



Sorting Algorithms

1. Insertion
2. Selection
3. Bubble
4. Shell
5. Quick
6. Merge



Divide and Conquer

- Metode Divide and Conquer, setiap kali memecah persoalan menjadi setengahnya, namun menggunakan hasil dari kedua bagian tersebut:
 - cut the problem in half until the problem is trivial → tidak ber-problem lagi
 - solve for both halves
 - combine the solutions



Mergesort

- A divide-and-conquer algorithm:
- Membagi unsorted array menjadi 2 bagian hingga menghasilkan sub-arrays yang hanya berisi satu elemen
- Merge together solusi dari sub-problem:
 - Bandingkan elemen pertama dari 2 sub-array
 - Ambil elemen yang terkecil dan letakkan pada array hasil
 - Teruskan proses perbandingan dan pengambilan, sampai seluruh elemen sub-array dipindahkan ke array hasil

37	23	6	89	15	12	2	19
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Algorithm

Mergesort (Passed an array)

Jika ukuran array > 1

Bagi array menjadi dua

Panggil fungsi Mergesort untuk bagian pertama

Panggil fungsi Mergesort untuk bagian kedua

Merge dua bagian tersebut.

Merge (Passed two arrays)

Bandungkan elemen pertama dari kedua array

Pilih yang lebih kecil dan tempatkan pada array hasil, update posisi elemen pertama pd array yang telah diambil elemennya

(Jika salah satu array input telah kosong, maka letakkan elemen yang tersisa dari array lainnya ke array hasil)



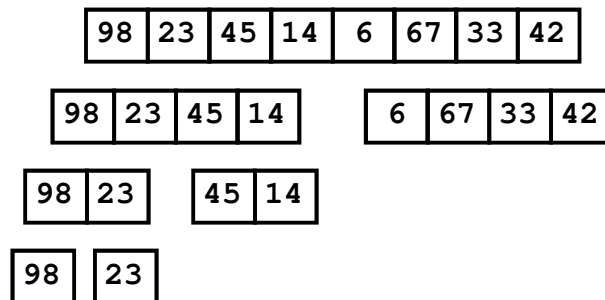
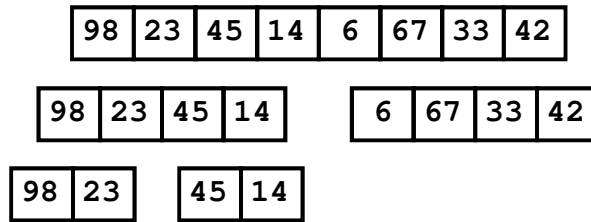
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98 23 45 14 6 67 33 42

