MERGING :- is a process of combining two sorted list into single list.

Eg:-

	A	B	C(Merge)	
2-sorted list ⇒	i→ 2	5 ←j	2	←K
A & B ⇒	i→ 8	9 ←j	5	←K
	i→ 15	12	8	←K
	i→ 18	17	9	
		←j	12	Same way
			15	
			17	
			18	

If A[i] < B[j] then A[i] Copy to C
i++

Now check
A[i] < B[j]
A[2] < B[1]
8 < 5
then Copy B[j] to C
j++

directly paste

In general Let m element → 0

Let n element

(m+n) element

⇓

$O(m+n)$ complexity

ALGORITHM MERGE (A, B, m, n)

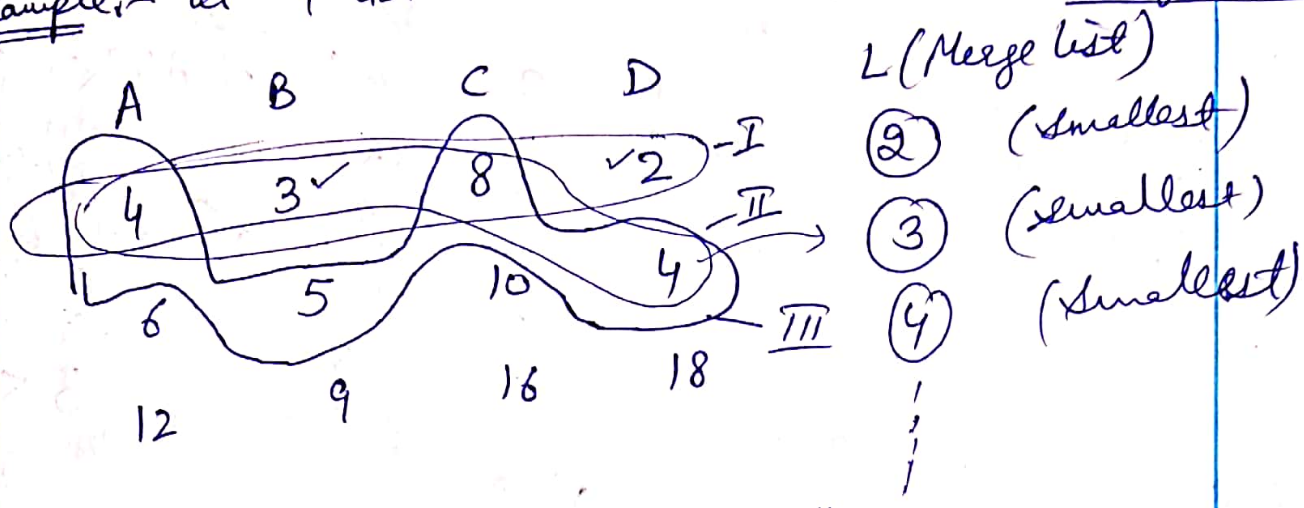
```
{
    i=1 , j=1 , k=1
    while (i≤m && j≤n)
    {   if A[i] < B[j]
            c[K++] = A[i++];      ⇒ // or c[K] = A[i]
                                        i++;
                                        K++;
        else
            c[K++] = B[j++];
    }
    for ( ; i≤m ; i++)
            c[K++] = A[i] ;
    for ( ; j≤n ; j++)
            c[K++] = B[j] ;
}
```

Same or Current place of i don't initialize it

// when size of Two list Diff:- then for Remaining elements then Simply Copy in C

