Experiment 4

Student Name: Niraj Kumar **UID: 22BCS16736**
Branch: CSE **Section: 638/A**
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Aim:

Problem-1: Beautiful Array

Algorithm:

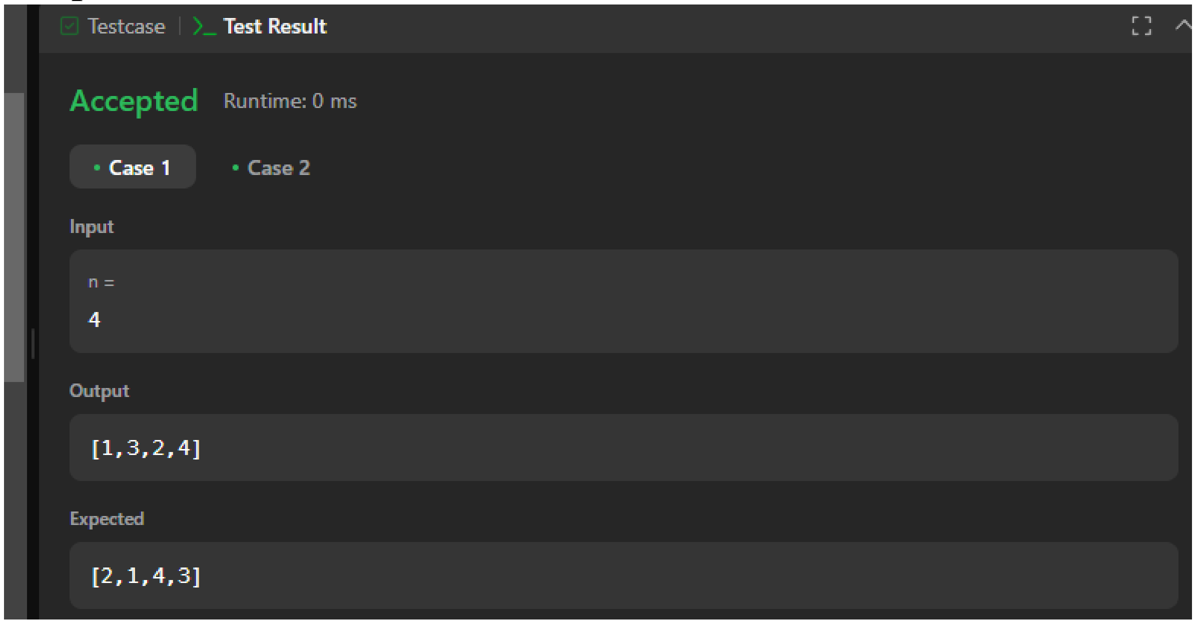
- **Start with Base Case**
- Begin with a list containing only [1] as the base case.
- **Build Odd and Even Sequences**
- Use a divide-and-conquer approach:
  - Generate odd numbers: 2 * num - 1 (as long as they are ≤ n).
  - Generate even numbers: 2 * num (as long as they are ≤ n).
- Append these numbers in order to ensure no three numbers satisfy 2 * nums[k] == nums[i] + nums[j].
- **Convert List to Array and Return**
- Store the result in an integer array and return it

Code:

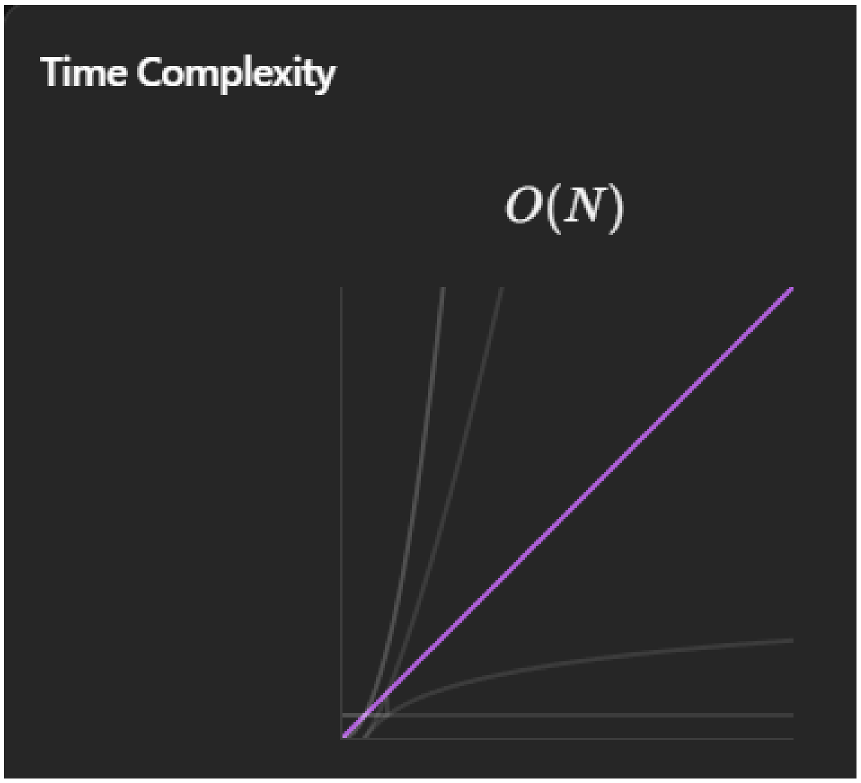
```
import java.util.*;

class Solution {
public int[] beautifulArray(int n) {
List<Integer> result = new ArrayList<>();
result.add(1);

while (result.size() < n) {
List<Integer> temp = new ArrayList<>();

for (int num : result) {
if (num * 2 - 1 <= n) {
temp.add(num * 2 - 1);
}
}

for (int num : result) {
if (num * 2 <= n) {
```

```
temp.add(num * 2);
}
}

result = temp;
}

int[] arr = new int[n];
for (int i = 0; i < n; i++) {
arr[i] = result.get(i);
}

return arr;
}
}
```

