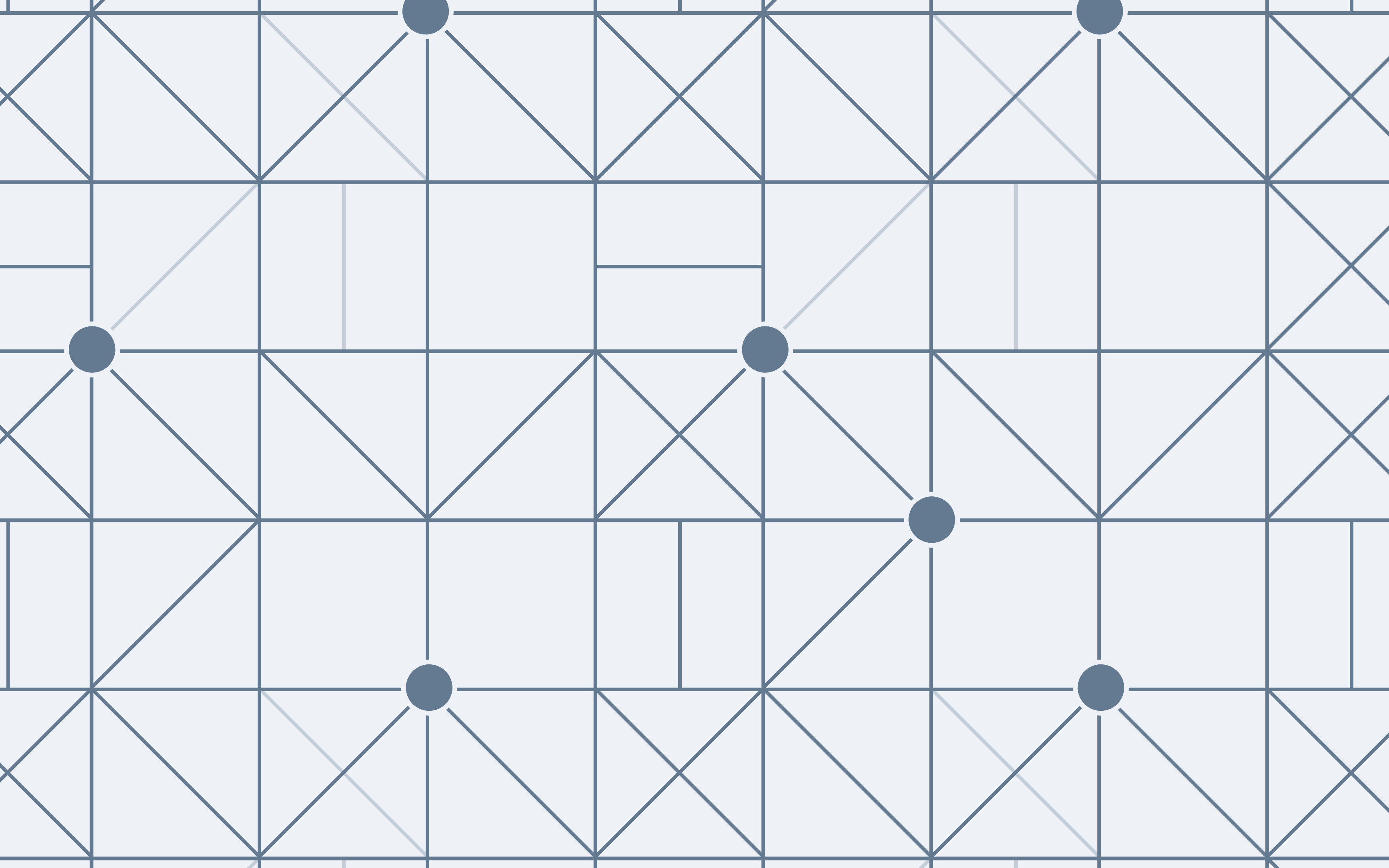


Allocate Min^m No. of Pages

$$
\begin{array}{ccccc}
 & 0 & 1 & 2 & 3 \\
Books[\,] = \{ & 34, & 12, & 67, & 90 \}
\end{array}
$$

students = 2

way 1
S1 → 34, 12, 67 → 113 pages
S2 → 90 → 90 pages

way 2
S1 → 34, 12 → 46 pages
S2 → 67, 90 → 157 pages

way 3
S1 → 34 → 34 pages
S2 → 12, 67, 90 → 169 pages

max^m pages
113
157
169

min
✓ 113 pages

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

~~Students = 2~~

<u>Case 1</u> : when you have only one student.

