155. Min Stack

Problem statement

1. Design a stack that supports push, pop, top, and retrieving the minimum element in constant time.

   Implement the `MinStack` class:

   - `MinStack()` initializes the stack object.
   - `void push(int val)` pushes the element `val` onto the stack.
   - `void pop()` removes the element on the top of the stack.
   - `int top()` gets the top element of the stack.
   - `int getMin()` retrieves the minimum element in the stack.

   You must implement a solution with `O(1)` time complexity for each function.

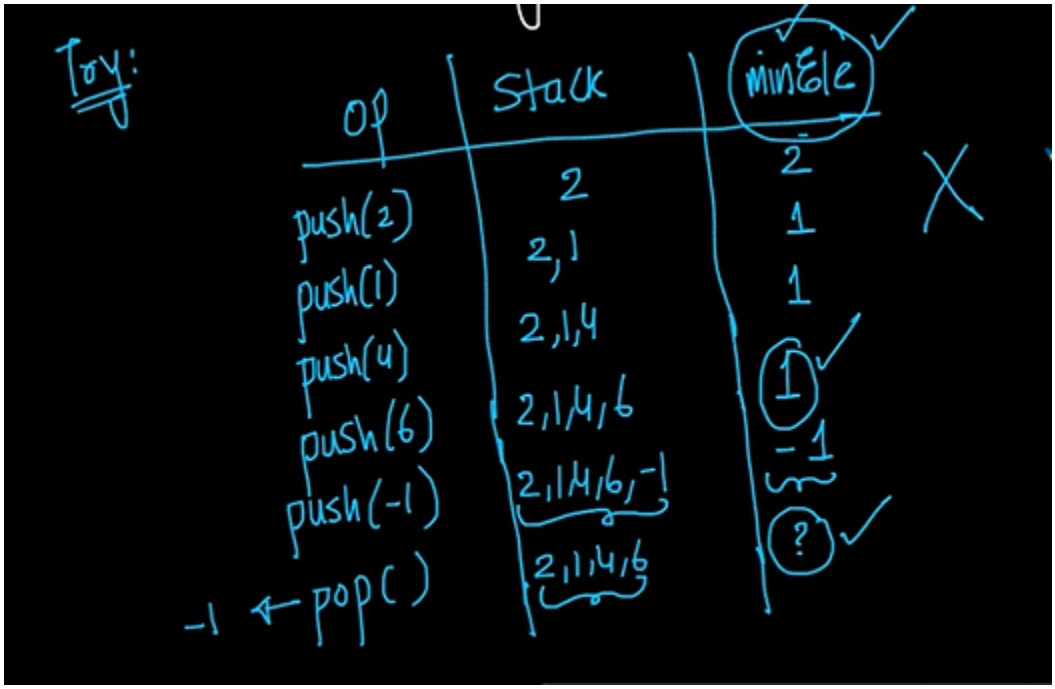
   Example 1:

   > **Input**
   > `["MinStack","push","push","push","getMin","pop","top","getMin"]`
   > `[[],[-2],[0],[-3],[],[],[],[]]`
   >
   > **Output**
   > `[null,null,null,null,-3,null,0,-2]`
   >
   > **Explanation**

   ```
   MinStack minStack = new MinStack();
   minStack.push(-2);
   minStack.push(0);
   minStack.push(-3);
   minStack.getMin(); // return -3
   minStack.pop();
   minStack.top();    // return 0
   minStack.getMin(); // return -2
   ```