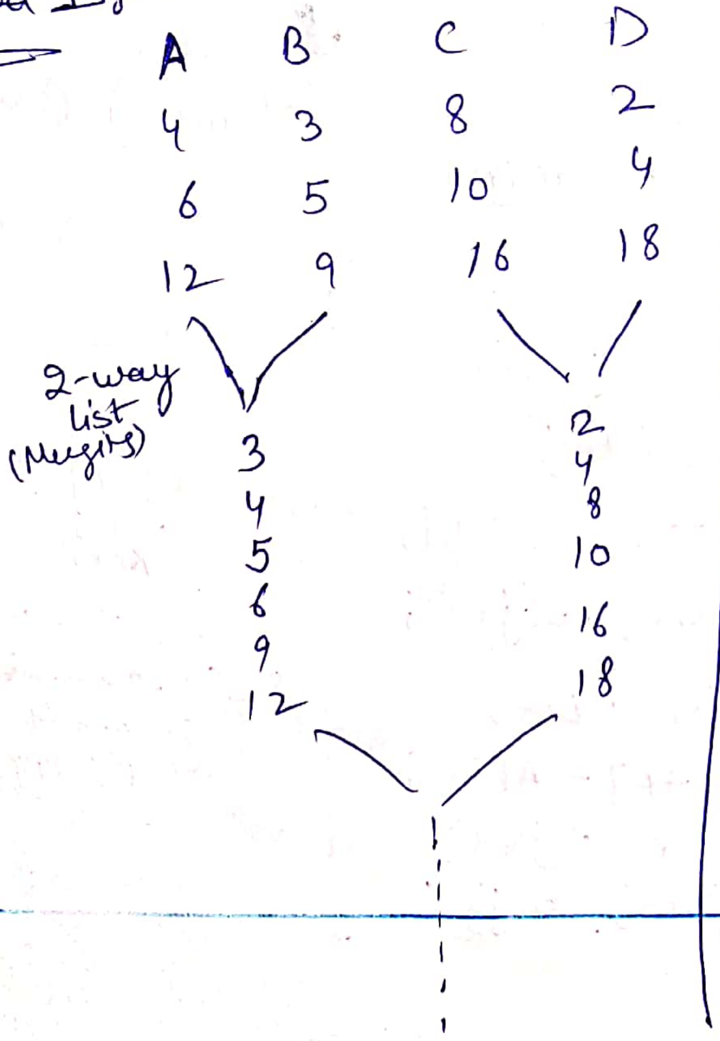
✱ If more than 2 list is Given than How Merging is done?

Example:- let 4 list we have to Merge called 4-way Merge List.

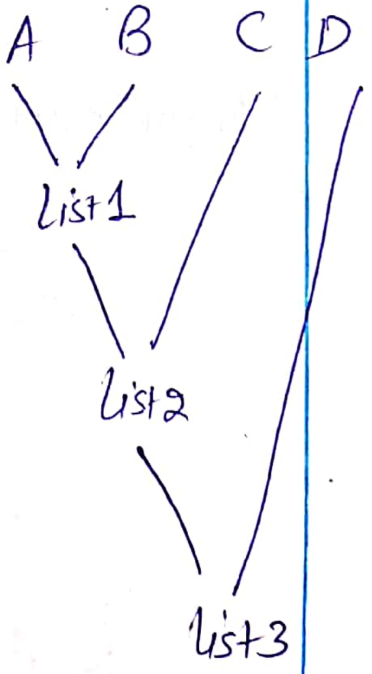


If M- list have to merge than called as M- way Merging

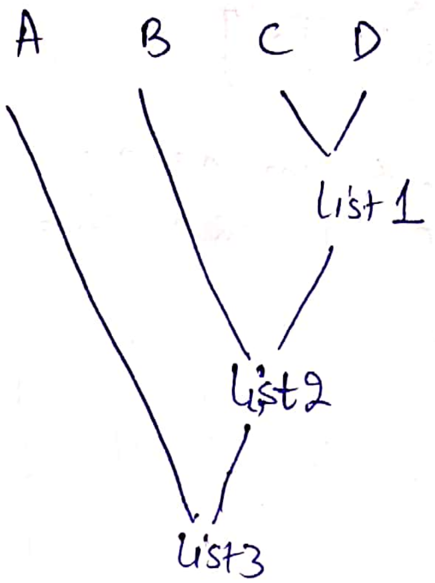
Method 1:-



Method 2:-



Method 3:- & Various Method---



* So, when we go for 2-way Merging & you have multiple List Then you can Merge them in various patterns.

* 2-way Merge Sort :-

2-way merge Sort is a iterative process / ~~repeating~~ repeating procedure using loop.

& Merge Sort → is a recursive procedure using recursive algorithm.

