

11. Container With Most Water

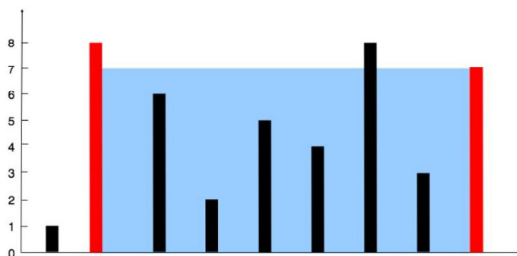
05 April 2022 08:01 PM

You are given an integer array `height` of length `n`. There are `n` vertical lines drawn such that the two endpoints of the i^{th} line are $(i, 0)$ and $(i, \text{height}[i])$.

Find two lines that together with the x-axis form a container, such that the container contains the most water.

Return the maximum amount of water a container can store.

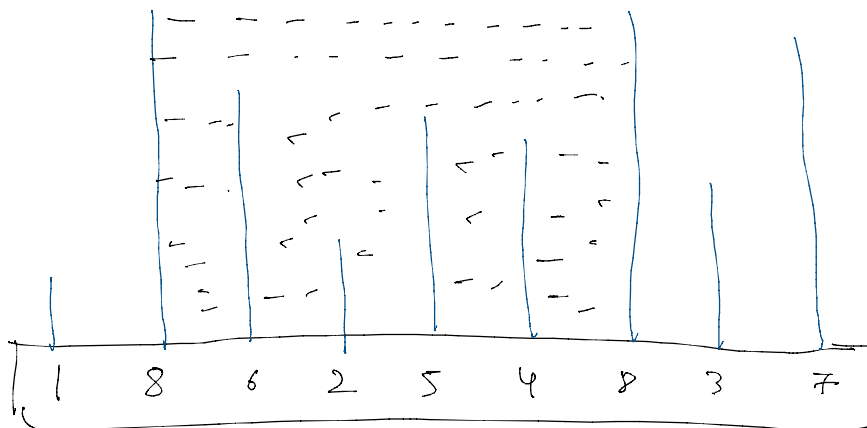
Notice that you may not slant the container.



Input: `height = [1,8,6,2,5,4,8,3,7]`

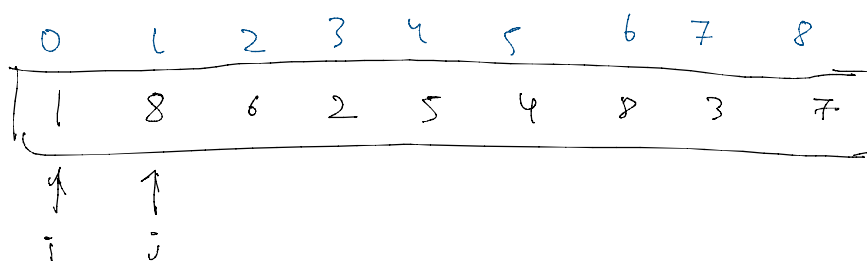
Output: 49

Explanation: The above vertical lines are represented by array `[1,8,6,2,5,4,8,3,7]`. In this case, the max area of water (blue section) the container can contain is 49.



find the max water?

① Brute force :



↳ Explore all pairs of lines

(i, j)

0, 1 6, 1 8, 1

$$0, 2 \quad 1, 2 \quad \dots$$

6, 8 1, 8 8, 8

height let pick $(1, 8) \Rightarrow \left. \begin{array}{l} \text{height}[1] = 8 \\ \text{height}[8] = 7 \end{array} \right\} \min(8, 7) = 7$

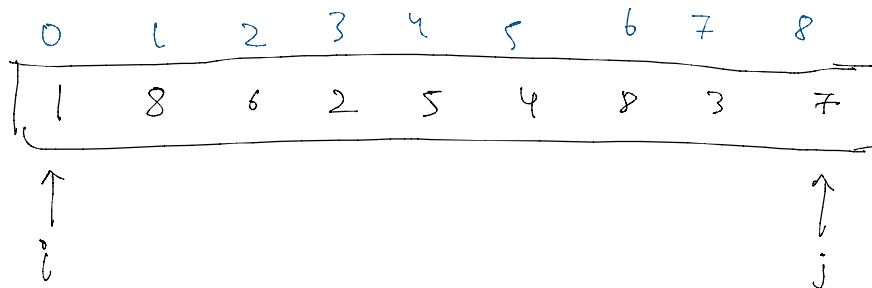
width (difference between the index) = $8 - 1 = 7$

Water = $7 \times 7 = 49$

You need to explore all the pairs.

$$T.C \Rightarrow O(n^2) \quad S.C \Rightarrow O(1)$$

Approach 2:



$$\text{water} = (j - i) * \min(\text{height}[i], \text{height}[j])$$

↓
width

$$= (8-0) + \min(1, 2) = 8 + 1 = 9 \text{ mit}$$

now we need to figure out which one to move i or j to find max. water unit.

Increment in 'i'

... \rightarrow maybe height increase \uparrow water \uparrow

$i++$ \rightarrow may be height increase } water
 \rightarrow height increase

Decrement 'j'

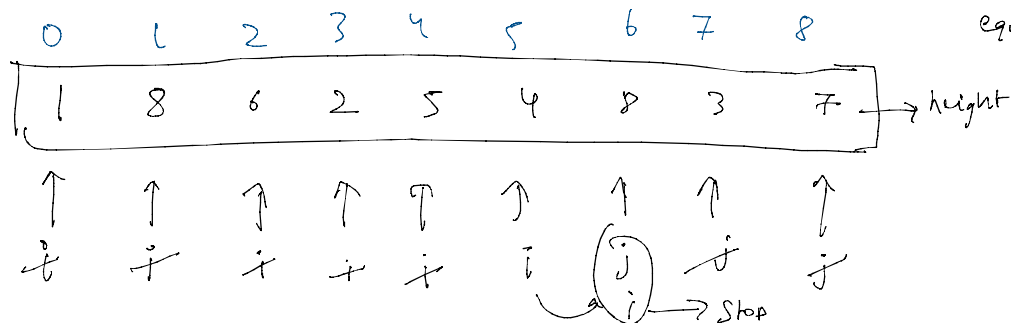
$j--$ $\left. \begin{array}{l} \text{height } \uparrow \text{ water } \downarrow \\ \text{height } \downarrow \text{ water } \downarrow \end{array} \right\}$ because width decrease.

So, favourable condition to increase i - ~~X~~

① height < $\left. \begin{array}{l} \text{increment } \rightarrow i \\ \text{decrement } \rightarrow j \end{array} \right\}$

E.g.
 if current height of (i, j) become less
 that is when $(8, 7)$ then decrement j
 if $(7, 8)$ the increment i

when both the height is
 equal $(8, 8)$ increment/decrement
 not any of it



width = 8 7 6 5 4 3 2 1

height = 1 7 3 8 6 2 5 4

water = 0 8 4 9

width = $j - i$

height = $\min(\text{height}[i], \text{height}[j])$

