

DESIGN AND ANALYSIS OF ALGORITHMS



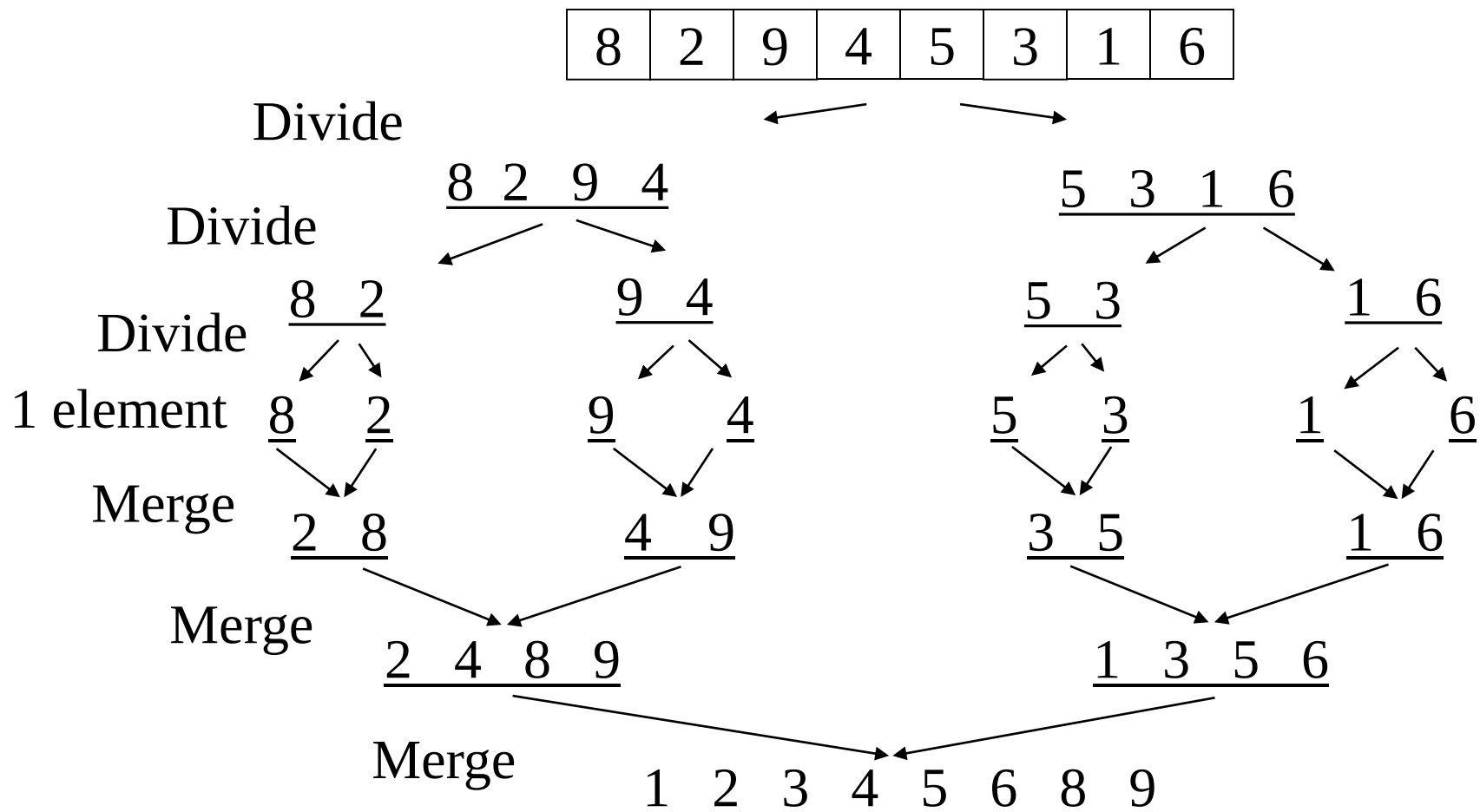
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Divide And Conquer

