Questions on Stacks & Queues

Q) Implement a Queue using stacks.

In Queue ! First in first out

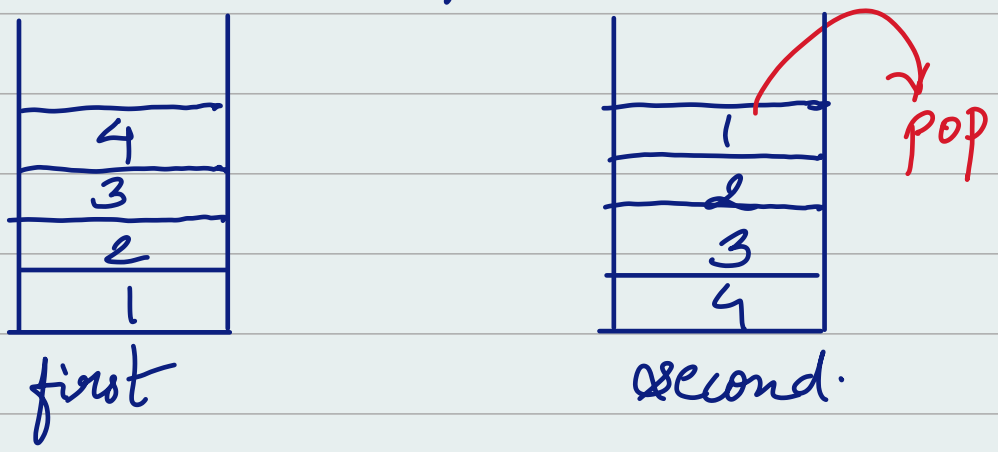
So to implement like queue using stacks, we will use two stack first stack & second stack.

So, Using two stacks

first stack

second stack

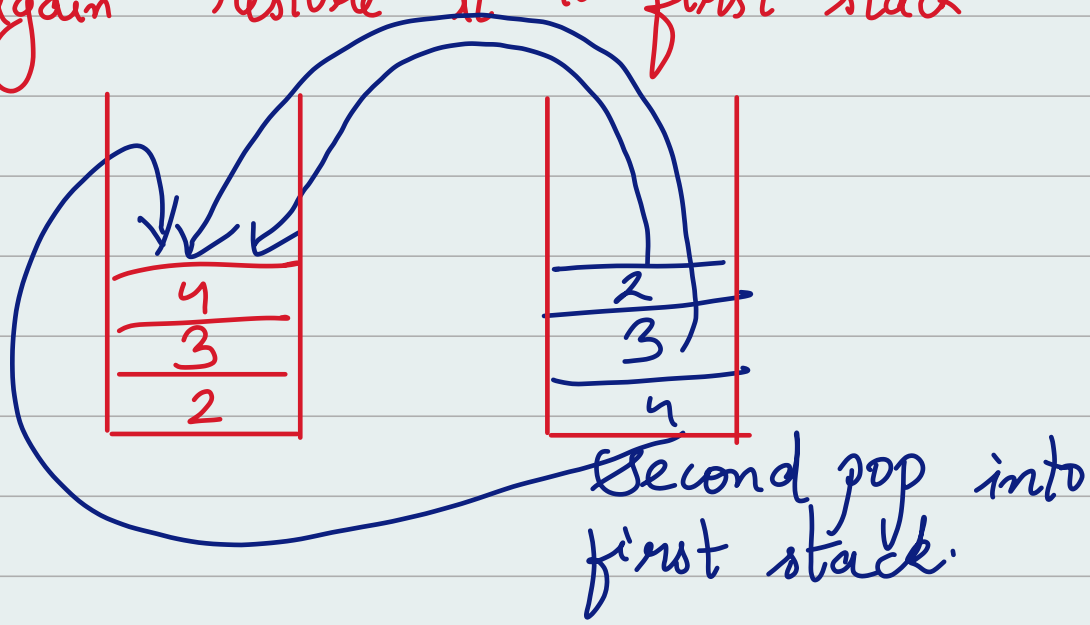
→ Empty the first stack into the second.