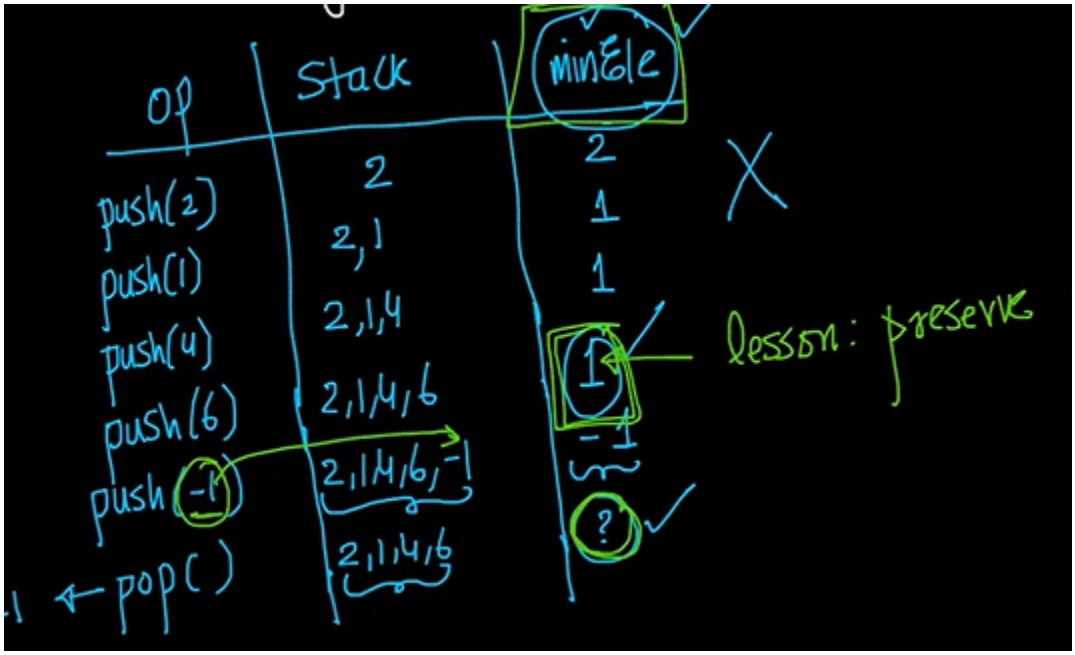
Problem Intuition

1. Lets consider a stack and a single variable minEle…which stores the min_ele



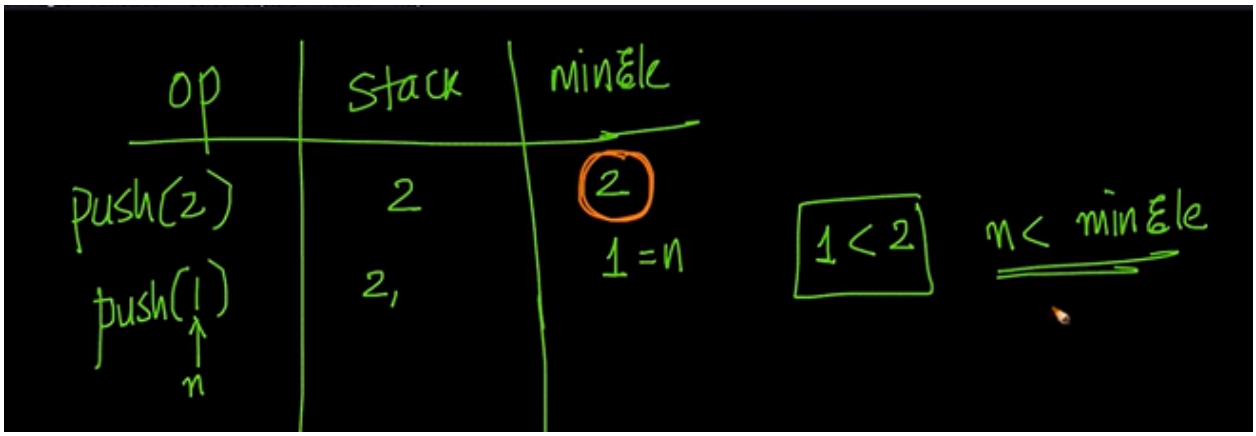
here first we have pushed 2 and min ele is 2….push(1) then min_ele is 1..

2. In the end we have push(-1) as it is the min element..we keep min_ele = 1…and later we have pop() it from the stack..now how can we obtain the min_ele? So using single variable min_ele..we cannot retrieve min_ele
3. So what we have learned from this is we need to preserve the previous min_ele

