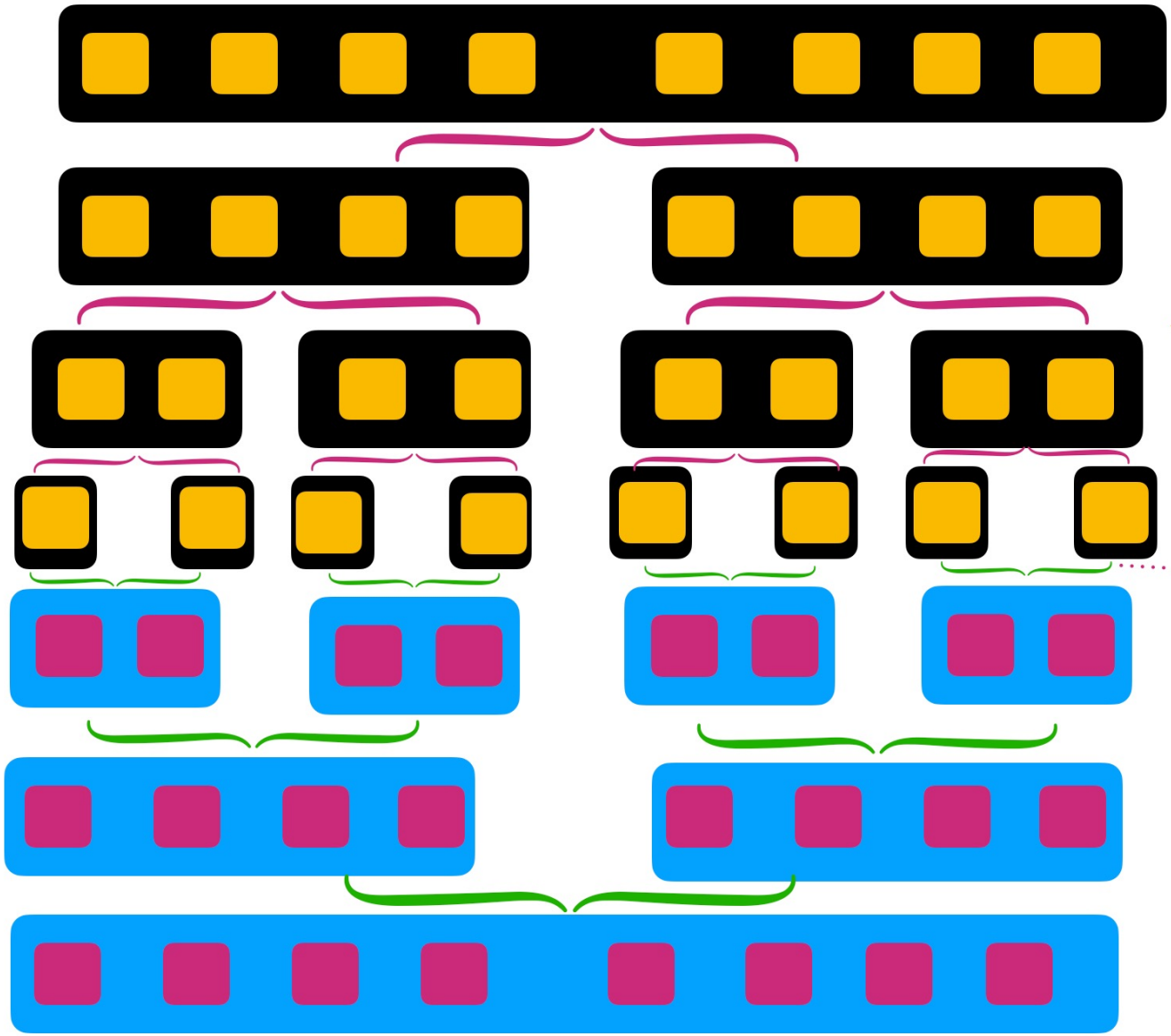
Merge Sort uses divide and conquer pattern.

Merge sort divides the problem into possible small problems then applies sorting recursively.

