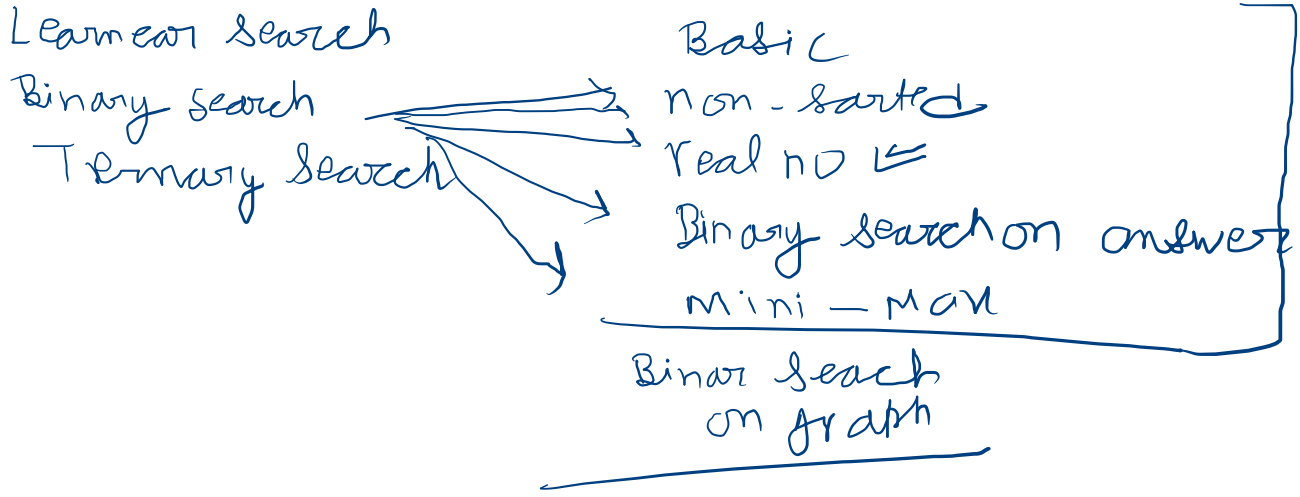
# Searching


Learnear Search
Binary Search
Ternary Search
Basic
non - sorted
real no
Binary search on answer
Mini — Max
Binar Seach
on graph

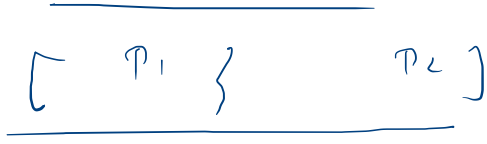
$T(n) = n - n-1 - n-2$ →

$T(n) = T(n-1) + O(1)$ → comparison

$T(n) = O(n)$

Binary Search →

Binary search says that if you have a search space at size n then we can divide the space in n/2 - by discarding 1 half



$T(n) = T\left(\frac{n}{2}\right) + O(1)$ → comparison

$T(n) = T(n/2) + O(1)$

$T(n/2) = T(n/4) + O(1)$

$T(n/4) = T(\quad) + O(1)$

$T(n) = T(1) + O(1)$

$n \to \frac{n}{2} \to n/4 \to n/8 \cdots$

$\frac{n}{2^k} = 1 \qquad n = 2^k$

$k = \log_2 n$

Sorted

Ques → find the first index that is greater or equal target?

ex →

| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 10 | 20 | 30 | 30 | 70 | 40 | 50 |

target = 30

ans = 2

→ lower bound

→ upper bound

target = 6

| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 2 | 3 | 5 | 6 | 6 | 6 | 8 |
| F | F | F | T | T | T | T |