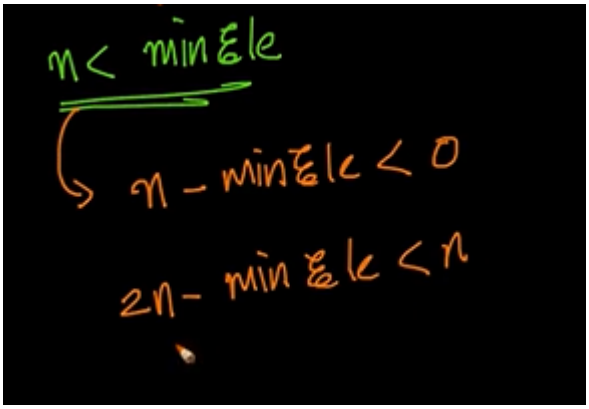


4. So here…we'll change the way we push and pop elements

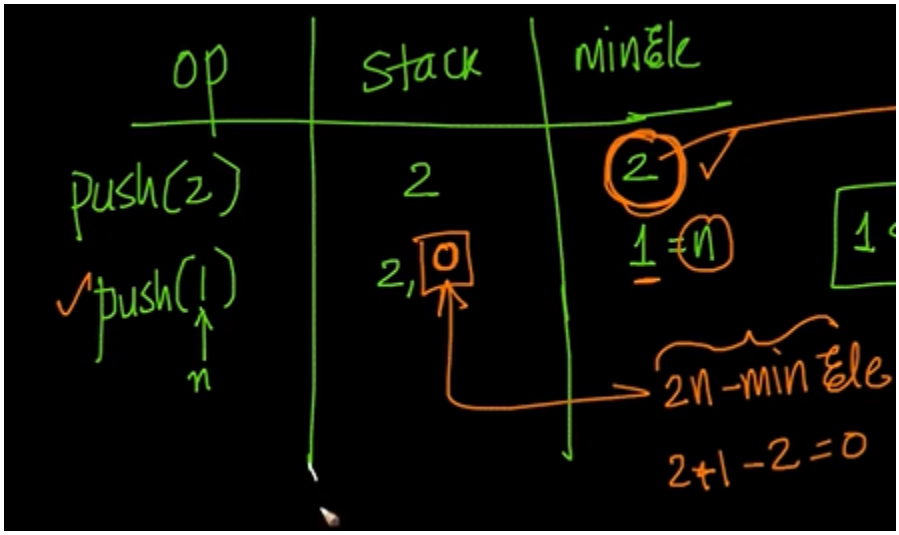
5. Here lets consider..the element which we are inserting is n….so when we push(1)..it is less then curr min_ele



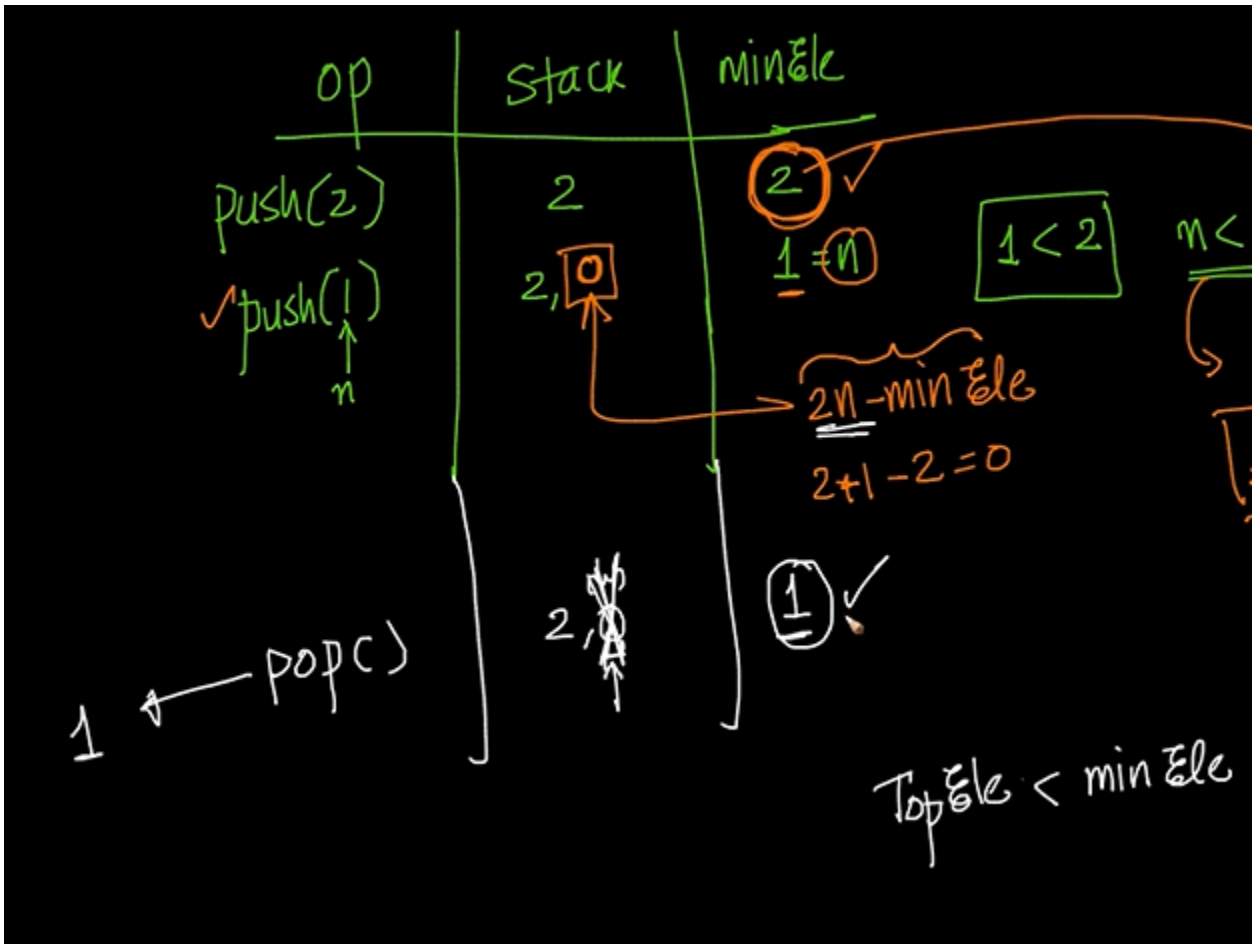
6. Now as the n<minele…we can write it as n-minele<0 and we add n on both sides ..then we get