Divide => divides source collection into possible n/2 sub problems recursively.

Conquer=> Applies the sorting at subproblem level (compare, swap & merge) then repeats recursively.



Divide

Divide=> Break up the problem into smallest possible sub problems.

Compare, Swap & Merge

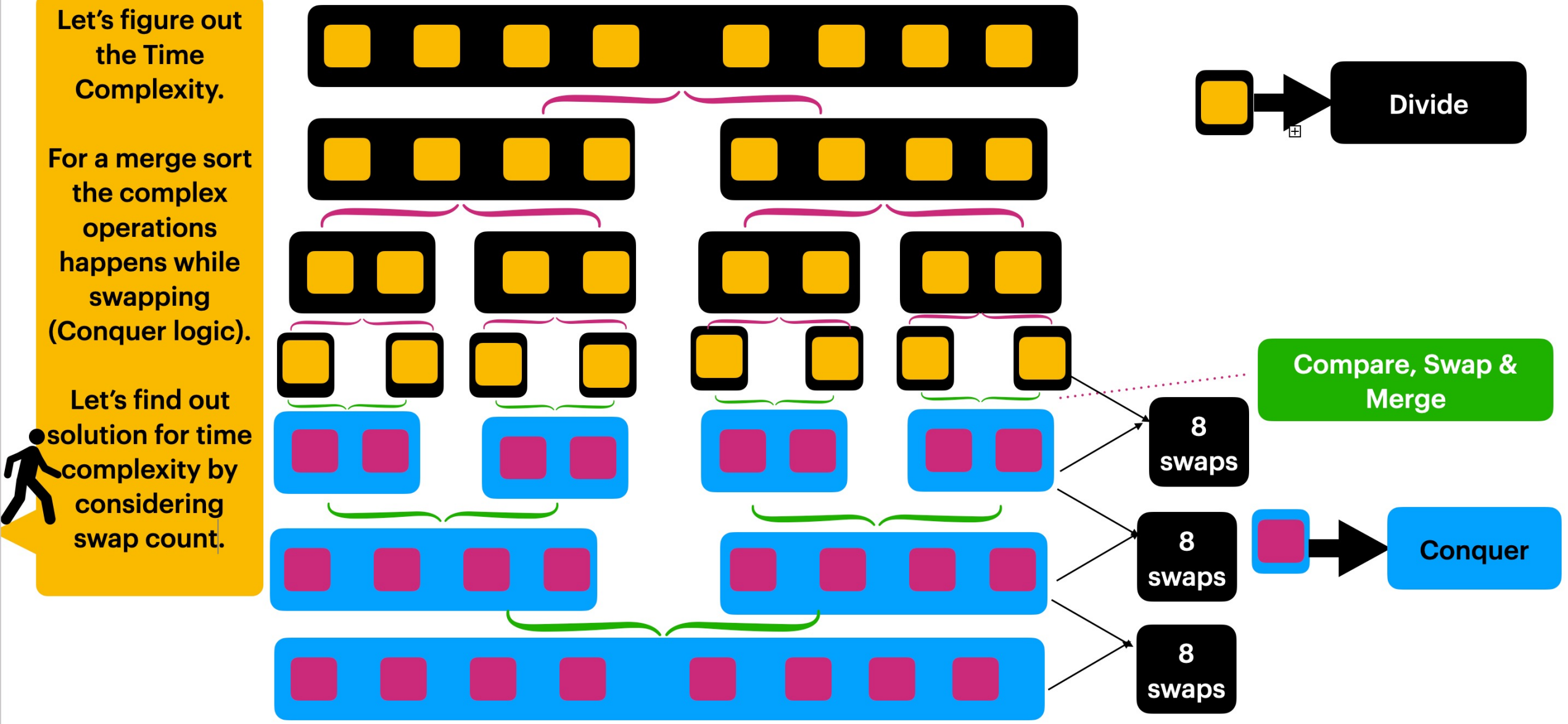
Conquer

Conquer=> Figure out the solution for the smallest sub problem, then apply the same technique to solve larger problems recursively .

