

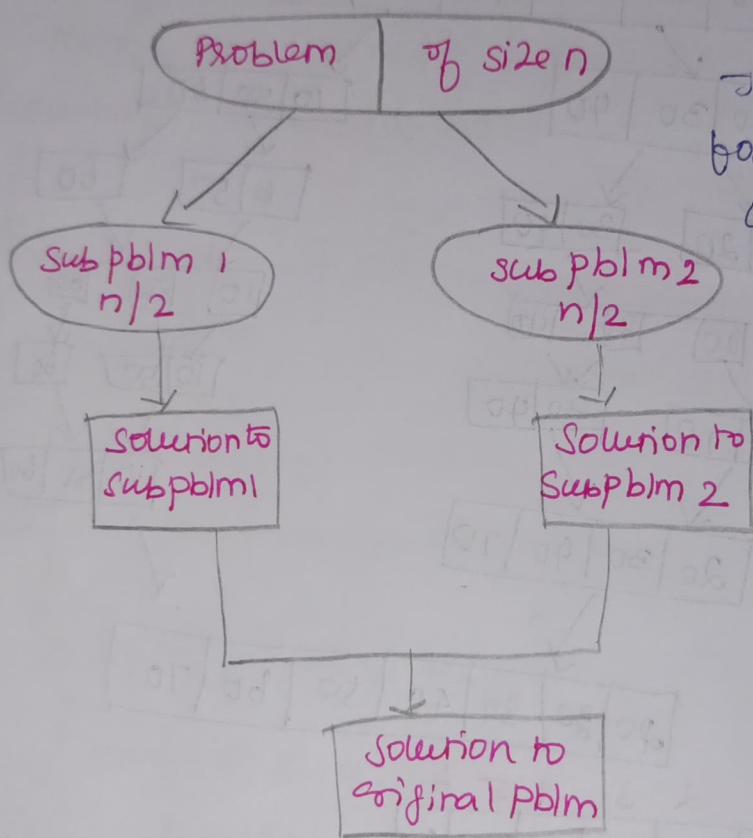
DIVIDE AND CONQUER

Divide and conquer algorithm works according to the following things.

↳ A problem instance is divided into several smaller instance of the same problem, of same size.

↳ Smaller instance are solved recursively

↳ If needed, solution from smaller instance can be solved and combined to get a solution.



This is suitable for parallel computations.

We can divide the n to size b .

$$T(n) = a \tau(n/b) + b(n)$$

Time for size n no of subinstances time for size n/b .
↳ time required for dividing problems.

Merge sort:

This uses divide and conquer strategy.

here division is carried out in dynamic manner.

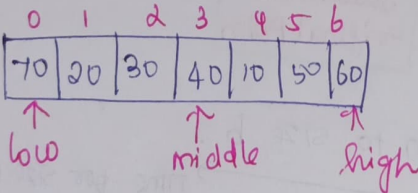
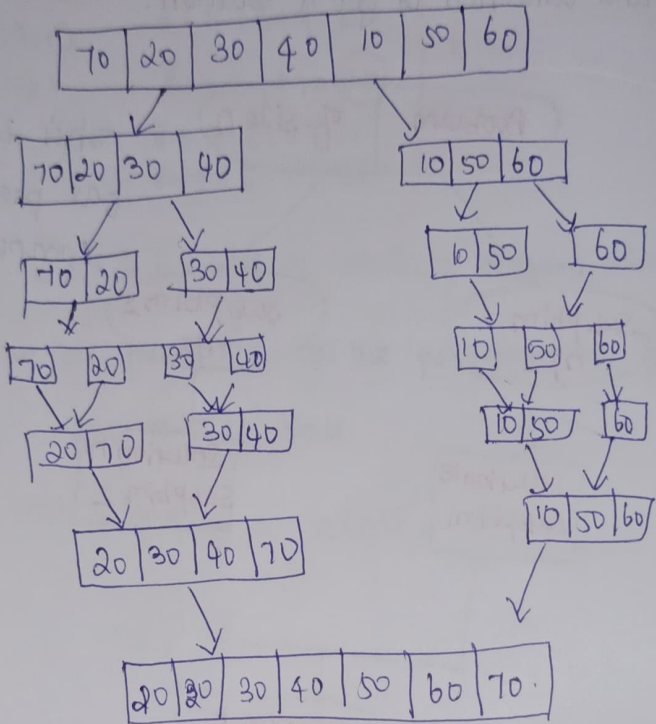
There are two steps

→ divide

→ conquer.