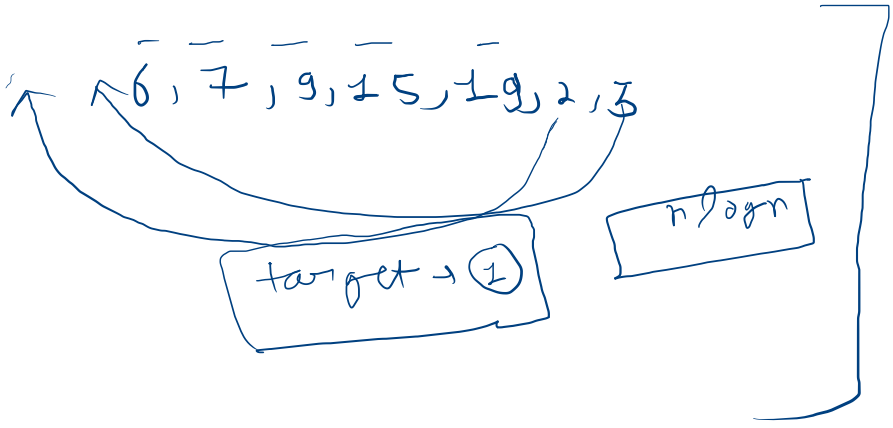
→ n/2

→ $lo + \frac{(hi - lo)}{2}$

$\frac{lo + hi}{2} = \frac{lo + hi + lo - lo}{2} = \frac{2lo + hi - lo}{2} = \frac{2lo}{2} + \frac{hi - lo}{2} =$

$lo + \frac{(hi - lo)}{2}$

Que → rotated sorted array find the index of target




Que → Given an array, find any element in array such that it follows the following condition

$a[i] > a[i+1]$ (if $i+1$ exist)

and

$a[i] < a[i-1]$ (if $i-1$ exist)

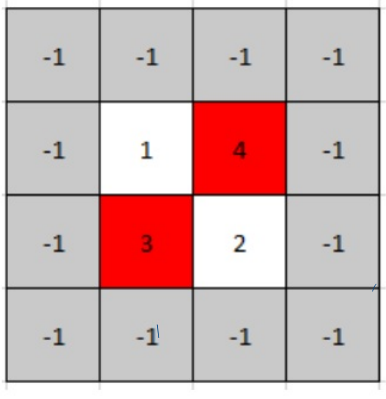
row 2 .

## 278. First Bad Version

Easy 5278 1963 Add to List Share

Ques Given a 2D array, find the Peak element in a 2D array (no adjacent element is equal)

**Example 1:**




```
Input: mat = [[1,4],[3,2]]
Output: [0,1]
Explanation: Both 3 and 4 are peak elements so [1,0]
and [0,1] are both acceptable answers.
```

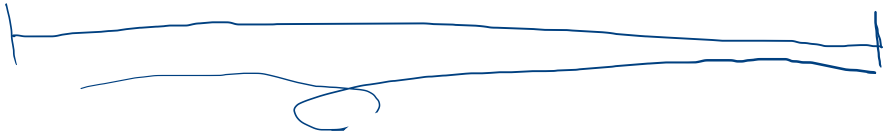
ans → Given a number n, ($n \leq 10^5$) find the square root of n (only int value)