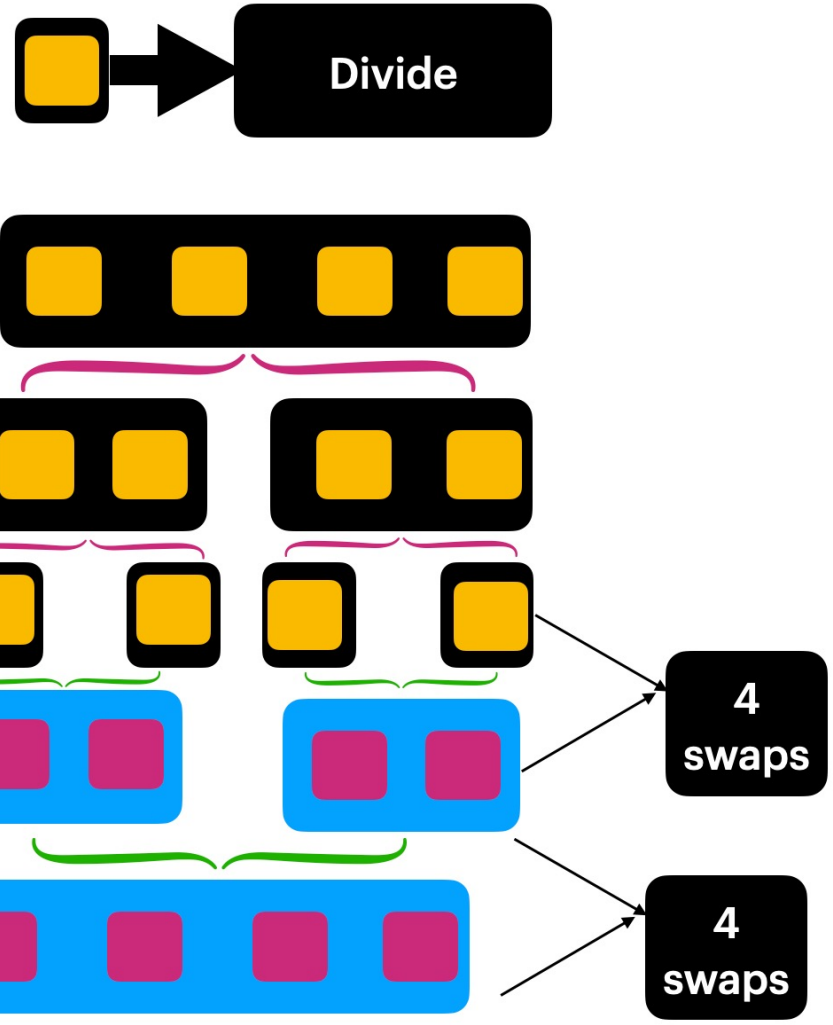
Let's figure out the Time Complexity.