→ first remove or pop the elements from the first stack into second stack

→ Remove (1) from second stack and then again restore it to first stack

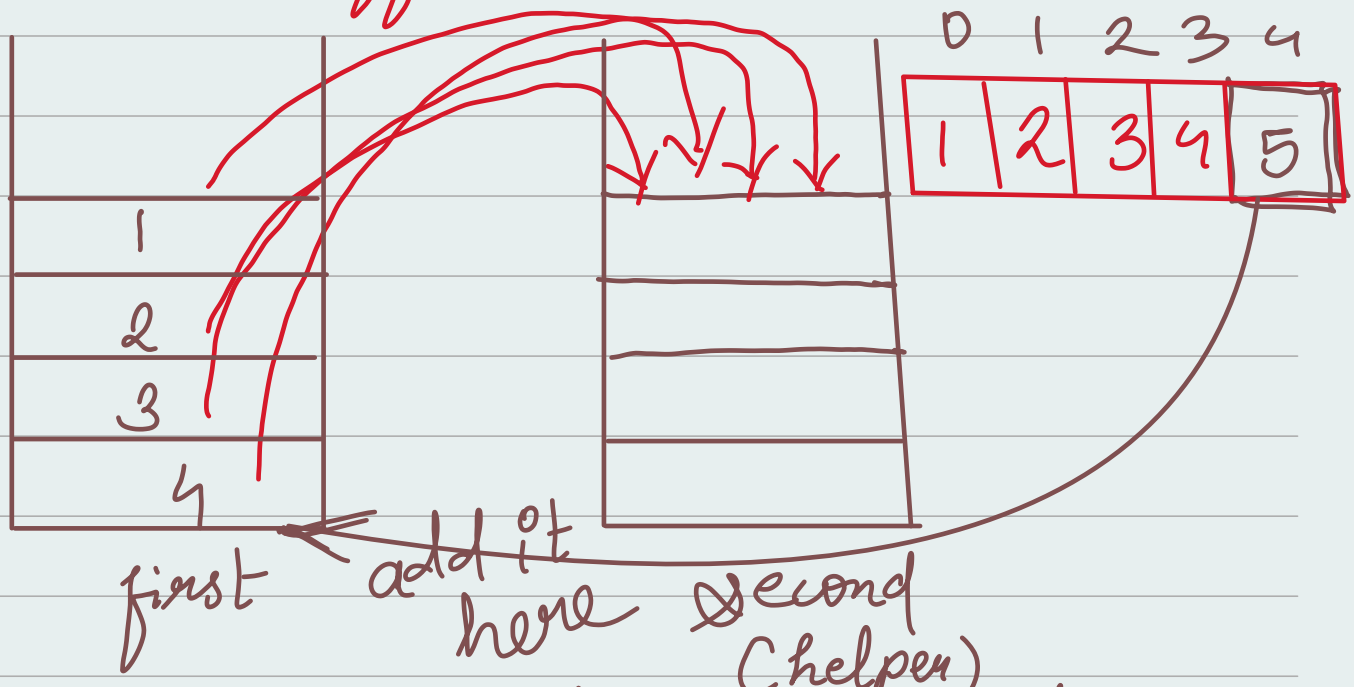
→



→ Now it is behaving like queue (FIFO).

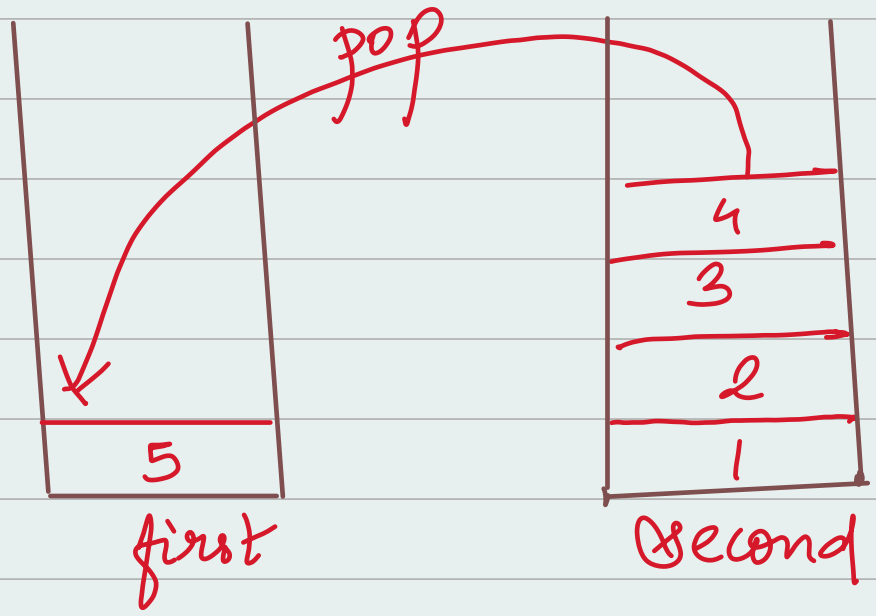
→ Complexity is O(N) for removing the elements from first stack and adding it into second stack. The complexity of adding elements are O(1). Similarly from second stack to first stack. Complexity O(N) for removing all the elements from 2 to 4 but adding it into the first stack is O(1).