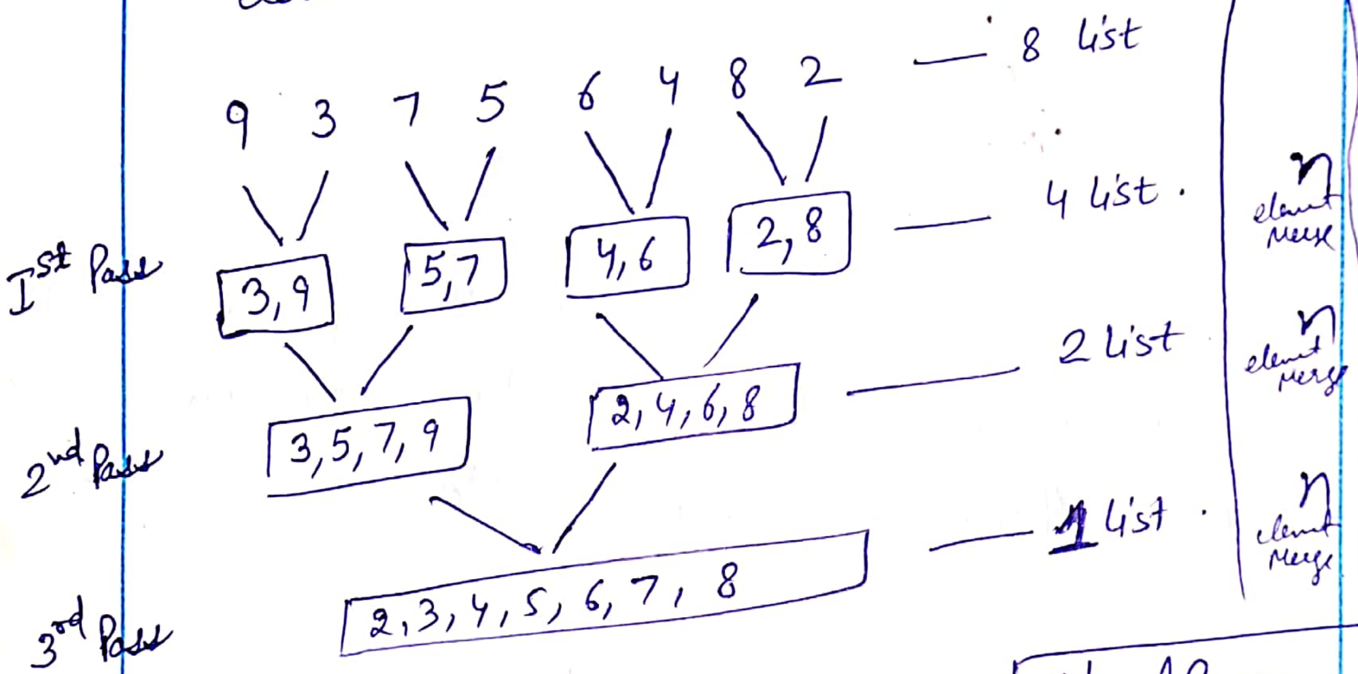
Examples:-

2-way Merge Sort

A =

1	2	3	4	5	6	7	8
9	3	7	5	6	4	8	2

Assume that each element in array is a list. So, there are 8 list containing 1 element in each list.



$$\frac{\frac{\frac{8}{2}}{2}}{2} = 1$$

$$\frac{8}{2^3} = 1$$

$$8 = 2^3$$

$$\boxed{\log_2^8 = 3}$$

$$\boxed{\text{No. of Passes required} = \log n}$$

$$\boxed{O(n \log n)}$$

MERGE SORT :-

```
MERGE-SORT(A, p, r)
if p < r
    q = ⌊(p+r)/2⌋
    MERGE-SORT(A, p, q) — T(n/2)
    MERGE-SORT(A, q+1, r) — T(n/2)
    MERGE(A, p, q, r) — n (element)
```

When something is raising by 2 every time & is power of 2 lastly.