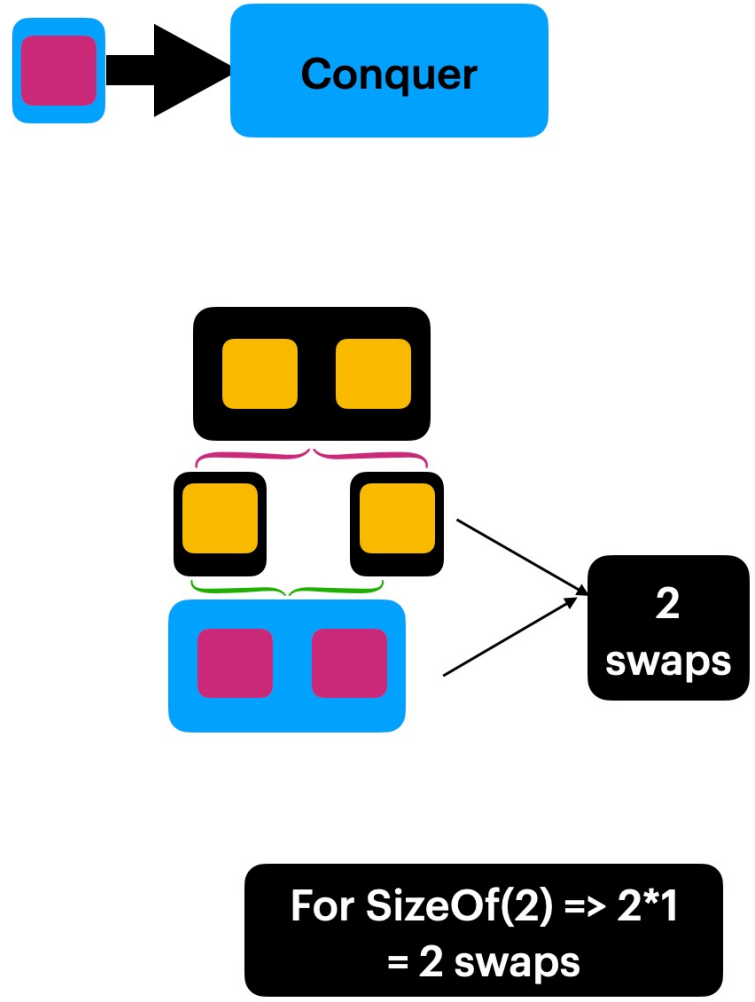
For a merge sort the complex operations happens while swapping (Conquer logic).

Let's find out solution for time complexity by considering swap count.



Merge Sort taken 24 swaps If the size of the array is 8.
SizeOf(8) => 8swaps in 3steps = 8*3 = 24 swaps





Merge Sort taken 8 swaps If the size of the array is 4.
SizeOf(4) => 4swaps in 2steps = 4*2 = 8 swaps

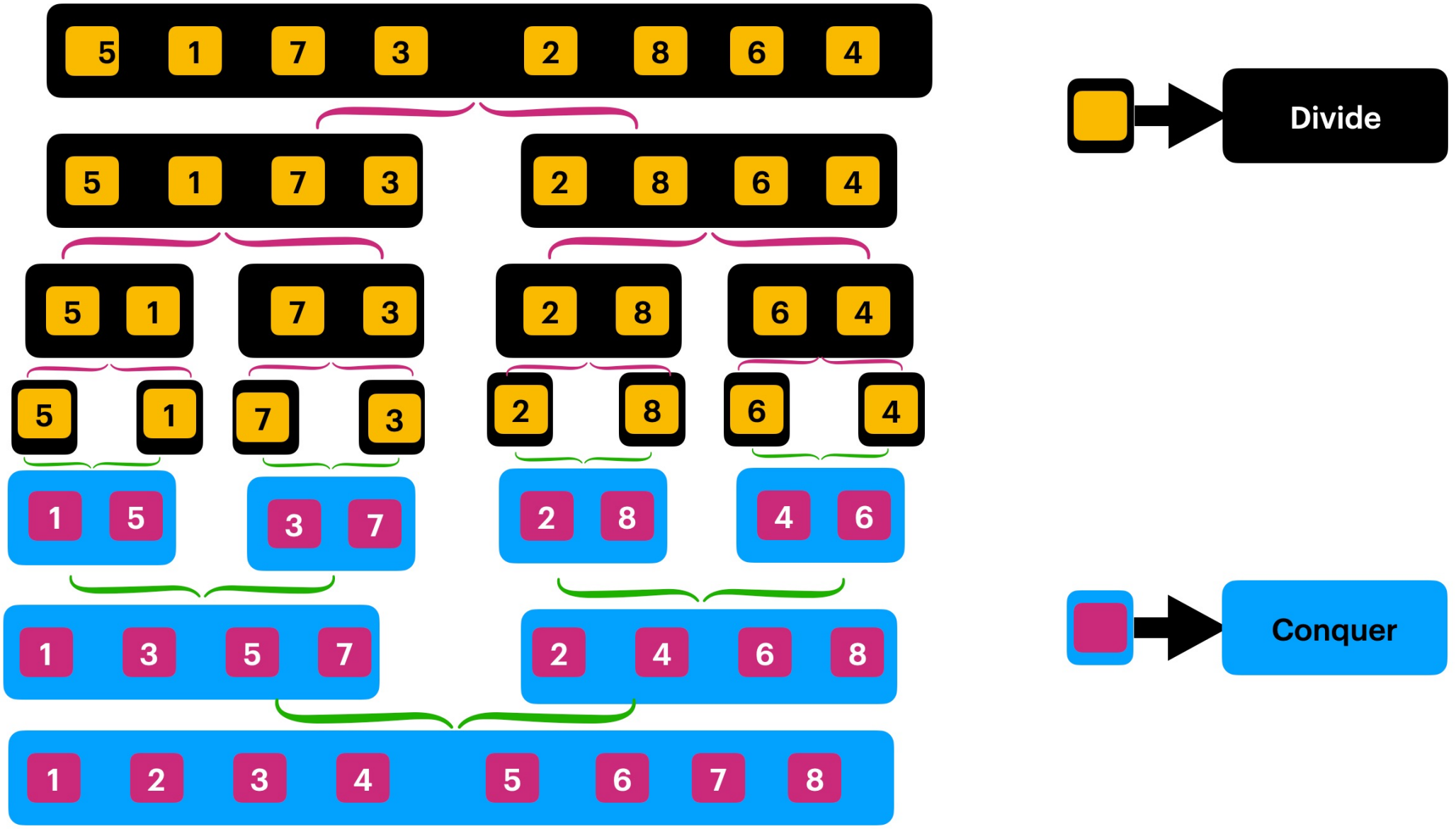
MergeSort :