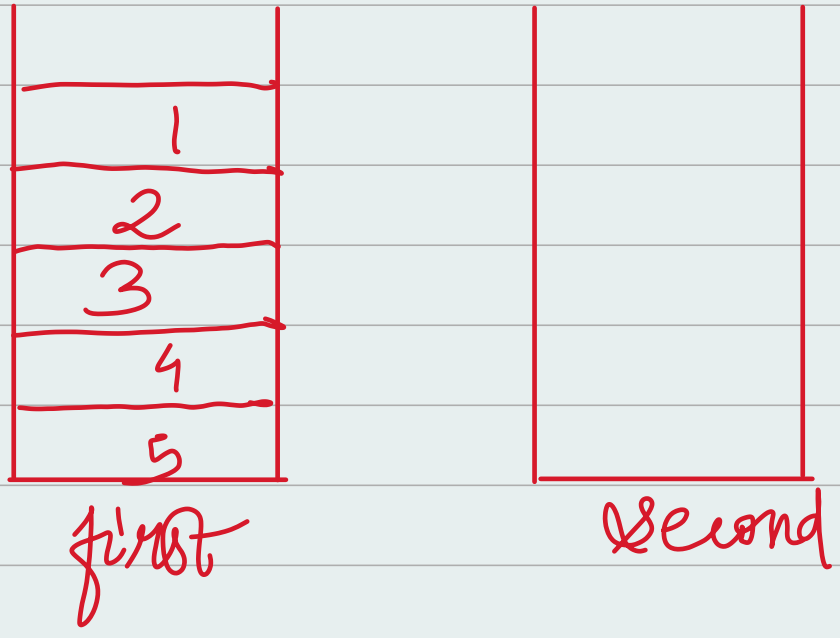
→ Remove efficient



Here we inserted the numbers in reverse list manner. But the problem is if we have to add 5 to the list we directly cannot do that for that we have to use helper function that is second stack. We will

pop all the elements from first stack to second stack and then add 5 into the first stack. After that removing or poping out the elements again from second stack to first stack. In this way we can add an elements in the end of the stack.

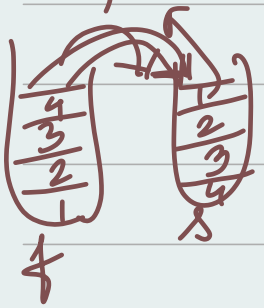




// Here O(1) is removal &
// O(N) is insertion time.

Code:

```
class QueueUsingStack {

    private Stack<Integer> first;
    private Stack<Integer> second;

    public QueueUsingStack(){

        first = new Stack<>();
        second = new Stack<>();

    }
    public void add(int item){

        first.push(item);
    }

    public int remove() throws Exception{

        while(!first.isEmpty()){

            second.push(first.pop());
        }
```

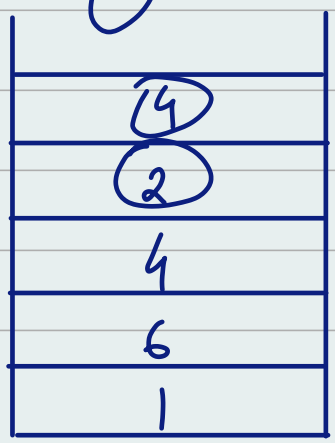


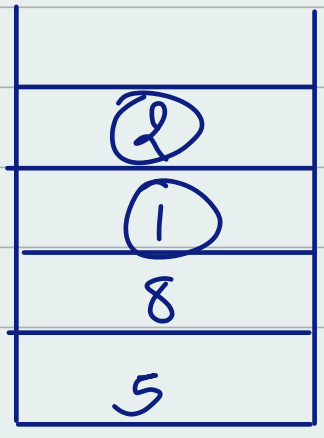
```
        int removed = second.pop();//1
        while(!second.isEmpty()){
            first.push(second.pop());
        }
        return removed;
    }
    public int peek() throws Exception{
        while(!first.isEmpty()){
            second.push(first.pop());
        }

        int peeked = second.peek();//1
        while(!second.isEmpty()){
            first.push(second.pop());
        }
        return peeked;
    }
    public boolean isEmpty(){
        return first.isEmpty();
    }
```

```
}

Code: Queue Using Stack remove

class QueueUsingStack {

    private Stack<Integer> first;
    private Stack<Integer> second;

    public QueueUsingStack(){

        first = new Stack<>();
        second = new Stack<>();

    }
public void add(int item) throws Exception{ // Adding 5 into
    while(!first.isEmpty()){                    the list
        second.push(first.pop());
    }
    first.push(item) // 5 number is pushed into
while(!second.isEmpty()){ first stack
    }first.push(second.pop());
public int remove() throws Exception{

    while(!first.isEmpty()){

        second.push(first.pop());
    }
```

```
        int removed = second.pop();//1
        while(!second.isEmpty()){
            first.push(second.pop());
        }
        return removed;
    }
    public int peek() throws Exception {
        return first.peek();
    }
    public boolean isEmpty(){
        return first.isEmpty();
    }
}
```