don't use inbuild library

$O(n^2)$ $O(n \text{ loops})$

Binary search on answer

$n = 36 = 6$

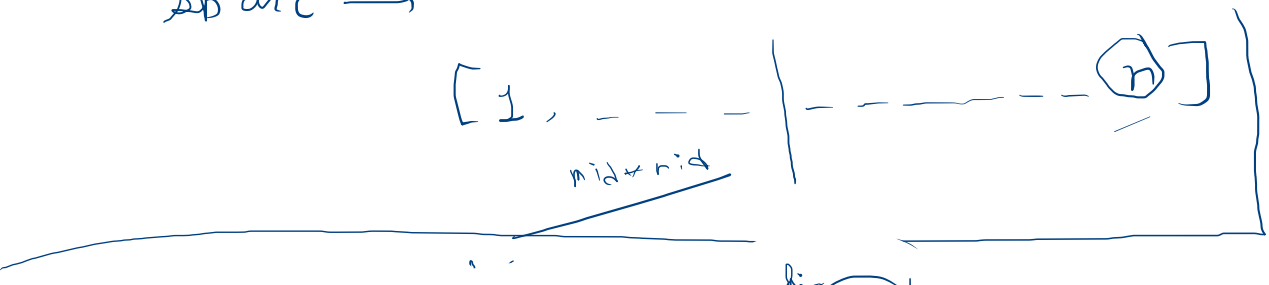


→ if the value of mid * mid, can i say the sqrt is ≤ n

→ value of n is Positive

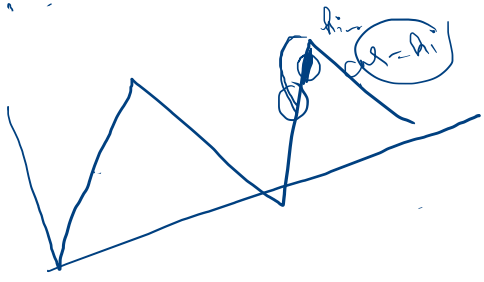
14

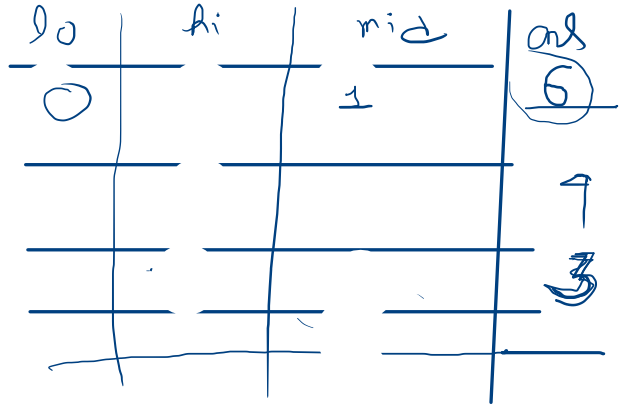
Space →




```
int lo=0;
int hi=n;
int ans=0;
while(lo<=hi){
    int mid=lo+(hi-lo)/2;
    if(mid*mid==n){
        return mid;
    }
    else if(mid*mid<n){
        //discard the left half
        lo=mid+1;
    }
    else{
        hi=mid-1;
        ans=hi;
    }
}
return ans;
```

3/2



There are n rectangle of same size (w * h)

find a Square of smallest size into which all of the n rectangle

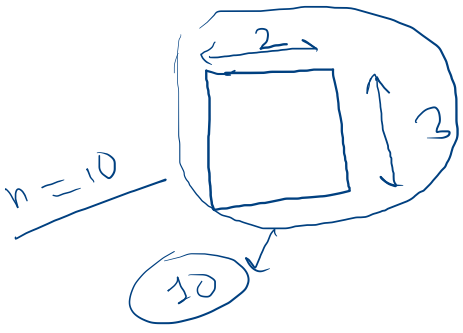
can be placed (Rotation is not allowed)