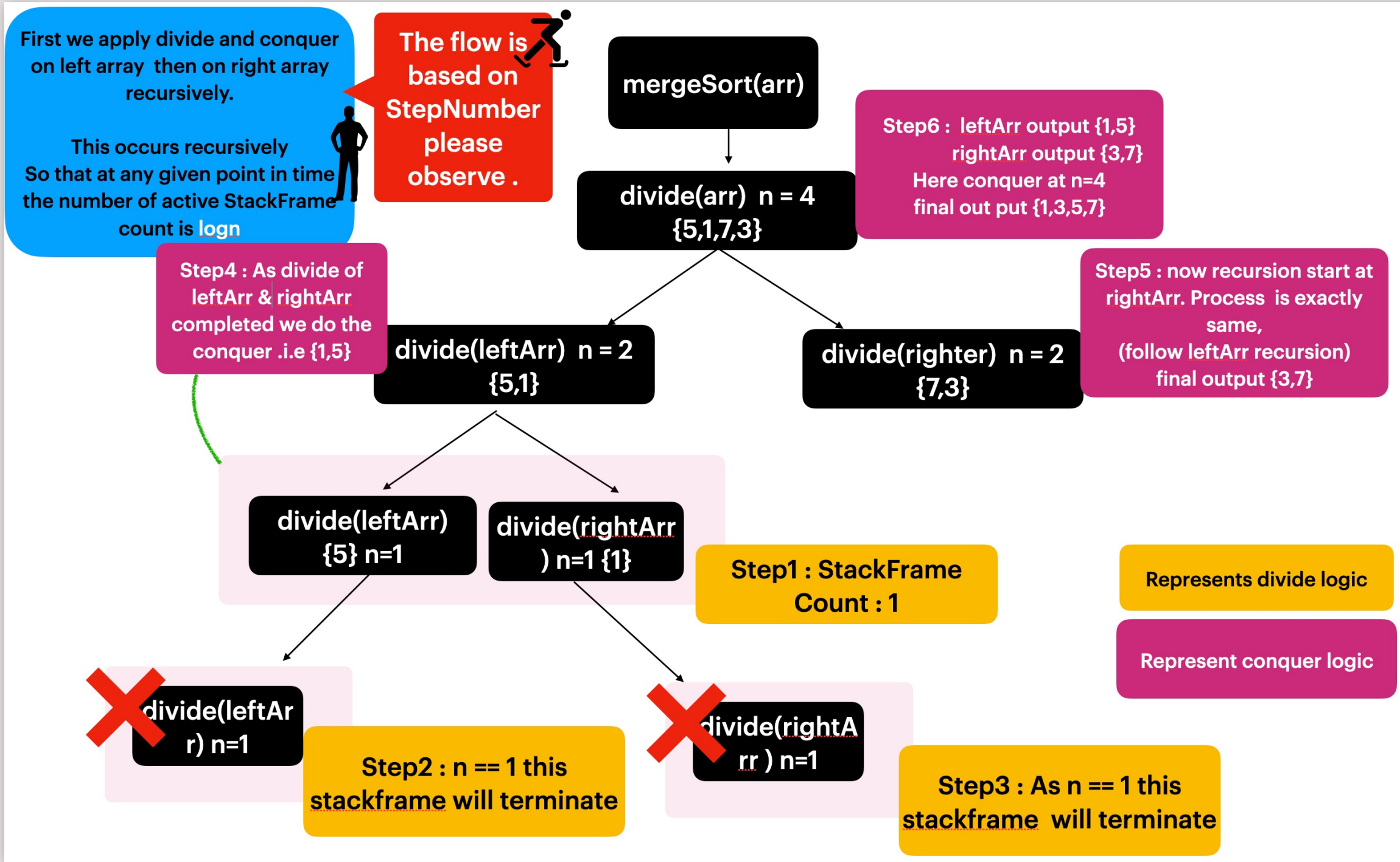
For Size Of (2) = 2 swaps => 2 * 1 = 2 * log2^1
For Size Of (4) = 8 swaps => 4 * 2 = 4 * log2^2
For Size Of (8) = 24 swaps => 8 * 3 = 8 * log2^3
Finally for a Merge Sort we can derive a time complexity as nlogn.