$M = 1$

way 1 $S1 \rightarrow 34, 12, 67, 90$ → 202 pages → min 203 pages

<u>Case 2</u> : when no. of students is equal N {No. of Books}

$M = N$

way 1

$S1 \rightarrow 34$

$S2 \rightarrow 12$

$S3 \rightarrow 67$

$S4 \rightarrow 90$

→ 90 pages → min 90 pages

✓ $1 \le M \le N$

Stud = 2

N students

1 students

mid

~~90~~ pages

~~104~~ pages

~~111~~ pages

~~112~~ pages

113

~~146~~ pages

~~117~~ pages

~~103~~ pages

~~110~~ pages

~~113~~ pages

~~111~~ pages

112 page

~~203~~ pages

~~146~~ pages

~~116~~ pages

112 pages

ans = ~~146~~ pages

~~117~~

113

(1) step 1 done

(2) Minimize the max^m page to be read.

$$\text{Books}[\,] = \left\{ \begin{array}{cccc} 0 & 1 & 2 & 3 \\ 34, & 12, & 67, & 90 \end{array} \right\}$$

Max^m Pages = 146

$$\left.\begin{array}{l} S1 \longrightarrow 34 + 12 + 67 \\ S2 \longrightarrow 90 \end{array}\right\}$$

$$\text{Books}[\,] = \left\{ \begin{array}{cccc} 0 & 1 & 2 & 3 \\ 34, & 12, & 67, & 90 \end{array} \right\}$$

Max^m Pages = 117

$$\left.\begin{array}{l} S1 \longrightarrow 34 + 12 + 67 \\ S2 \longrightarrow 90 \end{array}\right\}$$

$$\text{Books[]} = \begin{array}{cccc} 0 & 1 & 2 & 3 \\ \{34, & 12, & 67, & 90\} \end{array}$$

$\text{Max}^m \text{ Pages} = 103$

$$\left.\begin{array}{l} S1 \rightarrow 34 + 12 \\ S2 \rightarrow 67 \\ S3 \rightarrow 90 \end{array}\right\}$$

$$\text{Books[]} = \begin{array}{cccc} 0 & 1 & 2 & 3 \\ \{34, & 12, & 67, & 90\} \end{array}$$

$\text{Max}^m \text{ Pages} = 110$

$$\left.\begin{array}{l} S1 \rightarrow 34 + 12 \\ S2 \rightarrow 67 \\ S3 \rightarrow 90 \end{array}\right\}$$

$$\begin{array}{cccc} 0 & 1 & 2 & 3 \\ 34, & 12, & 67, & 90 \end{array}$$

Books[] = {34, 12, 67, 90}

Max^m Pages = 113

$S1 \rightarrow 34 + 12 + 67$

$S2 \rightarrow 90$

$$\begin{array}{cccc} 0 & 1 & 2 & 3 \\ 34, & 12, & 67, & 90 \end{array}$$

Books[] = {34, 12, 67, 90}

Max^m Pages = 111

$S1 \rightarrow 34 + 12$

$S2 \rightarrow 67$

$S3 \rightarrow 90$

$$\text{Books[]} = \left\{ \begin{array}{cccc} 0 & 1 & 2 & 3 \\ 34, & 12, & 67, & 90 \end{array} \right\}$$

Max^m Pages = 112

S1 → 34 + 12

S2 → 67

S3 → 90

Method of distribution.

