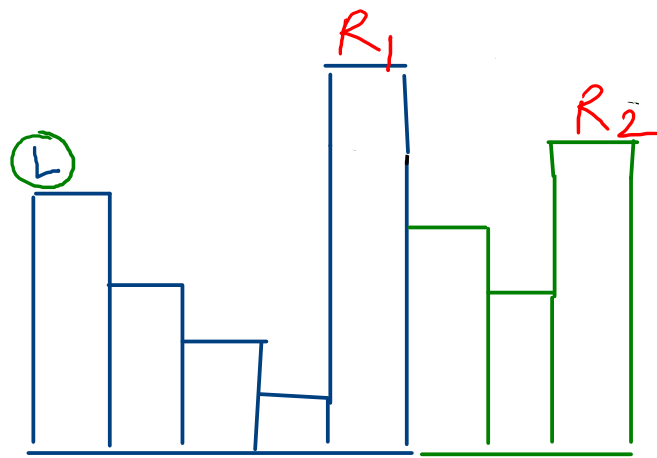# Rain Water Trapping Two Pointer Approach


$$\text{Area over } i\text{th bar} = \min\left(\text{left\_max}, \text{right\_max}\right) - \text{bar}[i]$$

Observations: If we start calculating the area from left local minima with the assumption that in right somewhere we will find bar of greater height. i.e., left_max <= right_max

→ If assumption comes true means area calculated is correct.

→ If assumption comes false, i.e left_max > right_max means we should have calculated the area rather from right.
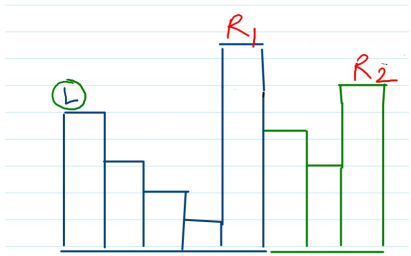
The area calculated using local left-max i.e. 'L' to be correct, our assumptions needs to come true. We cannot predict about the right-max without observing the right of current index.

Strategy : Let's initialise the left-max = bar[0th index]
right_max = bar[last index]

L
R_2

Case 1

If left-max < right-max means first bar is smaller than last bar.

case A : There is no greater bar than right-max (left bar) in between first and last bar.

→ There is no issue if we calculate the area from left.

Case B : There is a greater bar than right-max (last bar) in between first and last bar.
R_2

→ Then the area calculated from left will be correct till the first right-max (R_1)

Thus, the area calculated is always true just we need to take care of till which right-max.

→ We keep on calculating the area from left till R_1 and at R_1 we re-assign left-max with R_1, so that left-max(R_1) becomes greater than right-max(R_2) and flip the direction of area calculation. Means allow the runtime control to enter in case 2.

Case 2 If right_max < left_max
means last bar is smaller than first
bar.

→ Here we should just start
the area calculation from right.
And everthing else remain similar to
Case 1.

Case A: There is no greater bar than left_max (L)
in between first bar (left_max) and last bar (right_max)

→ There is no issue, area calculated
will be correct across whole width of
histogram.

Case B: There is a greater bar than left_max (first bar)
in between first bar and last bar (right_max)

→ Here we calculate the area starting from
right end till the greater bar. And at
greater bar we re-assign right_max
with greater bar. This allow the runtime
control to flip the area calculation direction.