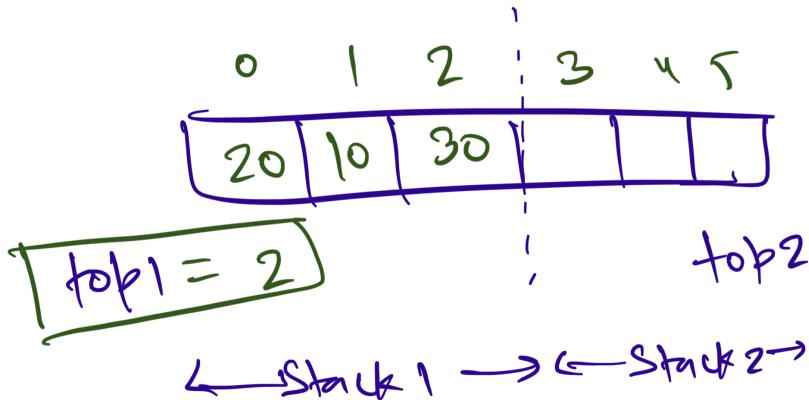


Stack Problems - II



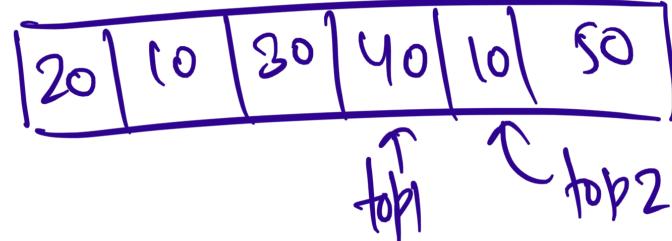
Implement Two stacks using one Array



$\text{push1}(20)$
 $\text{push1}(10)$
 $\text{push1}(30)$
 $\Leftarrow \text{push1}(40)$

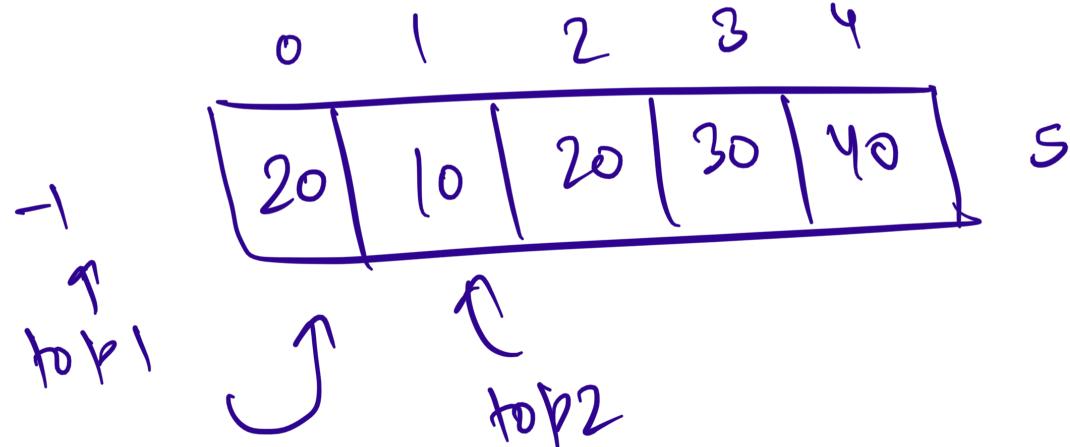
Not optimised

psh1
psh2
pop1
pop2.



