PW SKILLS

0	1	2	3	4	5
1	5	2	8	3	4

Inversion

$\boxed{\begin{array}{l} i < j \\ arr(i) > arr(j) \end{array}}$

1 $\longrightarrow$

(5,2), (5,3), (5,4) — 5 $\longrightarrow$ 2, 3, 4 — 3

2 $\longrightarrow$

(8,3), (8,4) — 8 $\longrightarrow$ 3, 4 — 2

3 $\longrightarrow$

4 $\longrightarrow$

$\boxed{count = 5}$ (3+2)

$O(n^2)$

```
inversion(arr, n) {
    for(i=0 to n-1){
        for(j=i+1 to n){
        if(arr(i)>arr(j)){
            count +=1;
        }
    }
return count }
```

0	1	2	3	4
5	4	3	2	1

Decreasing order

$i < j$

$arr(i) > arr(j)$

$\Downarrow$

Worst case scenario

5 —— 4, 3, 2, 1 (4)

4 —— 3, 2, 1 (3)

3 —— 2, 1 (2)

2 —— 1 (1)

10

Increasing order

0	1	2	3	4
1	2	3	4	5

Best case scenario

$$\left.\begin{array}{l} 1 \longrightarrow 0 \\ 2 \longrightarrow 0 \\ 3 \longrightarrow 0 \\ 4 \longrightarrow 0 \\ 5 \longrightarrow 0 \end{array}\right\}$$

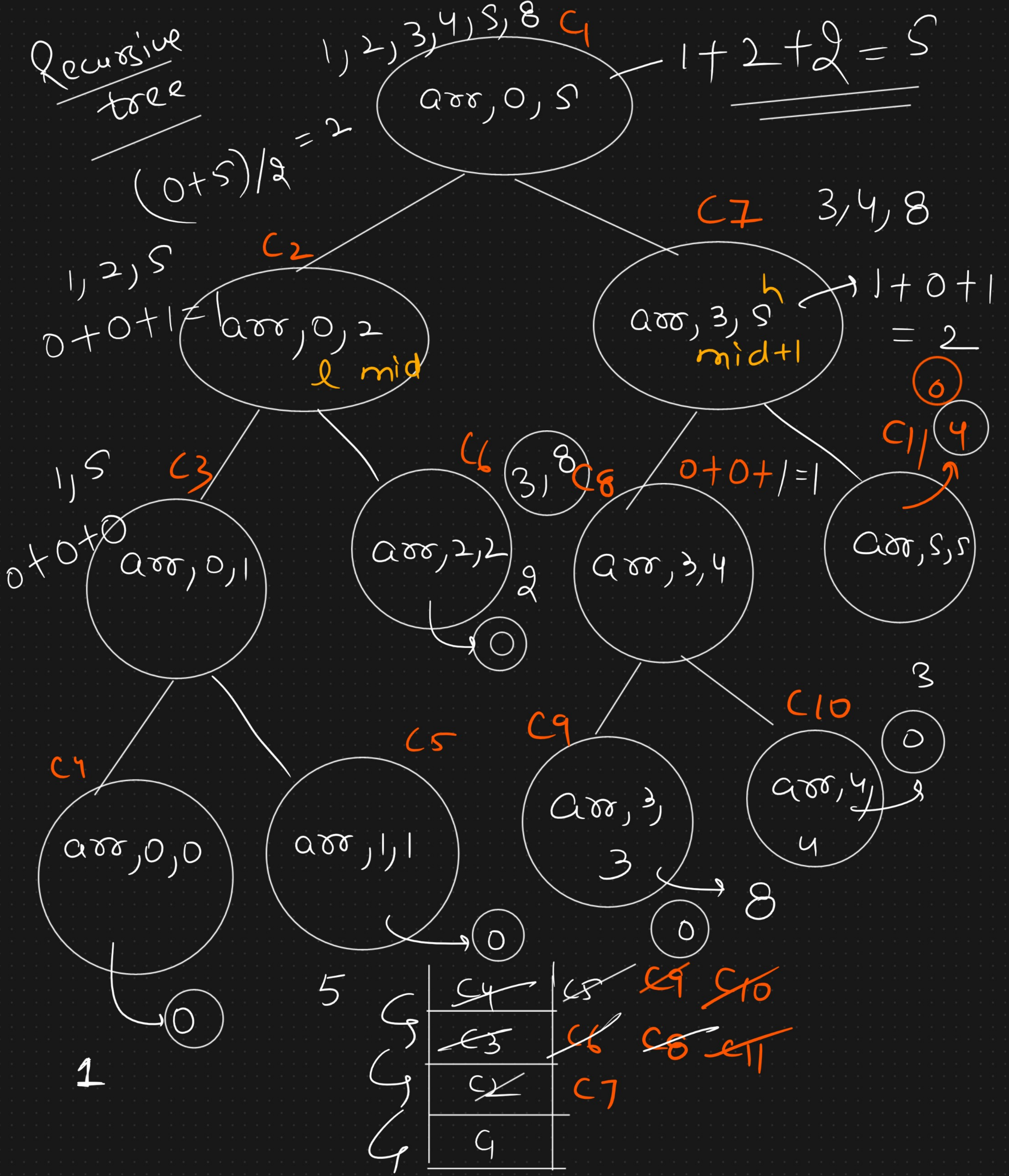
inversion = 0

0
5

$\longrightarrow 0$

Divide & Conquer

0	1	2	3	4	5
1	5	2	8	3	4



```
inversionCount(arr, l, h) {
    if (l < h) {
        mid = l + (h-l)/2                                  Divide  —  c

        count += inversionCount(arr, l, mid)               conquer  —  2T(n/2)
        count += inversionCount(arr,
                                mid+1, h);

        count += mergeProcedure                            Combine  →  n
                        (arr, l, mid, h);
    }
    return count;
}
```

Recurrence Relation

$$T(n) = 2T\left(\frac{n}{2}\right) + n$$

$$= O(n \log n)$$