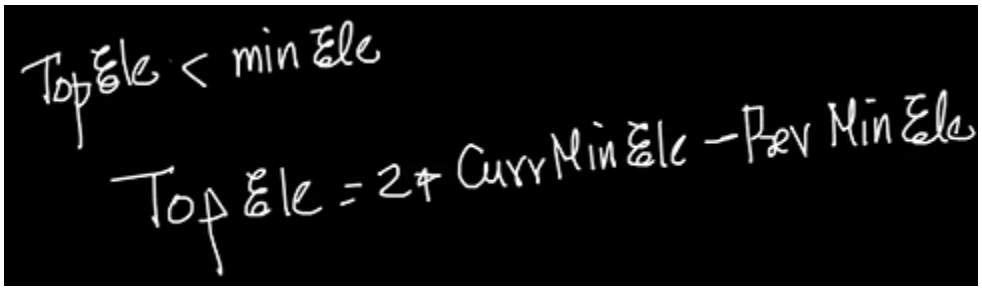
7. So now ..in the place push(1)..we'll push (2n-min_ele)



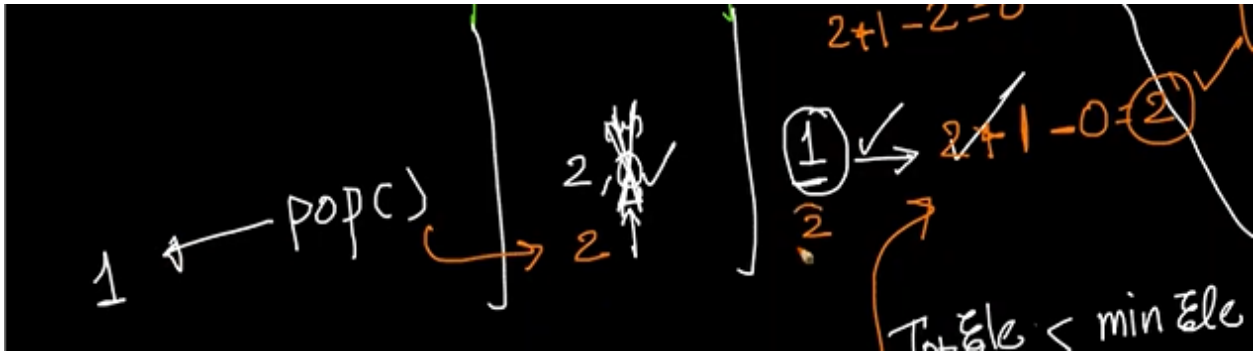
8. Now lets do pop operation…so here first we'll return the min_element and if top element < = min_ele …then we'll update the min_ele



9. Now how our top_ele came into existence…it because of the function



10. Now from here..we can get the Prev_min_ele



11. Refer this example…of how we used Push and pop operations