



Google
FB
Amazon
Apple
...

Nearest smaller Element

Given an array of +ve integers.

for every i , find the nearest smaller element on the left of i which is smaller than $A[i]$

Eg:

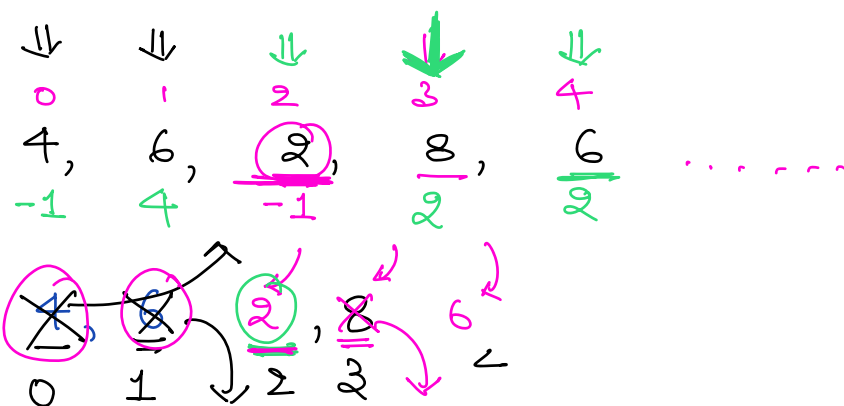
↓	↓	↓	↓	↓	↓
← 0	1	2	3	4	5
4,	2,	5,	10,	8,	2
-1	-1	2	5	5	-1

Brute force

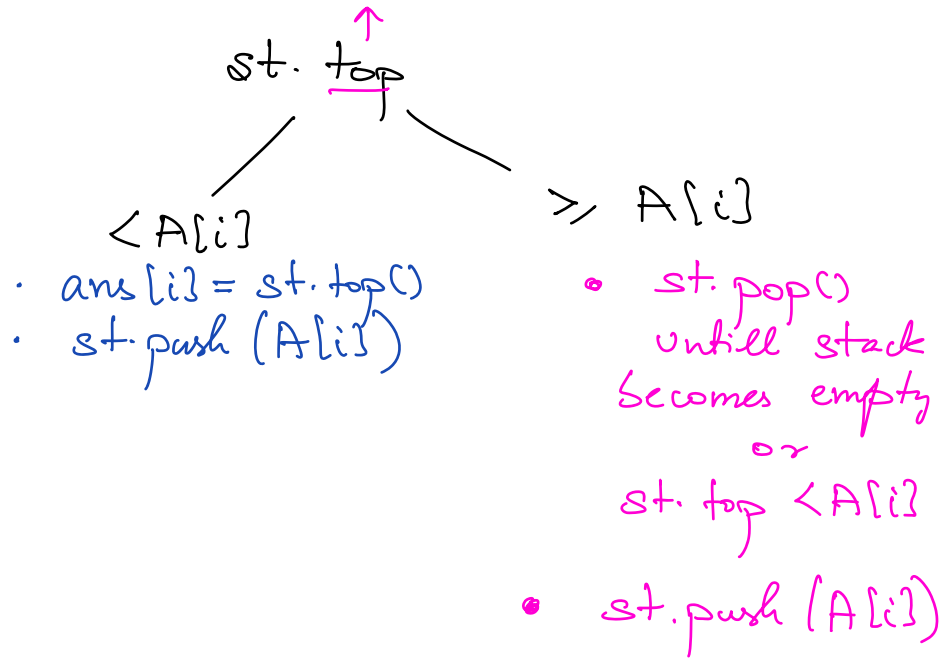
for every i :
Iterate from $(i-1)$ to 0

return the 1st element smaller than $A[i]$.

$$T.C. = O(N^2)$$



Stacks



Code

```

ans[]
st → stack < Integers >

for (i = 0 ; i < N ; i++) {
    while ( ! st.isEmpty() && st.top >= A[i] ) {
        st.pop();
    }

    if ( st.isEmpty() ) {
        ans[i] = -1;
    }
    else {
        ans[i] = st.top();
    }
}

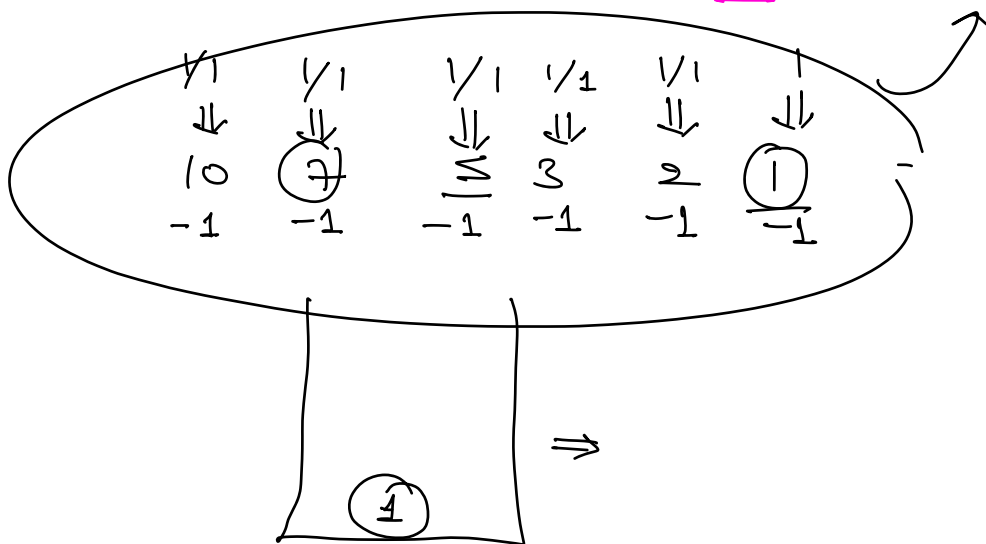
```

}

st.push(A[i]);

}

T.C. = $O(\underline{2N}) = O(N)$



Q

Find the index of the nearest smaller element in the left.

ans[]

st → stack < Integer >

for (i=0 ; i < N ; i++) <

while (! st.isEmpty() && $A[\underline{\text{st.top}}] \geq A[i]$)

st.pop();

}

if (st.isEmpty()) {

ans[i] = -1;

}

else {

ans[i] = st.top();

}

st.push(i);

}

T.C. = $O(N)$

1) Distance of NSE on left

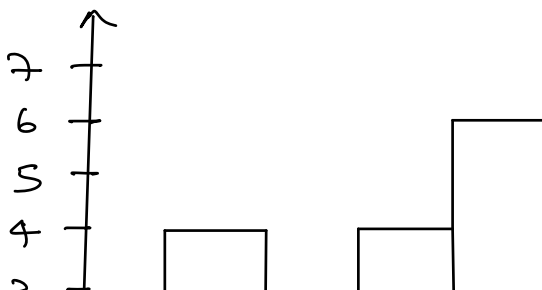
2) NSE on right $(N-1) \rightarrow 0$

3) Nearest greater Element on left

4) NGE on right $(N-1) \rightarrow 0$

Q
Amazon

Largest Rectangle in a histogram.



$$3 \times 4 = \underline{\underline{12}}$$

$$i \rightarrow \underline{= (NSEP - NSEL - 1) \times A[i]}$$

Pre Computation $\Rightarrow \frac{NSEP[]}{NSEL[]} > O(N)$

ans = 0;

for (i=0; i < N; i++) {

base = NSEP[i] - NSEL[i] - 1

Height = A[i];

area = base x height

ans = max(ans, area);

}

T.C. = $O(N)$
S.C. = $O(N)$