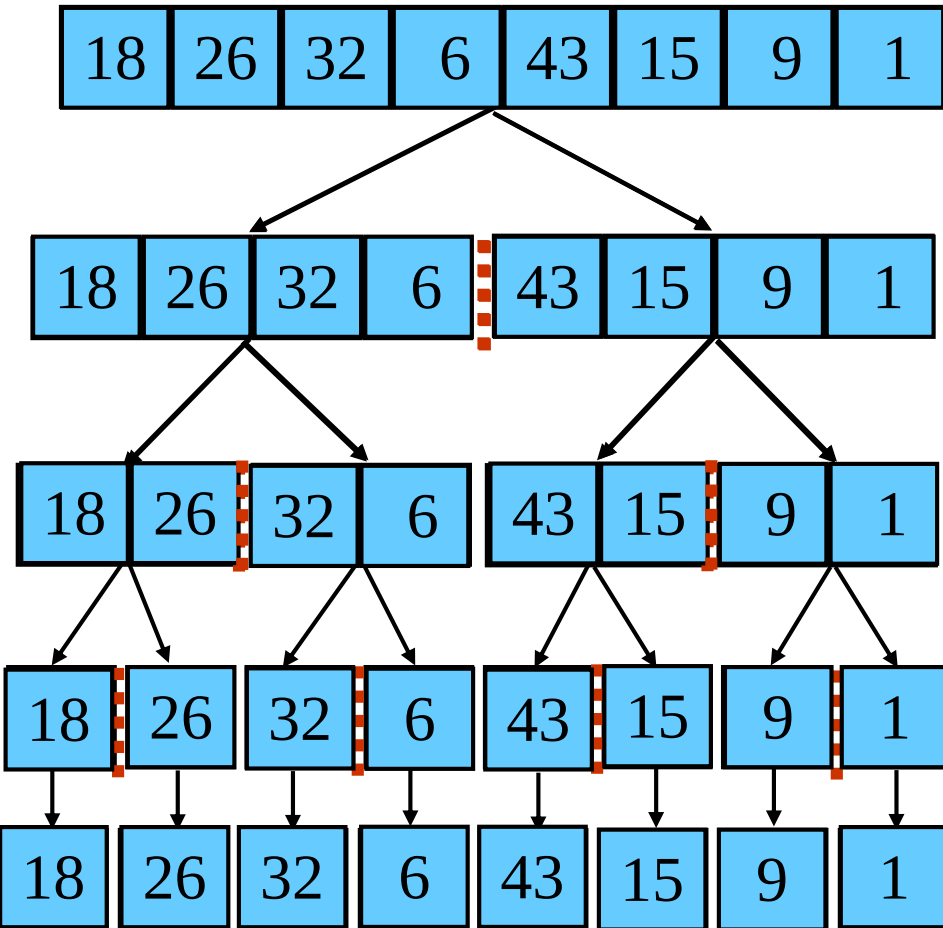
- Merging two lists of **one element** each is the same as sorting them.
- Merge sort divides up an unsorted list until the above condition is met and then sorts the divided parts back together in pairs.
- Specifically this can be done by recursively dividing the unsorted list in half, merge sorting the left side then the right side and then merging the left and right back together.