$\text{push2}(50)$
 $\text{push2}(10)$
 $\text{push2}(1);$

$$\equiv \boxed{\underline{\underline{\text{top1} + 1 == top2}}}$$



0

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

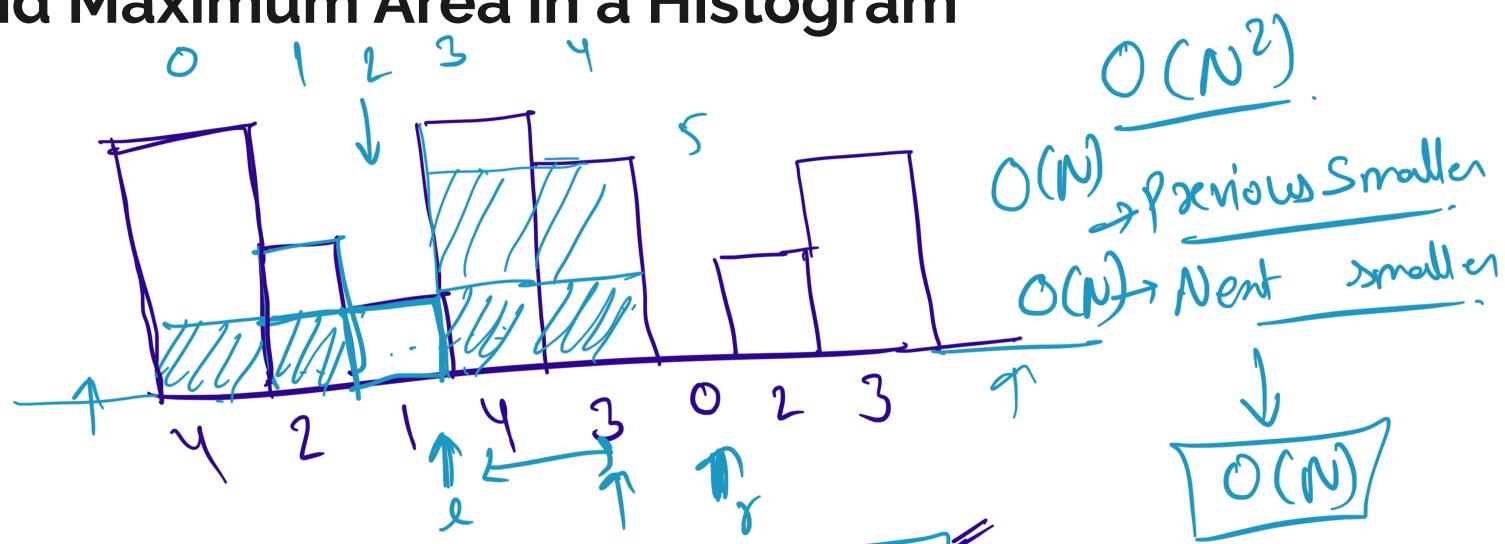
↑
top₁ = 1 ↑
top₂ = 5

$$= 2 + 1 < 3$$

pop1().

$$= \frac{\text{pop2}().}{\cancel{20 = 30}}$$

Find Maximum Area in a Histogram



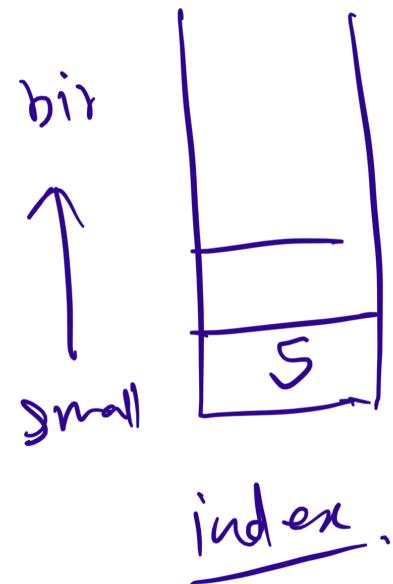
$$\lambda = 4 \otimes 2$$

$$\gamma = 5$$

$$(r - \lambda - 1) =$$

$$5 - 2 - 1 = 2$$

\rightarrow
 $a[] = \{ 4, 3, 9, 2, 5, 1, 8, 3 \}^{-1}$
 $ps[] = \{ -1, -1, 1, -1, 3, -1, 5, 5 \}^{\uparrow}$
 $ns[] = \{ 1, 3, 3, 5, 5, 8 \}^{\uparrow, \uparrow}$



$$\begin{array}{ll}
 0 \rightarrow & (1 - (-1) - 1) * 4 = 4 \\
 1 \rightarrow & (3 - (-1) - 1) * 3 = 9 \\
 2 \rightarrow & (3 - (1) - 1) * 9 = 9
 \end{array}$$

