Name : Abdul Manan
Roll# 2020-10-0198

Q#. 01

To prove that this is correct, we have to prove:

For all a < b, $| Lr_x - Lb_x | <= | Lr_y - Lb_y |$

We will prove this by induction:
For only one stick in both Boxes, the statement is true.

We assume that for a particular r, this statement is true i.e.

$$| Lr_r - Lb_r | <= | Lr_{r+1} - Lb_{r+1} |$$

Now, we have to prove that for r+1, this is also true.

$$| Lr_{r+1} - Lb_{r+1} | <= | Lr_{r+2} - Lb_{r+2} |$$

Since, we know that our greedy algorithm always choses sticks with smaller length first. So, we can say that length of ‘r+1’ stick is always less than or equal to ‘r+2’.

So,

$Lr_{r+1} <= Lr_{r+2}$

and $Lb_{r+1} <= Lb_{r+2}$

Now, we know that two smaller lengths have smaller difference and two bigger values will always have bigger difference.

Now, this shows that our Greedy will always **Stays Ahead** of Optimal solution or in other words, our inductive hypothesis is true.