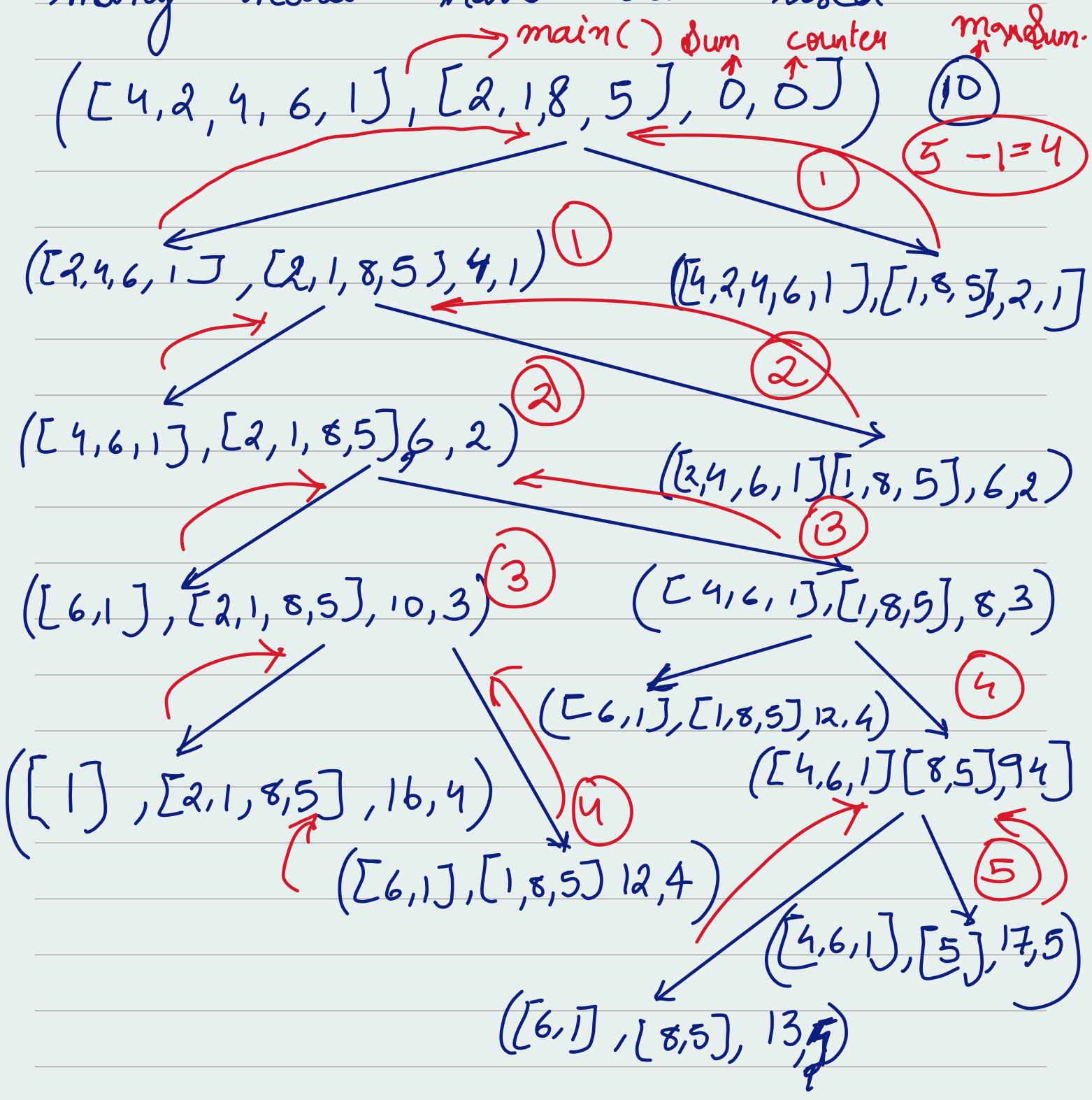
8) Game of Two Stacks :- Hacker Rank Problem.





Take stacks Sum such as it should not go more than maxSum = 10

For example : (4)+(2)+(2)+(1)=9
and take a counter like how many nodes have been used.



The 5th counter is breaking the condition so we have to subtract with 1 $\Rightarrow 5-1 = 4$ ans

Code :

```
class TwoStacks {

    static int twoStacks(int x, int[] a,
        int[] b ){

        return twoStacks(x, a, b, 0, 0)-1;
                         (maxSum, stack1, stack2, sum, counter)

    }
    private static int twoStacks(int x,
        int [] a, int [] b, int sum,
        int count ){

            if (sum > x ){
                return count;
            }
        if (a.length == 0 || b.length == 0){
            return count;
        }
```

int ans1 = twoStacks(x, Arrays.copyOfRange(a, 1, a.length), b, sum+a[0], count+1);

[4 2 4 6 1]

2, 4, 6, 1

int ans2 = twoStacks(x, a, Arrays.copyOfRange(b, 1, b.length), sum+b[0], count+1);

[2, 1, 8, 5]

1, 8, 5

return Math.max(ans1, ans2);

}

public static void main(String[] args){

Scanner s = new Scanner(System.in);