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

Max^m Pages = 100

Student No. = ~~1~~ ~~2~~ 3

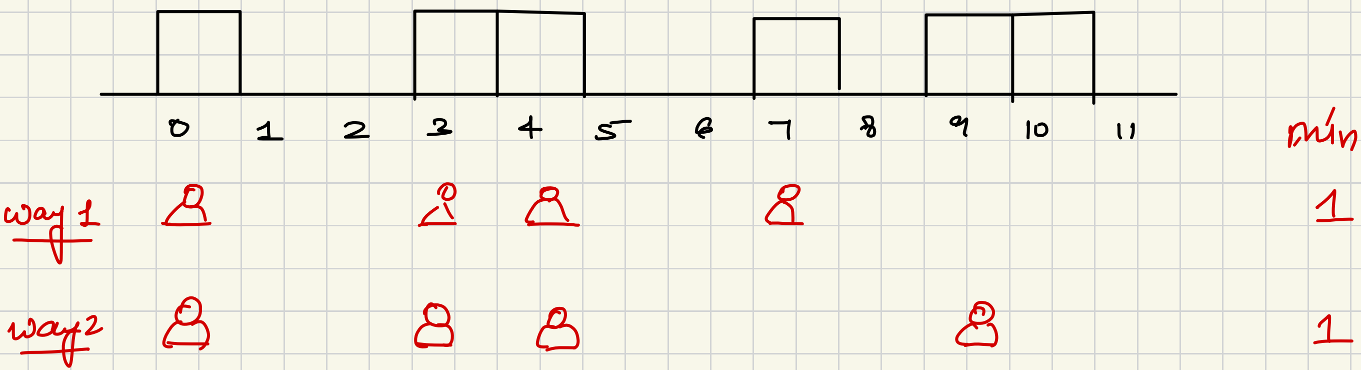
No. of Books he is reading = {
~~1~~ ~~34~~ ~~46~~
~~2~~ ~~67~~
~~3~~ 90
}

Aggressive cows.

aggressive to each other

stalls[] = {0, 7, 3, 9, 10, 4}   cows = 4

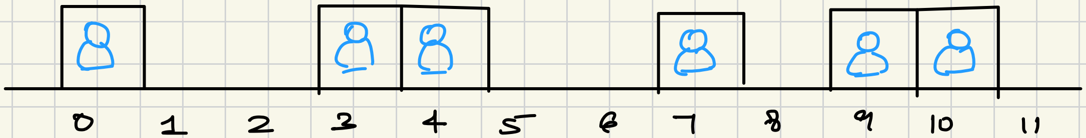
maximize the min distance b/w any two aggressive cows!



$^6C_4$ ways

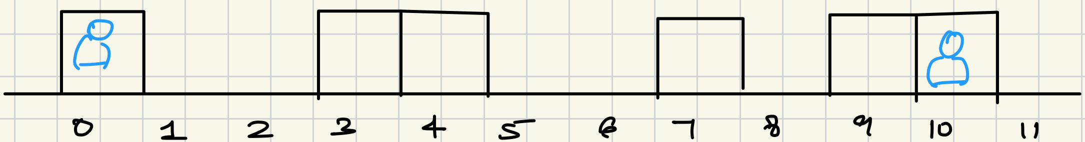
$\frac{6!}{4!\,2!} = \underline{15 \text{ ways}}$

