Homework 3

Count Tuples

given an array `arr` and integer `d`, count there are how many tuples `(i, j, k)` satisfy following conditions:

- `i < j < k`
- `arr[i] <= arr[j] <= arr[k]`
- `arr[j] - arr[i] <= d && arr[k] - arr[j] <= d`

Example

Given 5 numbers and d=2, the only one tuples found is `(0, 3, 4)`.

```
5 2
3 8 1 5 6
```

```
1
```

Array Product

given an array `arr`, it's guranteer that each number in `arr` appears exactly twice. define a function `f(x)`, says that the indecies of `x` is `i` and `j`, the value of `f(x)` can be obtained by following equation:

```
(product(arr[k] where i < k < j && arr[k] < x) % 1000000007
```

if none of k satisfy `arr[k] < arr[i]`, then `f(x) = 1`.

Array Product

compute the product of all values of $f(x)$ for each unique x and print the result modulo 1000000007, as the answer may be large.

Example

because `f(19) = 9` (= 3 * 3) and `f(3) = 1` (no k satisfies given conditions), the product of them is 9.

```
4
19 3 3 19
```

```
9
```

Minimal BST Subtree Product

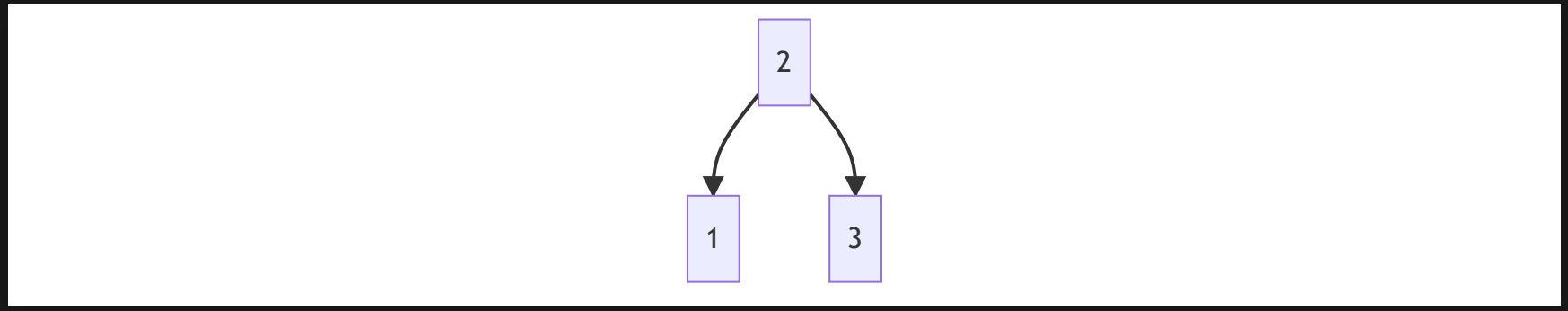
```
p(BST) = sum(node.val * node.depth for node in BST)
```

p.s. depth of root is 1.

given some numbers, find minimal `p(T)` where `T` is BST constructed from those numbers. (there might be many possible BSTs)

Example

$$p(R) = 2 * 1 + 1 * 2 + 3 * 2 = 10$$



Example

```
3
14 18 11
```

```
72
```

Count Point Groups

given n points on 2D plane and a distance d, we say that two points a, b are "connected" if `abs(a.x - b.x) + abs(a.y - b.y) <= d`.
a point belongs to a group if (1) it is the only point in the group or (2) it is connected to another points in the group.

Example

The first 2 points form a group. and the 3rd one is the second group.

```
3 2
0 0
1 1
100 100
```

```
2
```