int t = s.nextInt(); // Taking number of test cases

for(int i=0; i<t; i++){ //Running the loop for that many test cases times

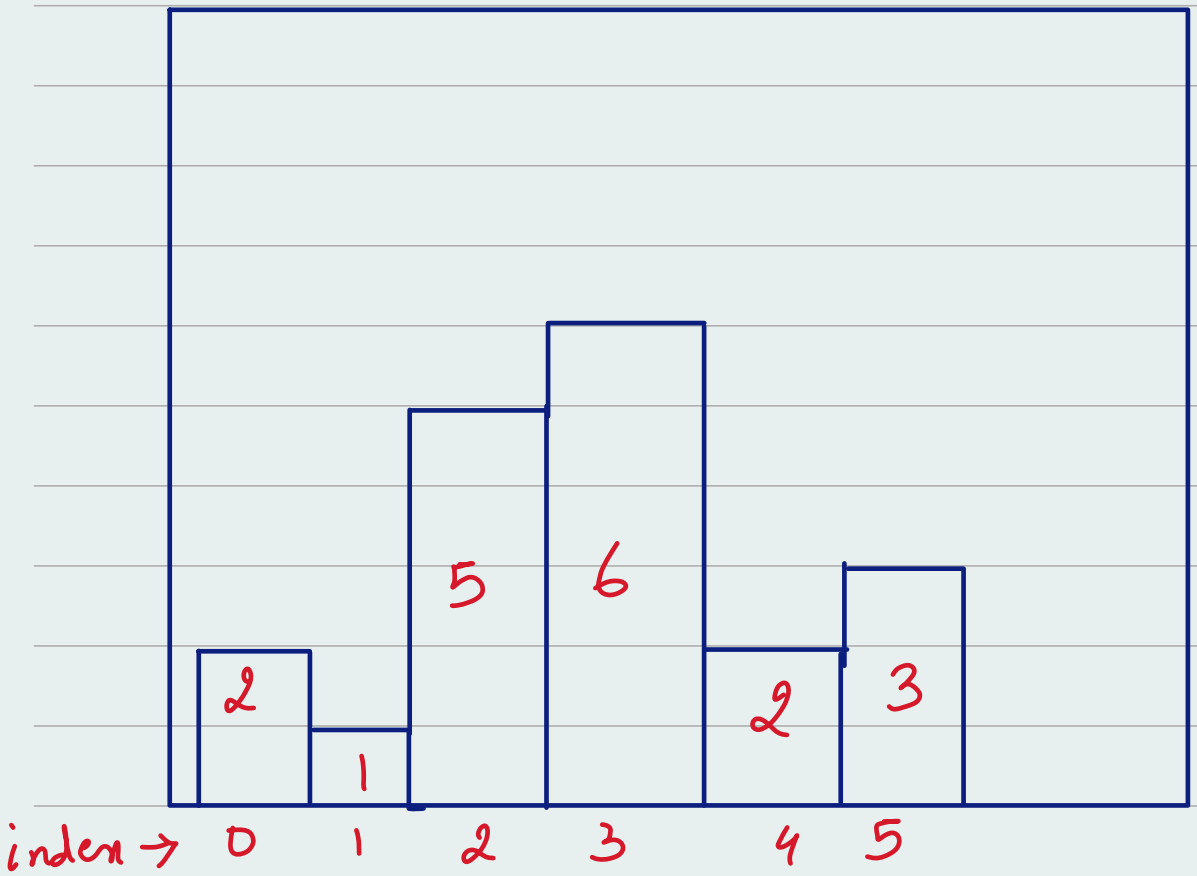
Taking // int n = s.nextInt();

size of a

Taking size of b

```
//int m = s.nextInt();
//taking sum
int x = s.nextInt();

int[] a = new int[n];
int[] b = new int[m];

for (int j=0; j<n; j++){
    a[j] = s.nextInt();
}
for (int j=0; j<m; j++){
    b[j] = s.nextInt();
}
System.out.println(twoStacks
        (x, a, b));
}
}
}
```

Q) Find the largest area (rectangle) in histogram?



* max till each index.

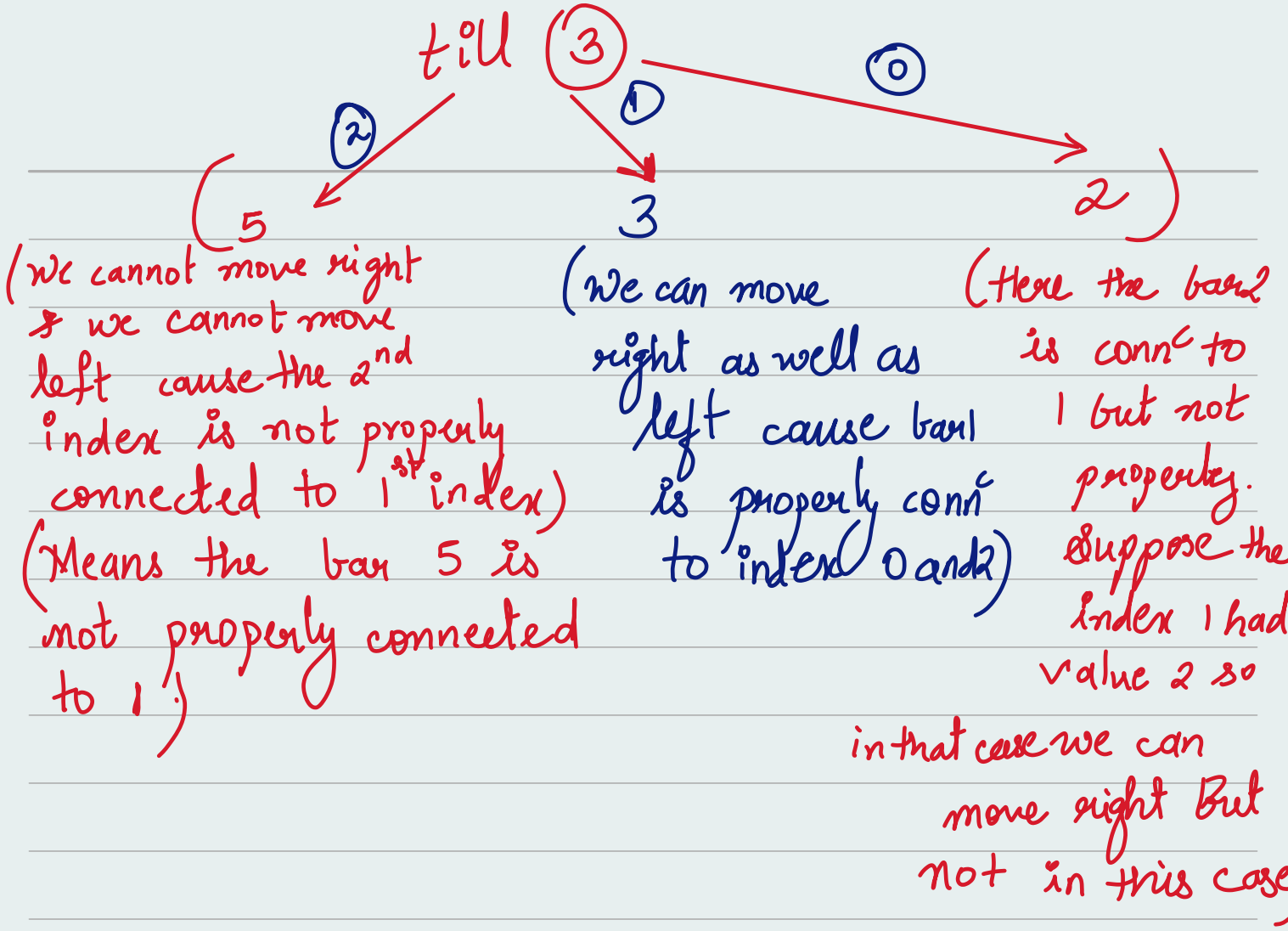
till ① → 2 (means 0th index value)