Output:



```
Accepted   Runtime: 0 ms

Input
n =
4

Output
[1,3,2,4]

Expected
[2,1,4,3]
```



Aim:

Problem-2: The Skyline Problem

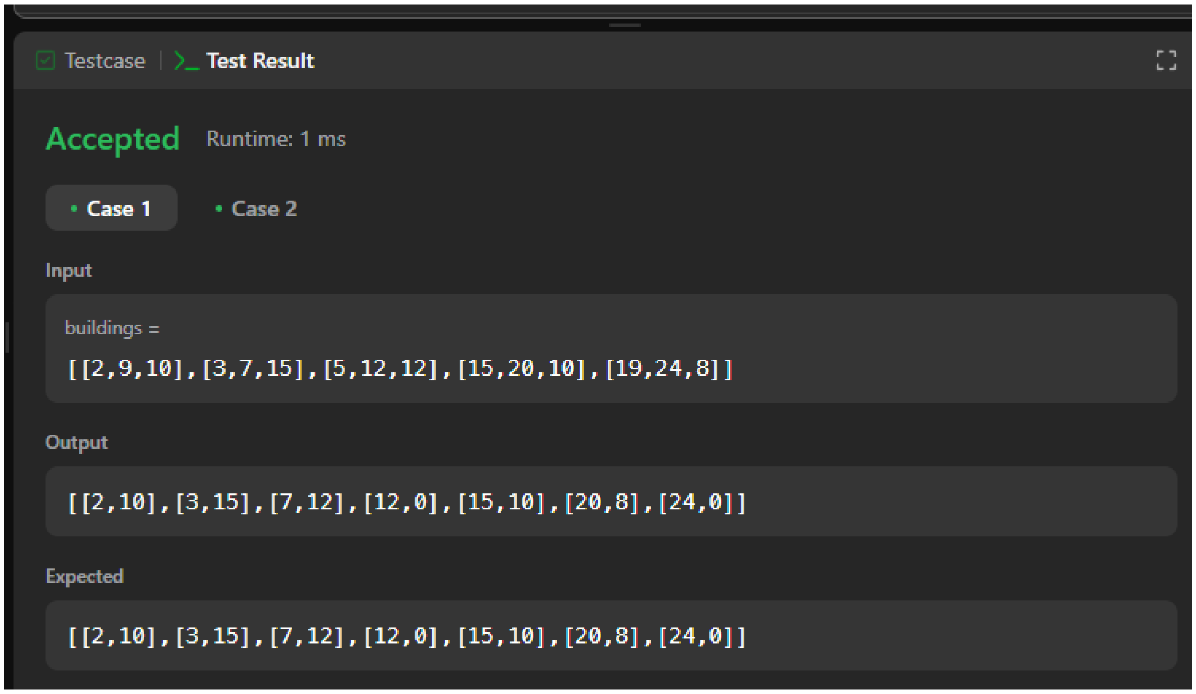
Algorithm :

- Process Building Edges
- Convert each building into two events:
    - Start event (left, -height) → Negative height for priority sorting.
    - End event (right, height) → Positive height to remove it later.
- Sort Events
- Sort by:
    - x-coordinate (ascending).
    - Height (descending for start events, ascending for end events).
- Sweep Line Algorithm with Priority Queue
- Maintain a max-heap (priority queue) to track active building heights.
- Iterate through sorted events:
    - Insert height for a start event.
    - Remove height for an end event.
    - If the max height changes, record the new skyline point.

Code :

```
import java.util.*;

class Solution {
    public List<List<Integer>> getSkyline(int[][] buildings) {
        List<int[]> events = new ArrayList<>();

        // Convert buildings to events
        for (int[] b : buildings) {
            events.add(new int[]{b[0], -b[2]}); // Start event (negative height for sorting)
            events.add(new int[]{b[1], b[2]});  // End event
        }

        // Sort events: First by x-coordinate, then height (start before end)
        Collections.sort(events, (a, b) ->
            a[0] != b[0] ? Integer.compare(a[0], b[0]) : Integer.compare(a[1], b[1])
        );

        List<List<Integer>> result = new ArrayList<>();
        PriorityQueue<Integer> maxHeap = new PriorityQueue<>(Collections.reverseOrder());
        maxHeap.add(0); // Ground level

        int prevHeight = 0;

        // Process each event
        for (int[] event : events) {
            int x = event[0], height = event[1];

            if (height < 0) { // Start of a building
                maxHeap.add(-height);
            } else { // End of a building
                maxHeap.remove(height);
            }

            int currentMax = maxHeap.peek();
            if (currentMax != prevHeight) { // If max height changes, record new skyline point
                result.add(Arrays.asList(x, currentMax));
                prevHeight = currentMax;
            }
        }
        return result;
    }
}
```

Output:



Accepted Runtime: 1 ms

Input

```
buildings =
[[2,9,10],[3,7,15],[5,12,12],[15,20,10],[19,24,8]]
```

Output

```
[[2,10],[3,15],[7,12],[12,0],[15,10],[20,8],[24,0]]
```

Expected

```
[[2,10],[3,15],[7,12],[12,0],[15,10],[20,8],[24,0]]
```