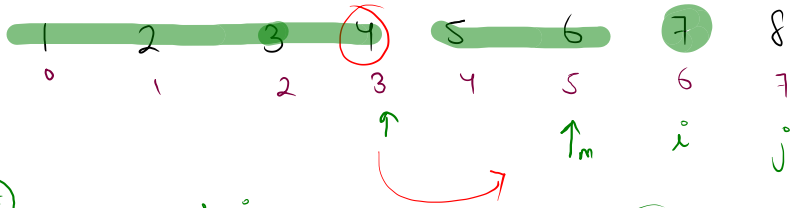
Binary Search

sorted

$x = 18$ → ans = -1

$x = 7$ → ans = 6



1st

mid (idx) = $i + j / 2$

$0 + 7/2 = 3$

$A[mid] = A[3] = 4$

2nd

$mid = 4 + 7/2 = 5$

$6 == x$ ×

$6 > 7$ ×

$6 < 7$

1. $A[mid] == x$
2. $A[mid] > x$
3. $A[mid] < x$ ⇝ $4 < 7$

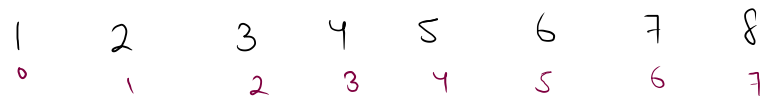
3rd

$6 + 7/2 = 6$

$A[6] = 7 == x$

(6) mid

Linear Search (10^6) → O(n)



x = -7

1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7

j

i

while (i <= j) X

{

m = i+j/2

1st = 0+7/2 = 3

2nd = 0+2/2 = 1

3rd = 0+0/2 = 0

i → j

[1
2
3]

↳ (-1)

}

first index & last index

$\log_2 n$ → binary search

key = 2

-4	2	2	2	2	2	2	5	7	16
0	1	2	3	4	5	6	7	8	9

j i m

$i \leq j$

Ans. { first idx = 1
last idx = 6

first idx

mid = 5

potential ans. = mid

= ~~5~~ ~~2~~ 1

Hint { 2 times binary search

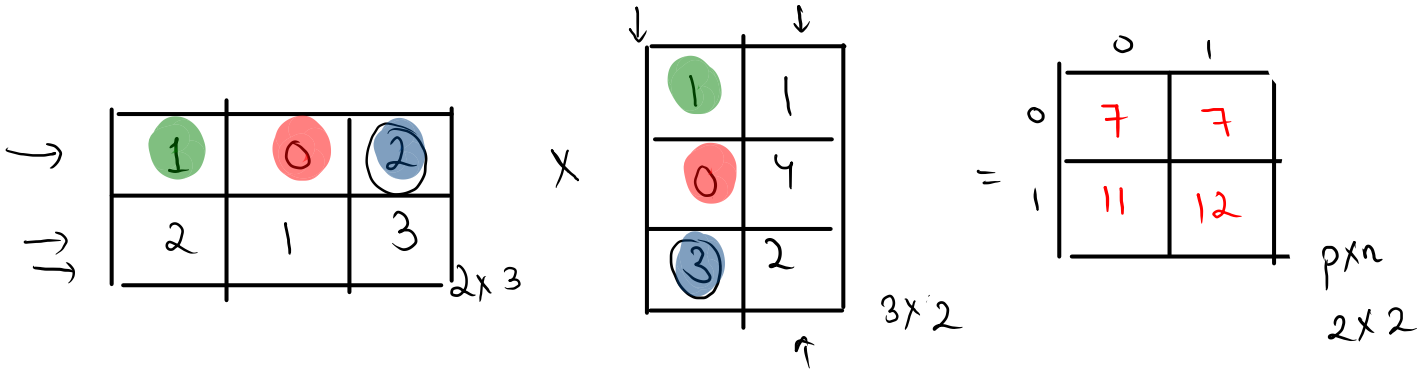
2D.

Matrix multiplication.

A]$_{2\times3}$ X B]$_{3\times2}$ =

p x q m x n

q == m → only possible.



$1\times1 + 0\times0 + 2\times3 = C[0][0]$

$1\times1 + 0\times4 + 3\times2 = C[0][1]$

$2\times1 + 1\times0 + 3\times3 = C[1][0]$

$2\times1 + 1\times4 + 3\times2 = C[1][1]$