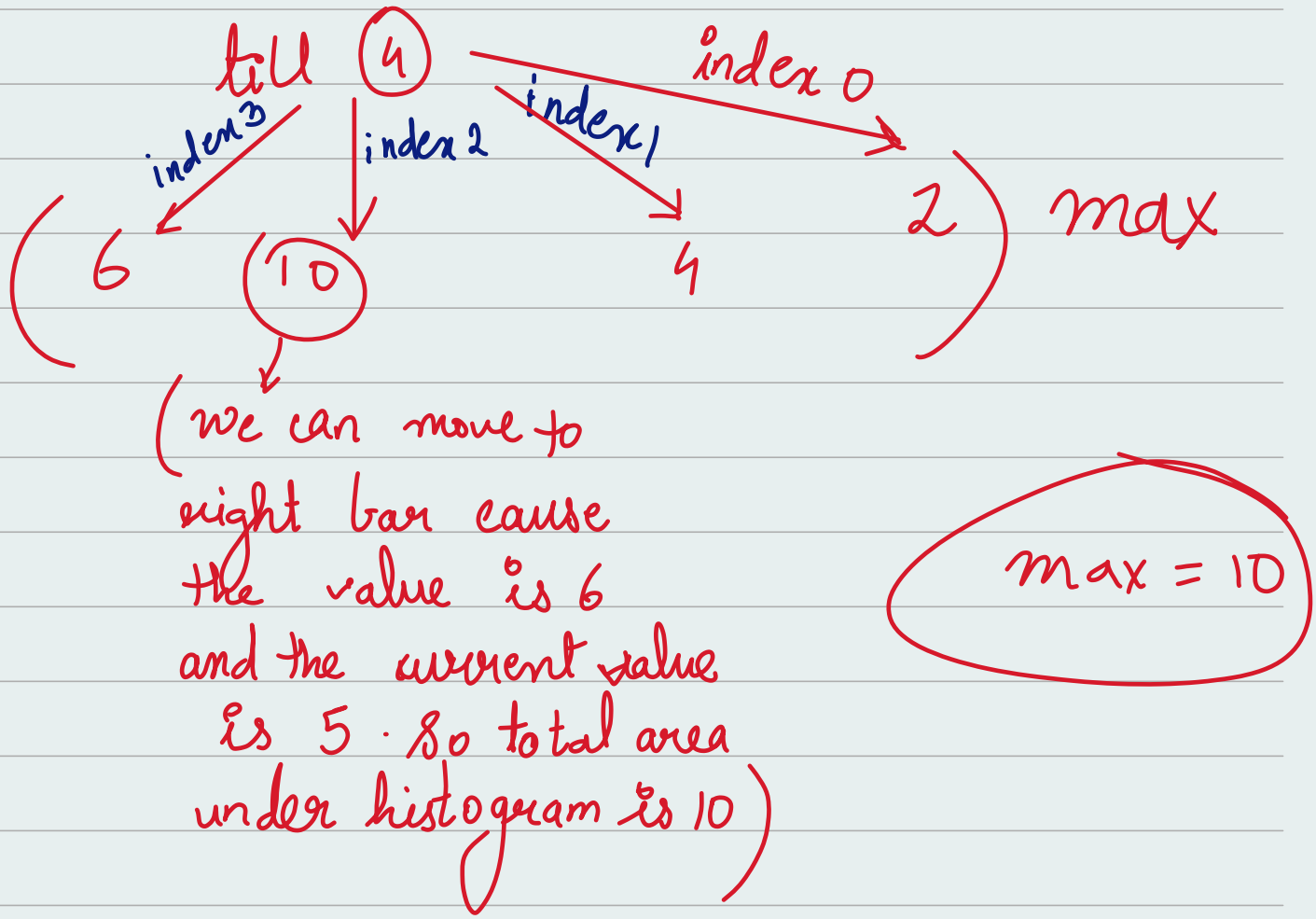
till ② → 2 (1th index connected to 0th index bar making it 2 so we can move left)

