**Sweep line Algorithm**

Line Sweep (or Sweep Line) is an algorithmic technique where we sweep an imaginary line (x or y axis) and solve various problem.

There would be an event (entry or event) and based on that we update the information and then return result.

A drawing of circles and lines

Description automatically generated

Sweep line helps us find intersecting points in a region.

A drawing of a rectangle

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At 1 we have 2 intersecting points.

Then the story is changing at 3 where now we have 3 intersecting points.[between 1&3 everynumber will have 2 intersecting points i.e. 2 as well].

It continues till 6, after that story again changes and 7 onwards we have 2 intersecting points. Then at 8 we only have 1 intersecting point.

The point/number where the value of intersecting points is changing is *critical point.*

Between 3 and 6 the intersecting points are points are same and both are critical points because even if we don’t write the numbers between the 3 and 6 we know they have the same frequency.[See the images]. (very important hai!!!!)

At last, this algorithm helps us find the intersection points.

See the image above .

In Sweep line algorithm – we hare using -> prefix array

* Map(sorted one) because we want overcome burden of the prefix array coz it stores the redudndent values as well and we only want to store the critical point with their frequencies rest in between value we calculate.
* How will we calculate the in between values? Using Binary search. E.g. say we need ans for 4. So using BS we will find the idx of the 4 or the place where 4 should be present(we have done this in BS questions).
* We will find the lower bound of 4 i.e. if 4 is not present our program will return the ceil of it i.e 7. Then we will check that it is not equal to 4 so we will check a value before it which is 3. (TreeMap helps us here and come handy if you want to write anything from scratch).

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A blackboard with blue text and circles

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Start of the interval pe +1

(End of the interval+1) pe -1

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Pehle 1-5 mein +1 then

2-3 mei +1

Then 3-5 mein +1;

O(n^2) prefix array approach

Sweepline

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We have seen the sweepline on an array.

But we will take ordered map and store things like

Map[1]=1

Map[2] = 1

Map[3]=1

Map[4]=-1

Map[6]=-2

By this we will achieve the functionality of the array but we will not waste the space like we do in an array. But sometimes the rightmost element can get missed Map[5]=2 is missing. Coz we use this for the collision or the intersecting point.

Choose the data structure according to your goal. Use array when you want to track the values in between the start and end. Use Map when you don’t need inbetween values.