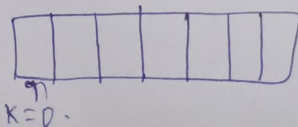
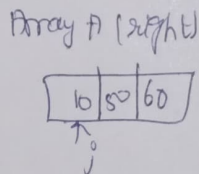
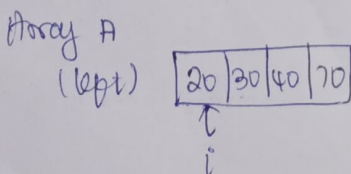
Ex:

70 20 30 40 10 50 60



The last step before has two sub arrays.

The two sublists are



Initially $k=0$:

check if $A[i] < A[j]$

Algorithm: Algorithm merge sort [int $A[0 \dots n-1]$]

// low as starting, high as ending

// o/p - sorted array.

if (low < high) then

{
mid = (low + high) / 2 -

merge sort (A, low, mid);

merge sort (A, mid+1, high);

Combine (A, low, mid, high);

↓

Algo:

{
k ← low;

i ← low;

j ← mid+1;

while (i ≤ mid and j ≤ high) do

{
if $A[i] < A[j]$ then

{
temp[k] ← A[i]

i ← i+1

k ← k+1

}

else

temp[k] ← A[j]

j ← j+1

k ← k+1

}

// Copying remaining elements of left sublist to temp.

while (i ≤ mid) do

{
temp[k] ← A[i]

i ← i+1

k ← k+1 }

Initially $k=0$

check if $A[i] \leq A[j]$

$20 \leq 10$ (false)

go to else part

$temp[k] \leftarrow A[j]$

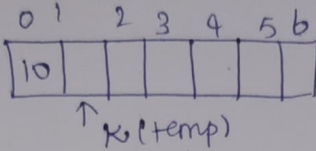
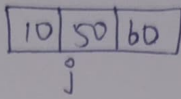
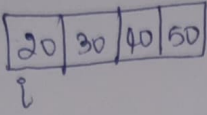
$j \leftarrow j+1$

$k \leftarrow k+1$

$temp[0] = 10$

$j = 1$

$k = 1$



Again check if $A[i] \leq A[j]$ $20 \leq 50$ (true).

do $temp[k] \leftarrow A[i]$

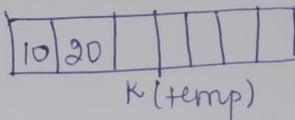
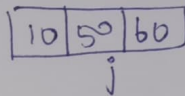
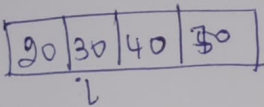
$i \leftarrow i+1$

$k \leftarrow k+1$

$temp[0] \leftarrow 50$

$i = 7$

$k = 2$



Again check if $A[i] \leq A[j]$ $30 \leq 50$ (true)

do $temp[k] = A[i]$

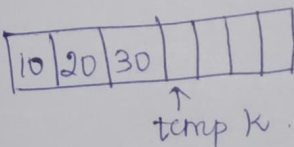
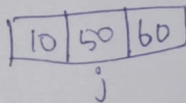
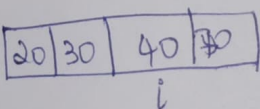
$i \leftarrow i+1$

$k \leftarrow k+1$

$temp[2] \leftarrow 30$

$i \leftarrow 2$

$k = 3$



Again check if $A[i] \leq A[j]$ $40 \leq 50$ (true)

$temp[k] \leftarrow A[i]$

$i \leftarrow i+1$

$k \leftarrow k+1$

$temp[3] \leftarrow 40$

$i = 3$

$k = 4$