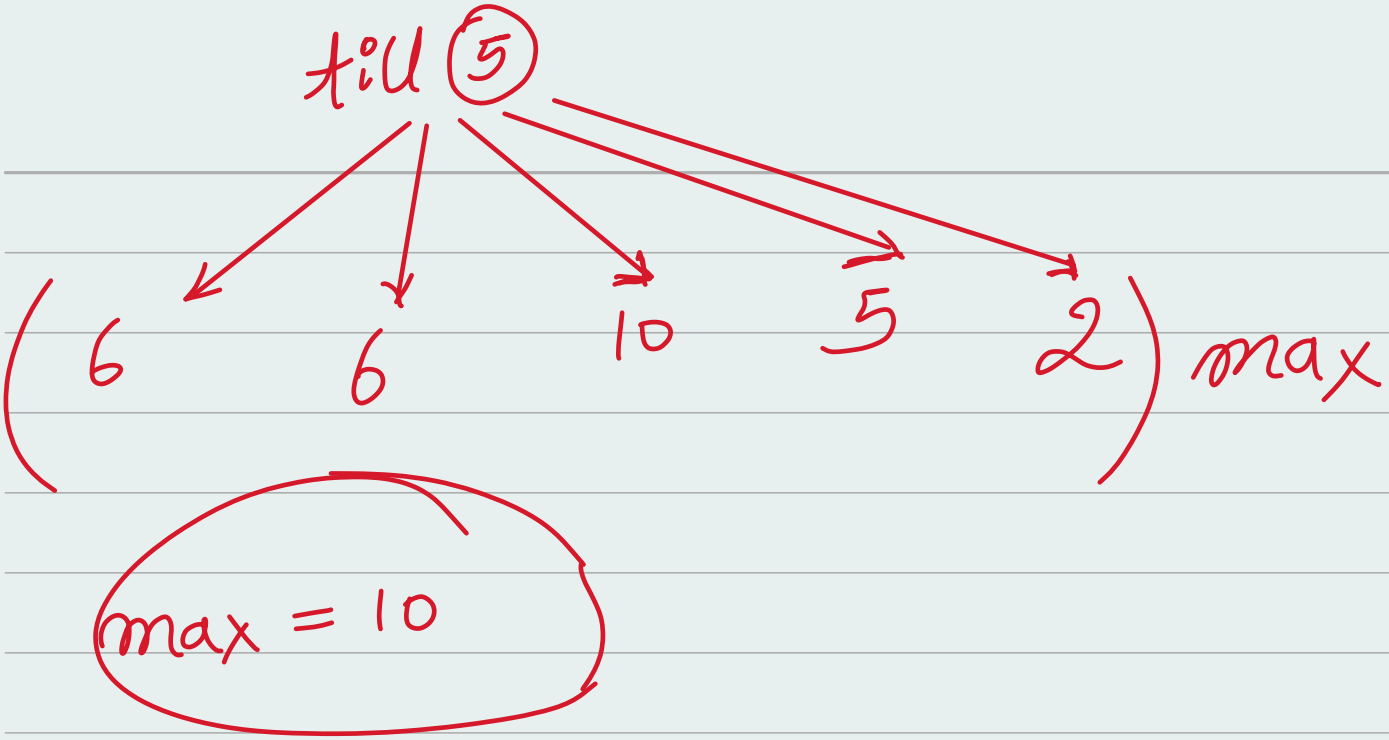
max = 2

2 {The value of index of

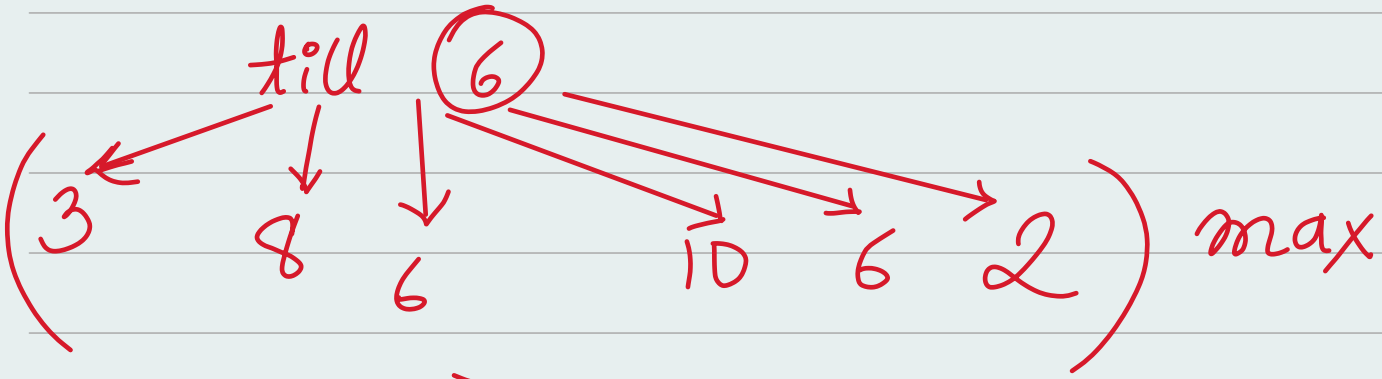
so the maximum of these two values would be 2