Time Complexity = O(nlogn)
Space Complexity = O(n)
Recursive / Non Recursive = Recursive
Stability = Stable

{4,1,4,3}
{4,1} {4,3}
{4} {1} {4} {3}
{1,4} {3,4}
{1,3,4,4}

Internal /Eternal Sort = Can be used for both.
Comparison Sort = Yes
Swap = O(nlögn)


5 1 7 3 2 8 6 4
5 1 7 3
2 8 6 4
5 1
7 3
2 8
6 4
5
1
7
3
2
8
6
4
1 5
3 7
2 8
4 6
1 3 5 7
2 4 6 8
1 2 3 4 5 6 7 8
Divide
Conquer


First we apply divide and conquer on left array then on right array recursively.
This occurs recursively So that at any given point in time the number of active StackFrame count is logn
The flow is based on StepNumber please observe .
mergeSort(arr)
divide(arr) n = 4 {5,1,7,3}
Step6 : leftArr output {1,5} rightArr output {3,7} Here conquer at n=4 final out put {1,3,5,7}
Step4 : As divide of leftArr & rightArr completed we do the conquer .i.e {1,5}
divide(leftArr) n = 2 {5,1}
divide(righter) n = 2 {7,3}
Step5 : now recursion start at rightArr. Process is exactly same, (follow leftArr recursion) final output {3,7}
divide(leftArr) {5} n=1
divide(rightArr) n=1 {1}
Step1 : StackFrame Count : 1
Represents divide logic
Represent conquer logic
divide(leftAr r) n=1
Step2 : n == 1 this stackframe will terminate
divide(rightA rr) n=1
Step3 : As n == 1 this stackframe will terminate

Finally About Merge Sort :

Merge Sort follows the divide & conquer pattern. Which divides array into possible sub problems then do the conquering .

As the merge sort does the sorting using Out-Place algorithm it takes O(n) Space complexity.

MergeSort is good for External Sorting.

Time Complexity = O(nlogn)
Space Complexity = O(n)
Recursive / Non Recursive = Recursive
Stability = Stable

{4,1,4,3}
{4,1} {4,3}
{4} {1} {4} {3}
{1,4} {3,4}
{1,3,4,4}

Internal /Eternal Sort = Can be used for both.
Comparison Sort = Yes
Swap = O(nlögn)