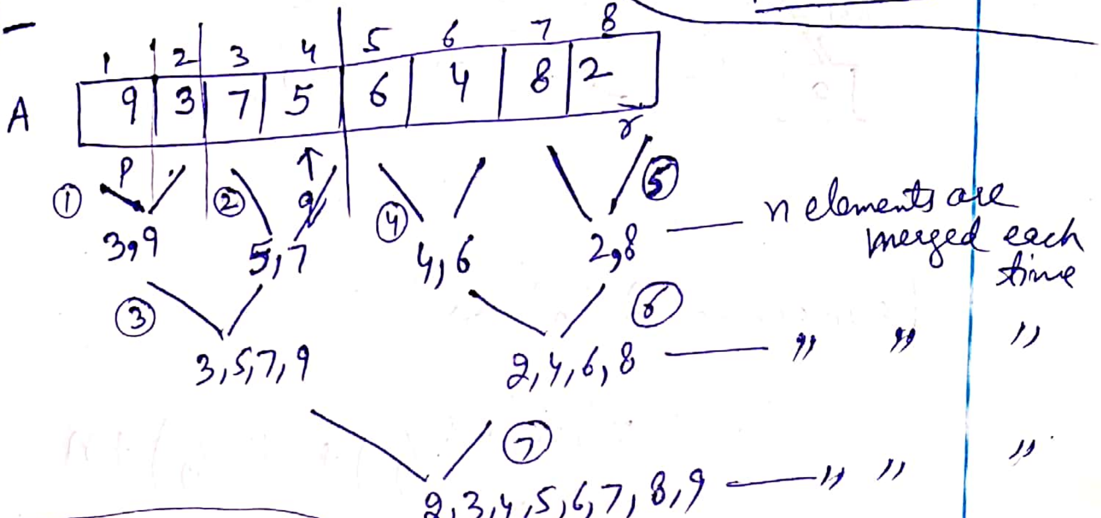
So, ~~[illegible]~~ $\frac{8}{2^3} = 1$

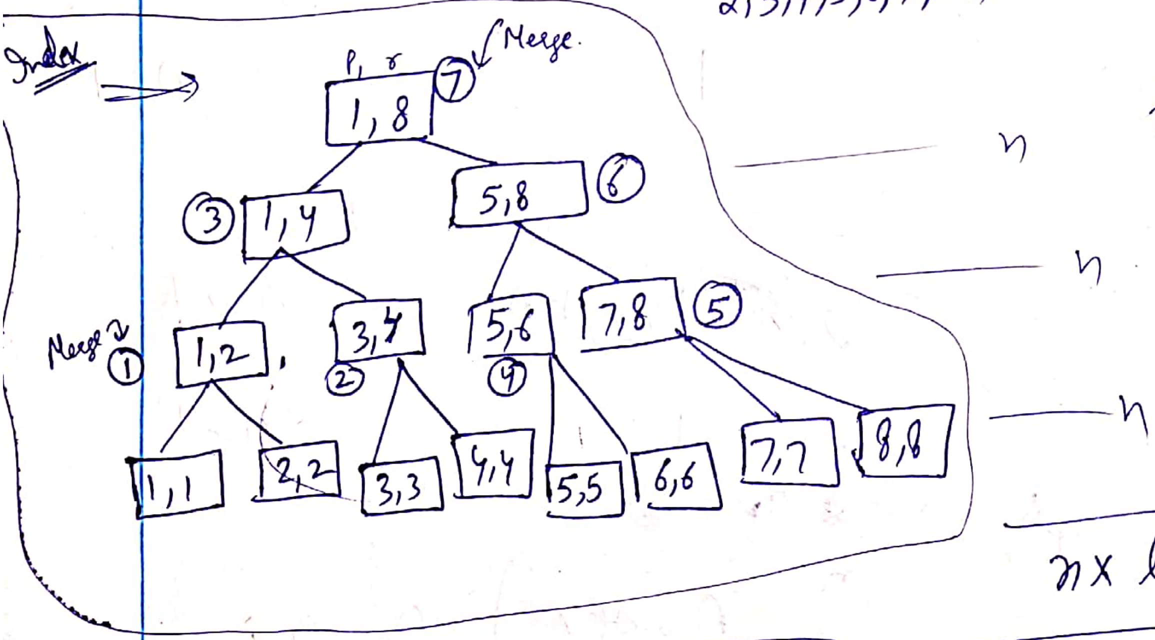
$8 = 2^3$

$\log_2 8 = 3$

$\boxed{\log n}$ — In general

Example:-





for 8 element = 3 levels

ie $\log_2 8 = 3$

~~[illegible]~~

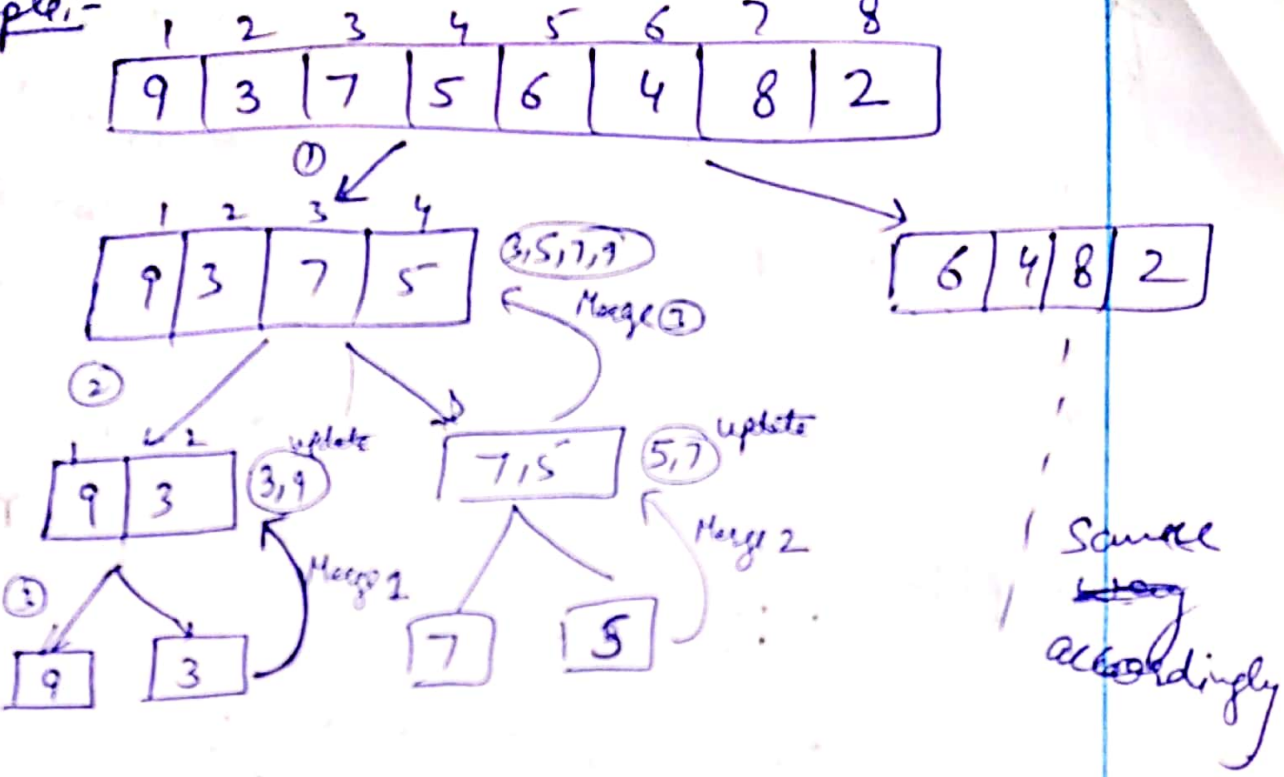
$n \times \log n$

total level

$\boxed{O(n \log n)}$

Acc. to algorithm:-

Example:-



Recurrence Relation :-

$$T(n) = \begin{cases} T(n/2) + T(n/2) + n & n > 1 \\ 1 & n = 1 \end{cases}$$

$$= \begin{cases} 2T(n/2) + n & n > 1 \\ 1 & n = 1 \end{cases}$$

Using Master's Theorem

$O(n \log n)$ Ans.