Mergesort Example

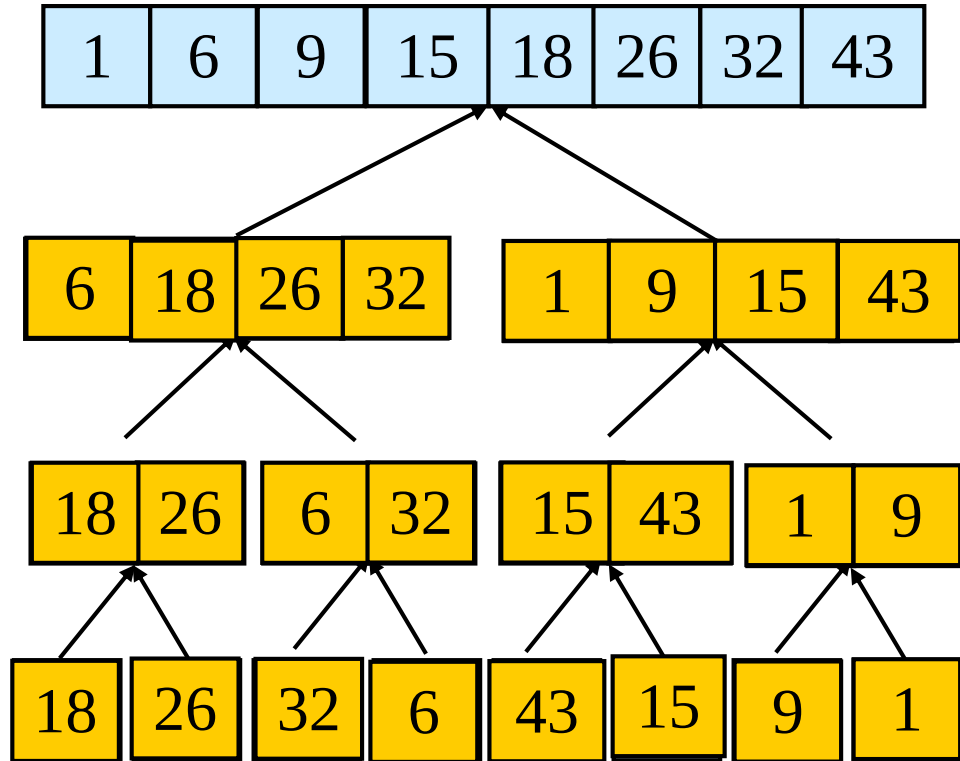


Merge Sort – Example

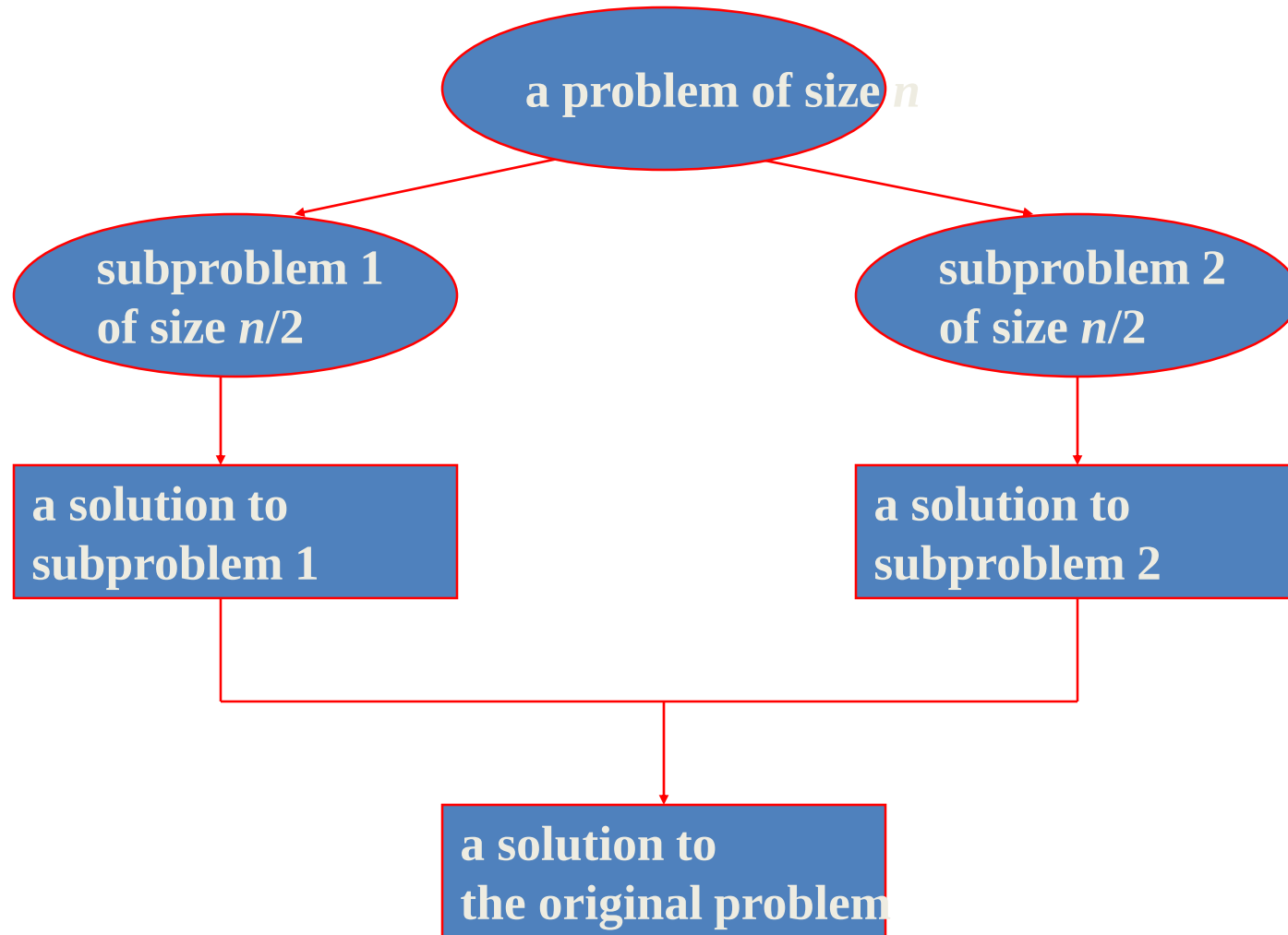
Original Sequence



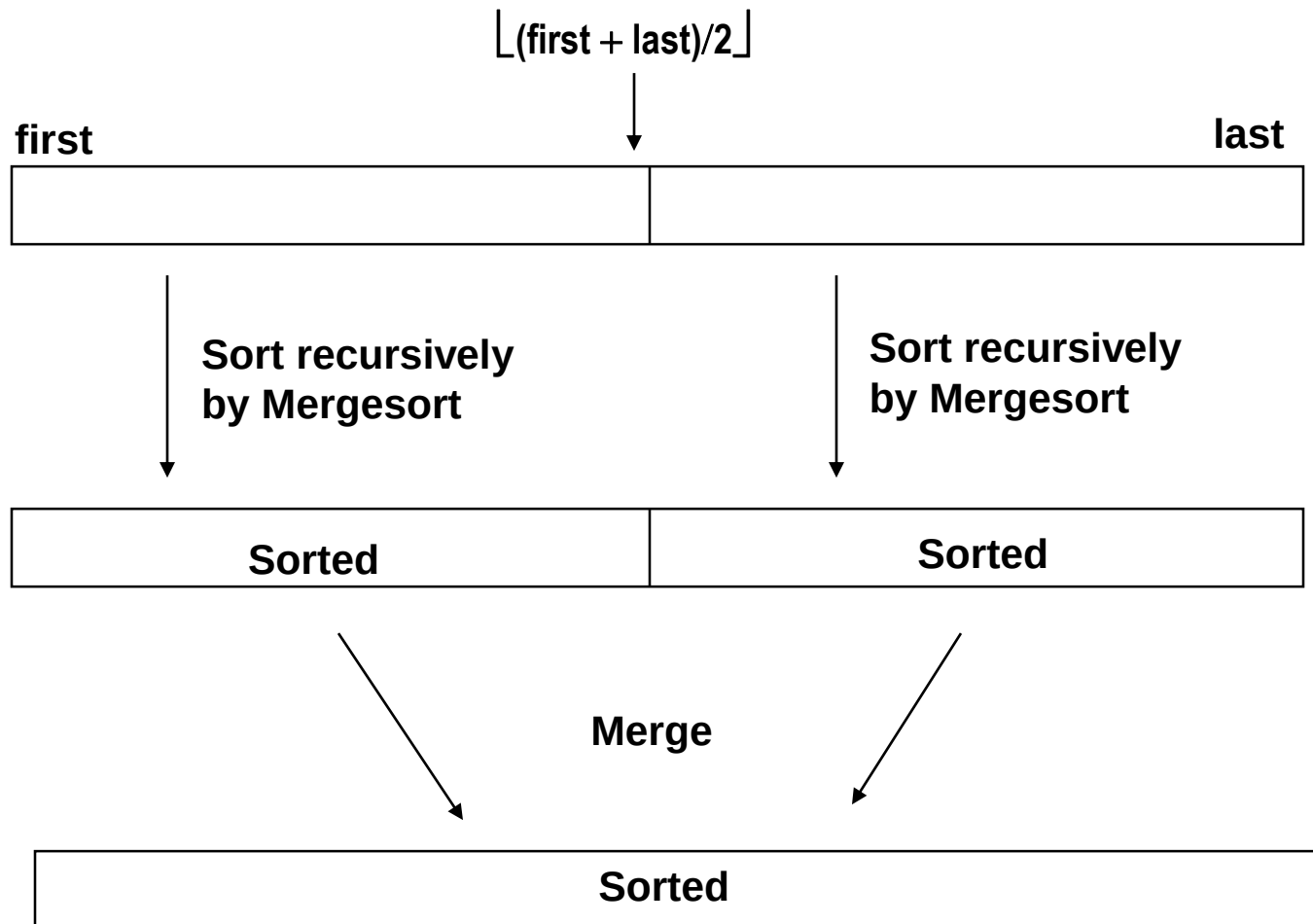
Sorted Sequence



Divide-and-conquer Technique



Using Divide and Conquer: Mergesort strategy



Merge Sort Algorithm

- Divide: Partition 'n' elements array into two sub lists with $n/2$ elements each
- Conquer: Sort sub list1 and sub list2
- Combine: Merge sub list1 and sub list2