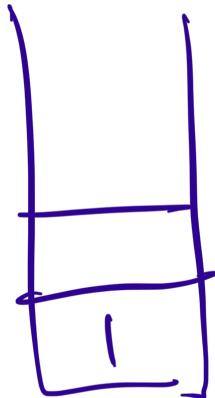


$a[] = \{ 4^0, 1^1, 3^2, 4^3, 2^4 \}$

index. $ns[] = \{ 1, 5, 4, 4, 5 \}$ \leftarrow ans

elements $ns[] = \{ 1, -1, 2, 2, -1 \}$

$\leftarrow i=0$

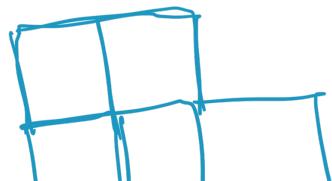
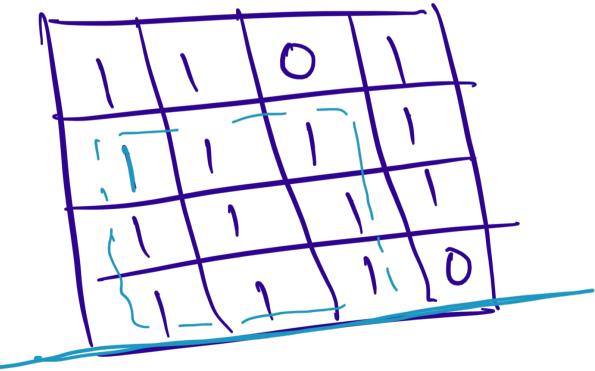


$c = 4$

$a[1] = 1$

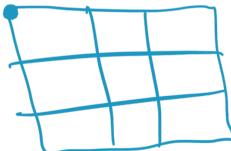
Find Maximum Area Submatrix in a Matrix with all 1s

$\rightarrow r_2, c_3$



$O(n^4) \neq O(n^2)$

r_1, c_1



r_2, c_2

for (r_1)
 for (c_1)
 for (r_2)
 for (c_2)
 for ($)$)
 for ($)$)

| | | | |
|---|---|---|---|
| | | | |
| X | X | 9 | X |
| X | X | X | X |
| X | X | X | 3 |
| 4 | 4 | 3 | 0 |

$$1 \times 2 = 2$$

$$2 \times 2, \quad 1 \times 4 = 4$$

$$2 \times 4 = 8$$

$$3 \times 3 = \underline{\underline{9}}$$

$O(N \times N)$.

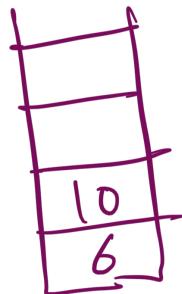
Implement minStack using O(n) extra space

push(), pop(), peek()

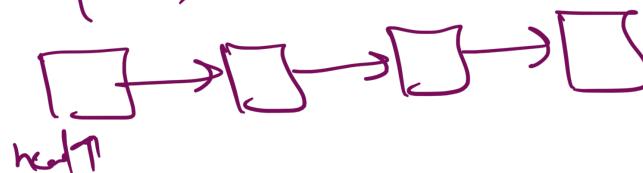
min()

minIndex
 ↑

min(), T.C → O(n)

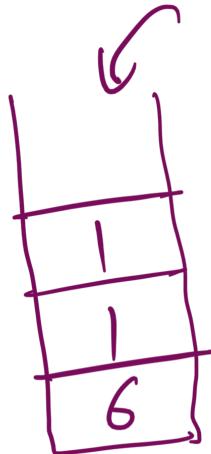
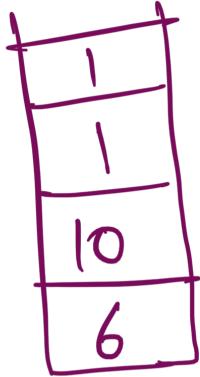


↑
top

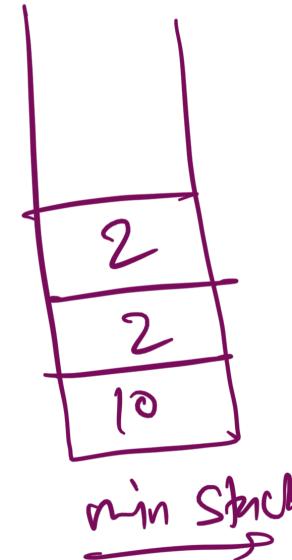
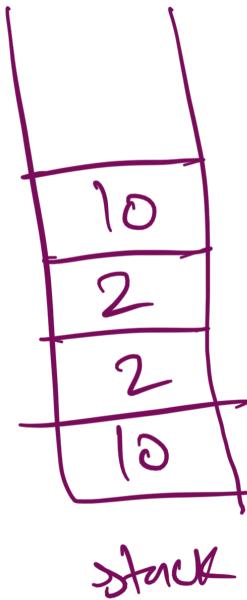


next

pop()



min()



↓
min + 2
1
2
2
2
2
2



Practice Problems

1. Implement k Stacks using Array
2. Implement minStack using O(1) space
3. Simplify Directory Path
4. <https://www.interviewbit.com/courses/programming/stacks-and-queues/>