Case 1   cows = N {No. of stalls}



min^m dist = 1 unit

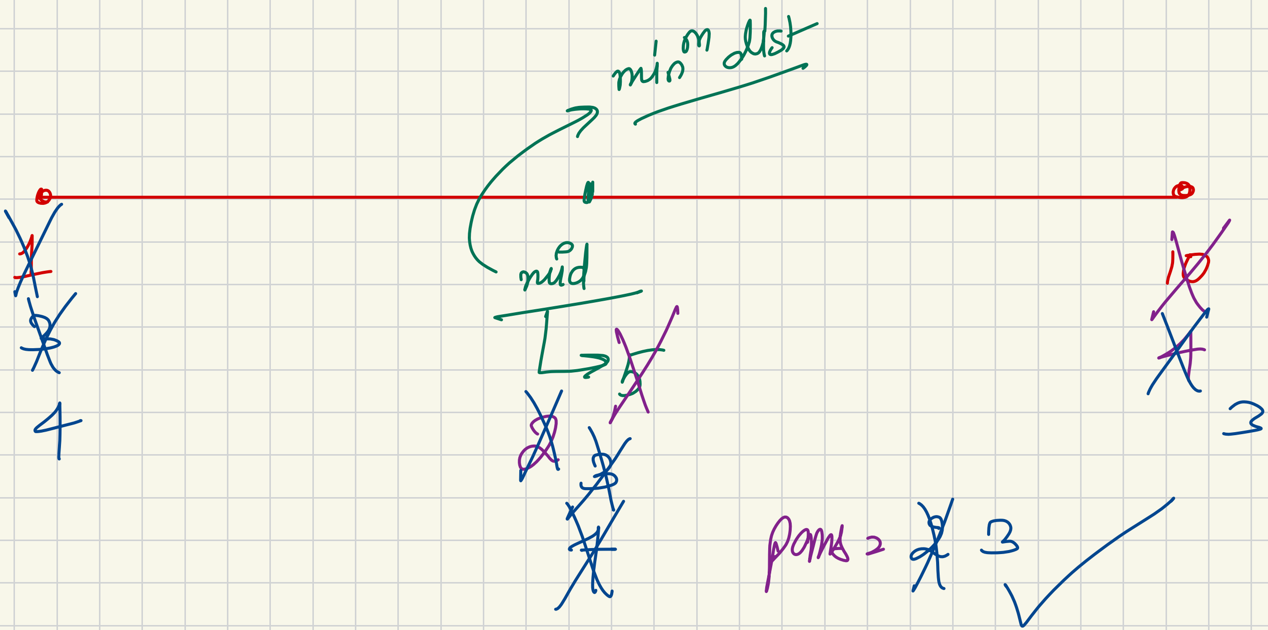
Case 2   cows = 2

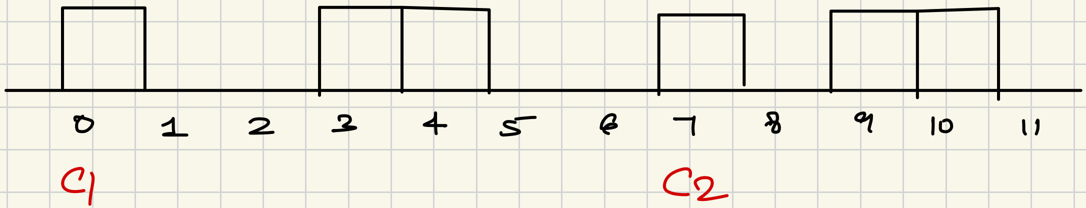


min^m dist = 10 unit

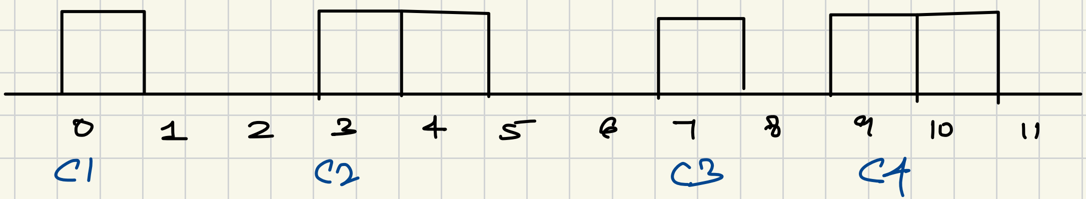
$2 \le \text{cows} \le N$

$\text{cows} = 4$

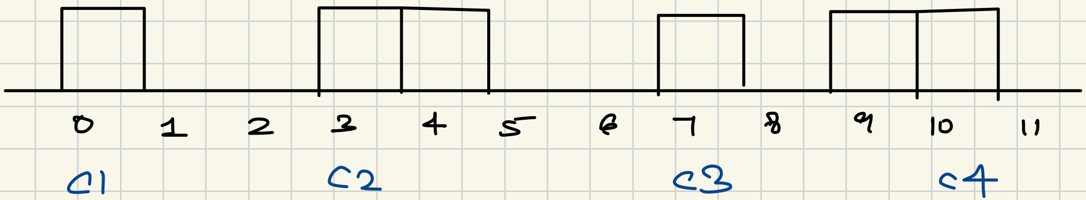




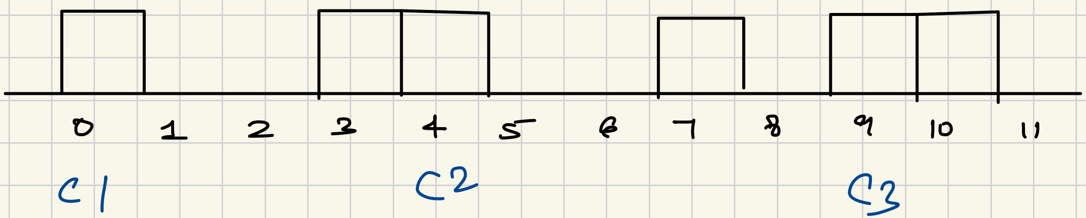
min Dist = 5



min Dist = 2



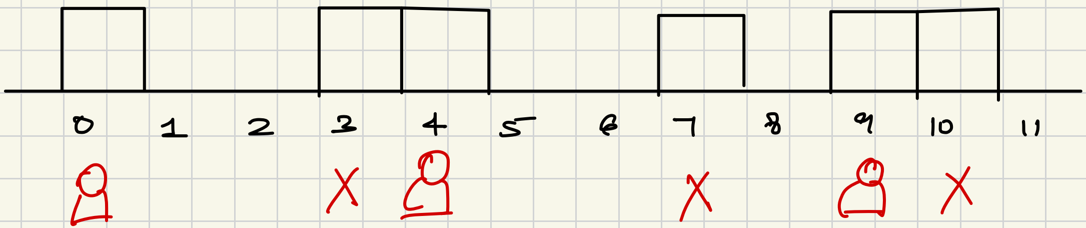
min Dist = 3



min Dist = 4

How to place cows

mindist = 4



lastPostion = ~~0~~ ~~4~~ 9

cowsPlaced = ~~0~~ ~~1~~ ~~2~~ 3 ✓

Infinite Sorted Array {Optimized Binary Search}

int[] arr = { 1, 3, 10, 11, 15, 17, 20, 25, 28 . . . . ∞ }

target = 1014

Brute force

↳ Linear Search { TC : $O(N)$ }

↳ index of person

$$\begin{array}{cccccccccccc} & 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & & 16 \end{array}$$

int[] arr = { 1, 3, 10, 11, 15, 17, 20, 25, 28, 30 ... 100, ∞ }

target = 90

~~Range [0, 1] ⟶ 2~~ ignore

1 Range [2, 2] ⟶ 1 ⟶ 2^0

$lo = hi + 1$
$hi = 2 * hi$