Merge Sort Example

99	6	86	15	58	35	86	4	0
----	---	----	----	----	----	----	---	---

Merge Sort Example

99	6	86	15	58	35	86	4	0
----	---	----	----	----	----	----	---	---

99	6	86	15
----	---	----	----

58	35	86	4	0
----	----	----	---	---

Merge Sort Example

99	6	86	15	58	35	86	4	0
----	---	----	----	----	----	----	---	---

99	6	86	15
----	---	----	----

58	35	86	4	0
----	----	----	---	---

99	6
----	---

86	15
----	----

58	35
----	----

86	4	0
----	---	---

Merge Sort Example

99	6	86	15	58	35	86	4	0
----	---	----	----	----	----	----	---	---

99	6	86	15
----	---	----	----

58	35	86	4	0
----	----	----	---	---

99	6
----	---

86	15
----	----

58	35
----	----

86	4	0
----	---	---

99

6

86

15

58

35

86

4	0
---	---

Merge Sort Example

99	6	86	15	58	35	86	4	0
----	---	----	----	----	----	----	---	---

99	6	86	15
----	---	----	----

58	35	86	4	0
----	----	----	---	---

99	6
----	---

86	15
----	----

58	35
----	----

86	4	0
----	---	---

99

6

86

15

58

35

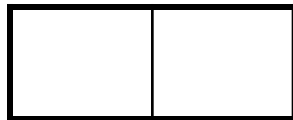
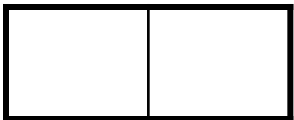
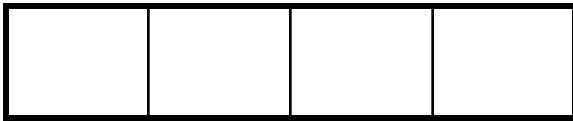
86

4	0
---	---

4

0

Merge Sort Example



99

6

86

15

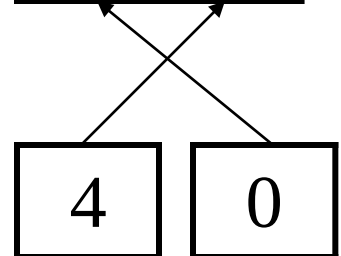
58

35

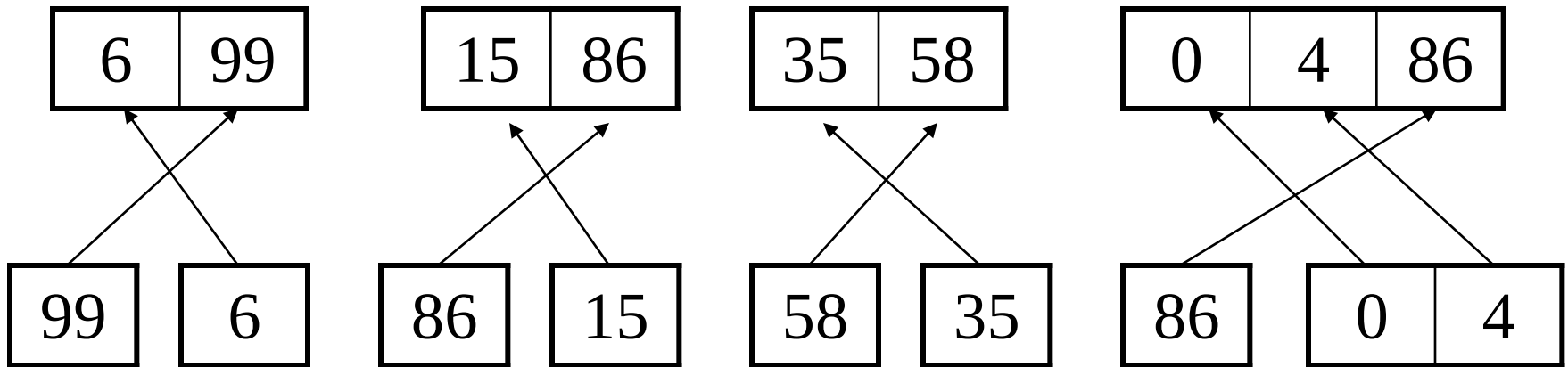
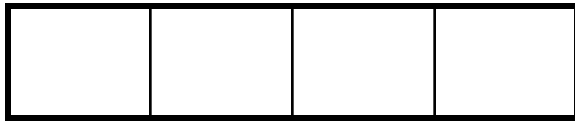
86