$(w, h, n) \leq 10^9$

$w = 2 \quad h = 3 \quad n = 10$

ans = 9

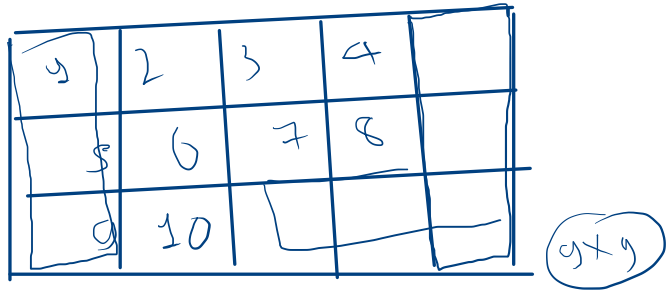
w := h

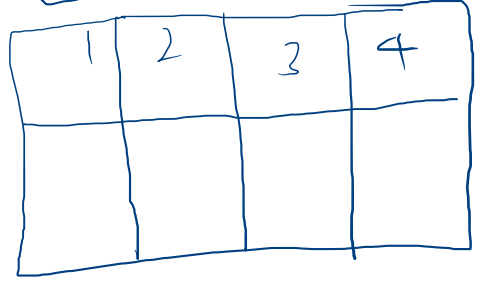



w, h → 3 * 2 = 6 area

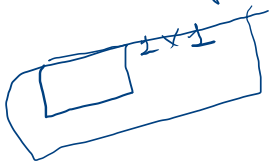
10

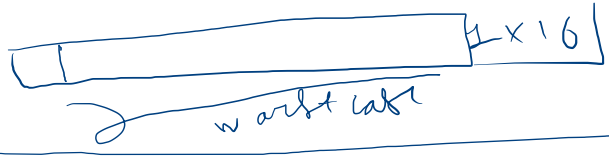
overall = 60



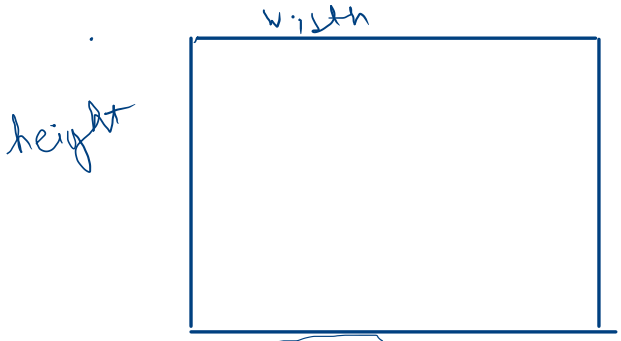



One of the sides of rectangle will cover a square side completly

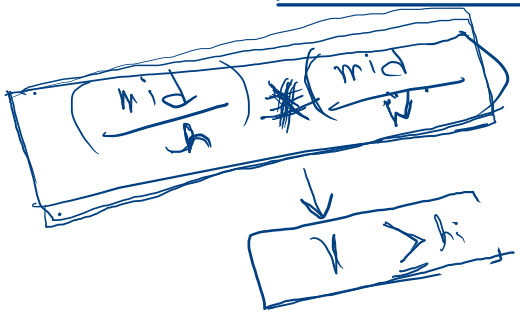


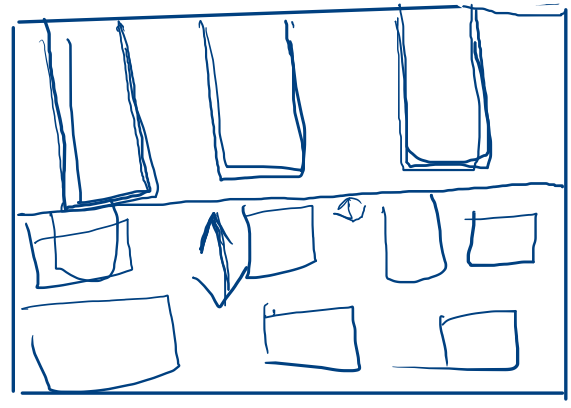





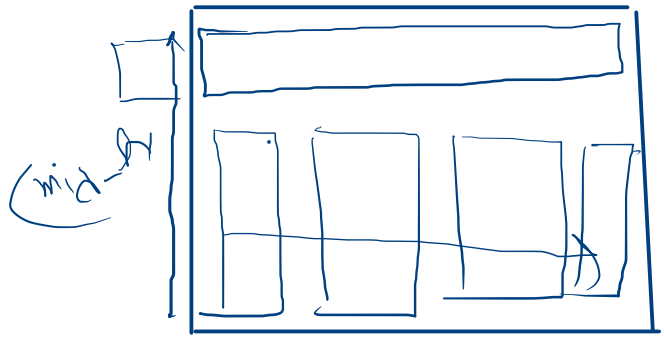

(mid * mid) square way rectangle can we fit
① vertically



$\left(\frac{mid}{h}\right)$

horizontally → $\left(\frac{mid}{w}\right)$




① horizontally

(mid) / h

② vertically

(mid) / w

(mid) * (mid / w) >= h

we can fit

n rectangles