2 Range [3, 4] ⟶ 2 ⟶ 2^1

3 Range [5, 8] ⟶ 4 ⟶ 2^2

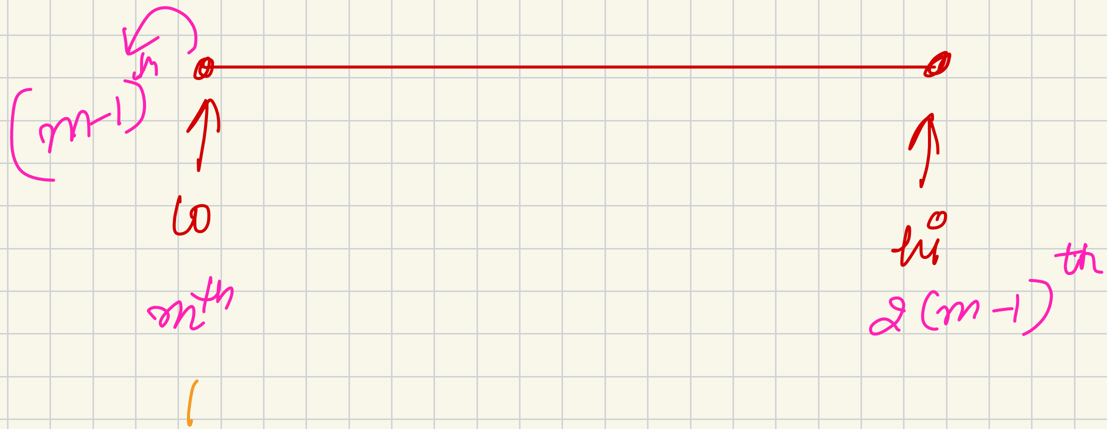
4 Range [9, 16] ⟶ 8 ⟶ 2^3

TC: $O(K)$

↓

Time to get Range

K^{th} ! ⟶ 2^{K-1}



$lo = n^{th}$
$hi = 2(n-1)^{th}$

$\text{No. of Ele} = 2(n-1) - n + 1 = 2n - 2 - n + 1 = \underline{\underline{n-1}}$

people

$\text{TC} : O(\log_2 n)$

$$2^{K-1} = m-1$$

taking $\log_2$ Both sides

$$\log_2 2^{K-1} = \log_2 (m-1)$$

$$(K-1)\cancel{\log_2 2}^{\,1} = \log_2 (m-1)$$

$$\underline{K = 1 + \log_2 (m-1)}$$

TC : $O(1 + \log_2 (m-1))$

Time to get Range $\approx O(\log_2 m)$

Overall

TC :

$\log_2 m + \log_2 M$

$O(\log_2 M)$

$\checkmark\ \Theta(\log_2 N)$

$\checkmark\ O(\log_2 M)$

Capacity of ship packages within B days.

$$\begin{array}{ccccccc} & 0 & 1 & 2 & 3 & 4 & 5 \\ \text{int[] } A = & \{3, & 2, & 2, & 4, & 1, & 4\} \end{array}$$

days = 3

min^m { max^m capacity of ship to deliver from one port to another

H.W. Problem

→ Min^m No. of Day to make m bouquets.

Hashing → Actual Implementation