0 4

Merge

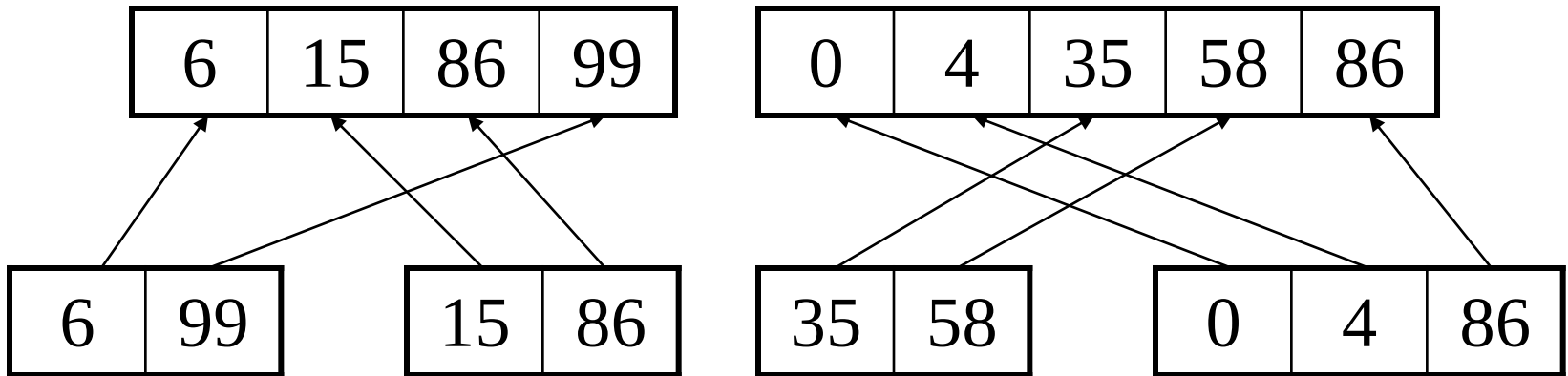


Merge Sort Example



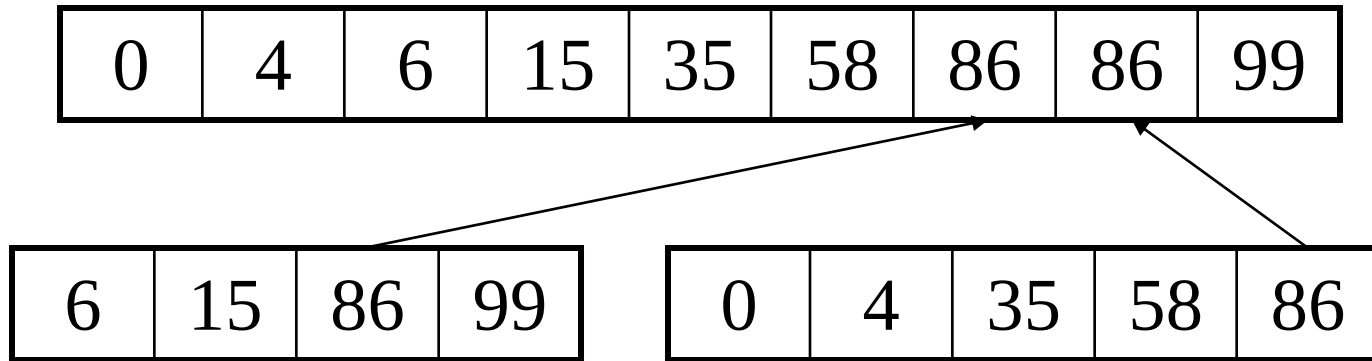
Merge

Merge Sort Example



Merge

Merge Sort Example



Merge

Merge Sort Example

0	4	6	15	35	58	86	86	99
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Time Complexity Analysis

- Worst case: $O(n\log_2 n)$
- Average case: $O(n\log_2 n)$
- Best case: $O(n\log_2 n)$