till 3
2
1
0
5
3
2
(We cannot move right & we cannot move left cause the 2nd index is not properly connected to 1st index)
(Means the bar 5 is not properly connected to 1)
(We can move right as well as left cause bar1 is properly conn to index 0 and 2)
(Here the bar2 is connc to 1 but not properly. Suppose the index 1 had value 2 so in that case we can move right But not in this case)


till 4
index 3
index 2
index 1
index 0
6
10
4
2
max
(We can move to right bar cause the value is 6 and the current value is 5. So total area under histogram is 10)
max = 10



max = 10



max = 10

Google, Facebook (Meta)

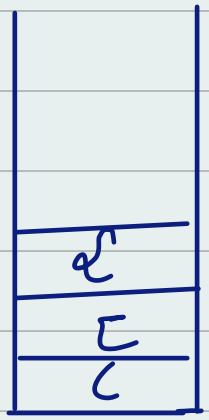
8) Determine if the input string is valid or not.

→ open brackets must be closed by the same type of brackets.

→ ( ), [ ], { } → true

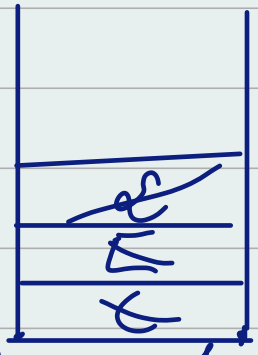
→ ( ] → false

→ ([{] }) = false



→ Check whether] is able to cancel the item at the top of the stack. In this case we have { so return false.

→ ([{ }])



The first closing } should be able to cancel the item at the top of the stack. In this case it is true. Otherwise return false.

Code: Valid Parenthesis:

```
class validParentheses {

    public boolean isValid(String s){

        Stack<Character> stack = new
                                 Stack<>();
```

make a list of characters ([{ }]) and run a loop

```
        for(char ch : s.toCharArray()){

            if(ch == '(' || ch == '[' ||
                    ch == '{'){
                stack.push(ch);
            } else {
                if(ch == ')'){
                    if(stack.pop() != '('
                    || stack.isEmpty()){
                        return false;
                    }
                }
                if(ch == '}'){
                    if(stack.pop() != '{'
                    || stack.isEmpty()){
                        return false;
                    }
                }
```

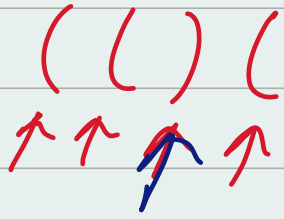
connection

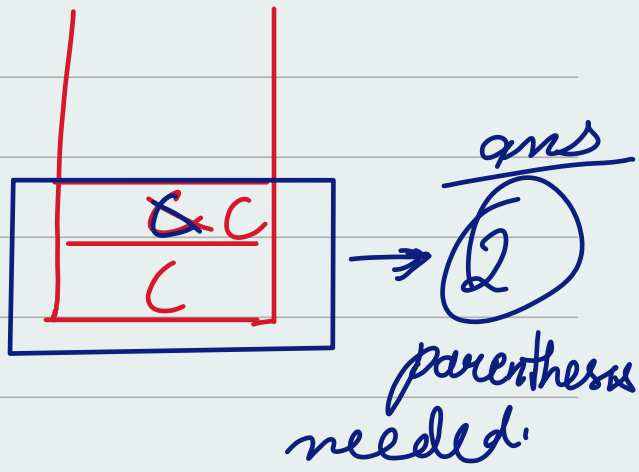
make (stack.isEmpty() || stack.pop() != opening brackets)

```
        }
        if (ch == ']') {
            if (stack.pop() != '[' || stack.isEmpty()) {
                return false;
            }
        }
    }
}
return stack.isEmpty();
}
}
```

8) Minimum Add to make Parenthesis valid.

→ (( ) (





Code:

```
class Solution {

    public int minAddToMakeValid
        (String s) {

    Stack<Character> stack = new
            Stack<>();

    for (char ch: s.toCharArray()){

        if (ch == ')' ){

            if ( !stack.isEmpty() &&
                stack.peek() == '(' ){

                stack.pop();

            } else {
                stack.push(ch);

            } else {
                stack.push(ch);

    }
}
```

return stack.size();

}