

## 11. Container with most water:

I/p: height = [1, 8, 6, 2, 5, 4, 8, 3, 7]

O/p: 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.

### Brute force:

- \* check every pair of lines
- \* calculate area = width \*  $\min(\text{height}[i], \text{height}[j])$
- \* keep track of max area.

```
class Solution {
    public int maxAreaBruteforce (int [] height) {
        int n = height.length;
        int maxArea = 0;
        for (int i = 0 ; i < n ; i++) {
            for (int j = i+1 ; j < n ; j++) {
                int area = (j-i) * Math.min (height[i],
                                                height[j]);
                maxArea = Math.max (maxArea, area);
            }
        }
        return maxArea;
    }
}
```

Time  $\rightarrow O(n^2)$       space  $\rightarrow O(1)$

## optimized approach (Two pointers):

use two pointers:

left = 0, right = n - 1

calculate area between left and right:

Move pointer with smaller height, because:

Increasing the smaller height may increase area.

Moving the larger height won't help.

class Solution {

public int maxArea(int[] height) {

int left = 0;

int right = height.length - 1;

int maxArea = 0;

while (left < right) {

int area = (right - left) \* Math.min(height[left], height[right]);

maxArea = Math.max(maxArea, area);

if (height[left] < height[right]) {

left++;

} else {

right--;

}

}

return maxArea;

}

}



## Dry Run:

$$\text{height} = [1, 8, 6, 2, 3, 4, 8, 3, 7]$$

$$\text{left} = 0, \text{right} = 8$$

$$\text{area} = (8 - 0) \times \min(1, 7) = 8 \rightarrow \text{maxArea} = 8$$

$$\text{height}[\text{left}] = 1 < \text{height}[\text{right}] = 7 \rightarrow \text{move left} \rightarrow 1$$

$$\text{left} = 1, \text{right} = 8$$

$$\text{area} = (8 - 1) \times \min(8, 7) = 7 \times 7 = 49 \rightarrow \text{maxArea} = 49$$

$$\text{height}[\text{left}] = 8 > \text{height}[\text{right}] = 7 \rightarrow \text{move right} \rightarrow 7$$

$$\text{left} = 1, \text{right} = 7$$

$$\text{area} = (7 - 1) \times \min(8, 3) = 6 \times 3 = 18 \rightarrow \text{maxArea} = 49$$

Result = 49.

Time  $\rightarrow O(n)$  space  $\rightarrow O(1)$ .