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Merge

Arna Fariza Algoritma dan Struktur Data 9



98 23 45 14 6 67 33 42

98 23 45 14 6 67 33 42

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23

Merge

Arna Fariza Algoritma dan Struktur Data 10



98	23	45	14	6	67	33	42
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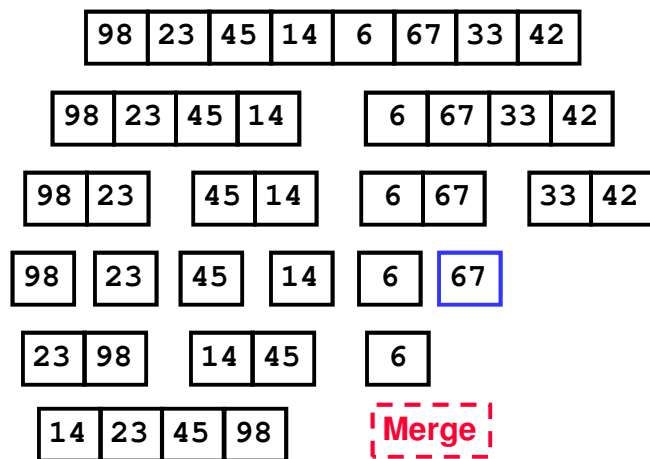
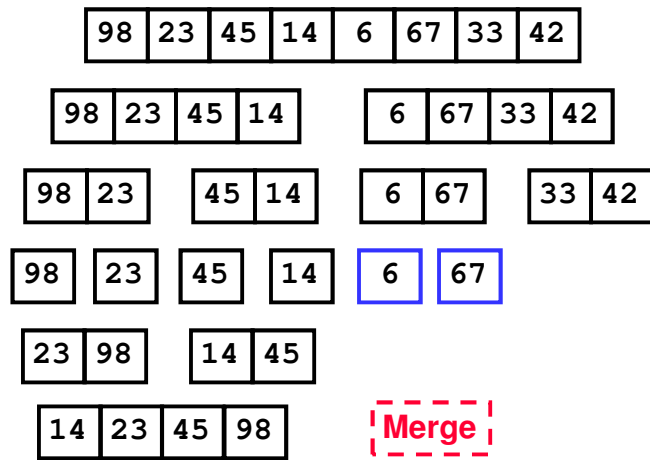
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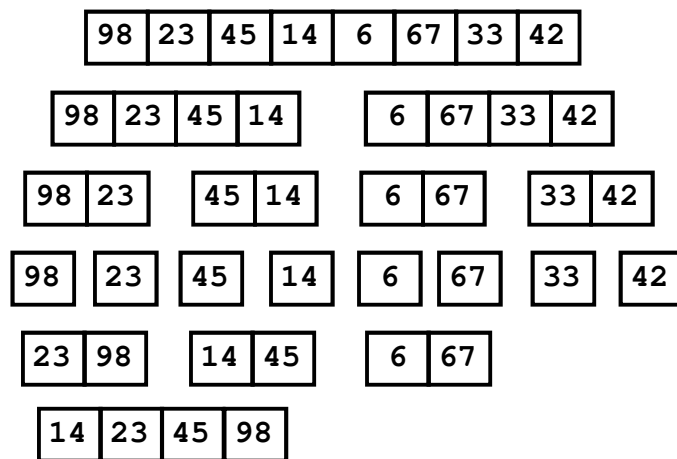
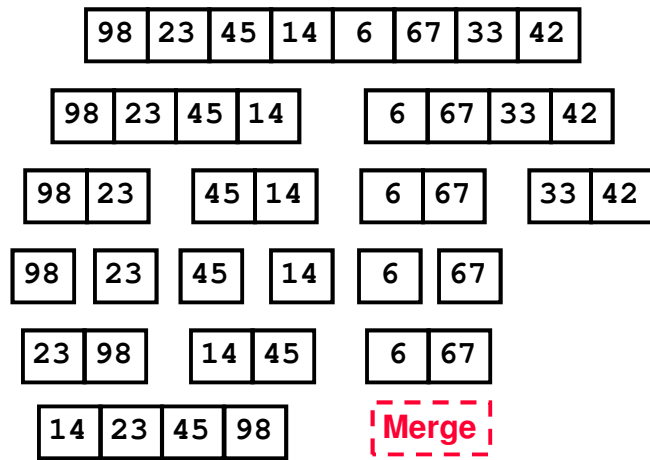
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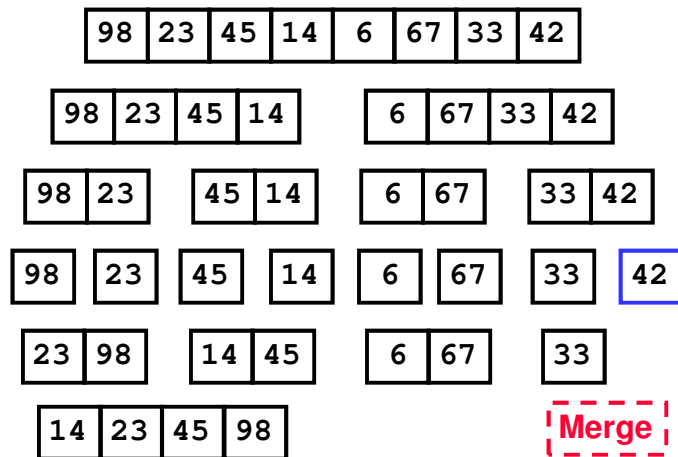
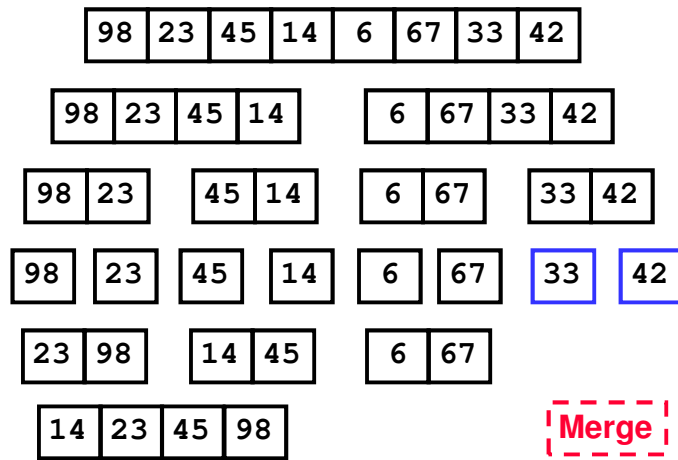
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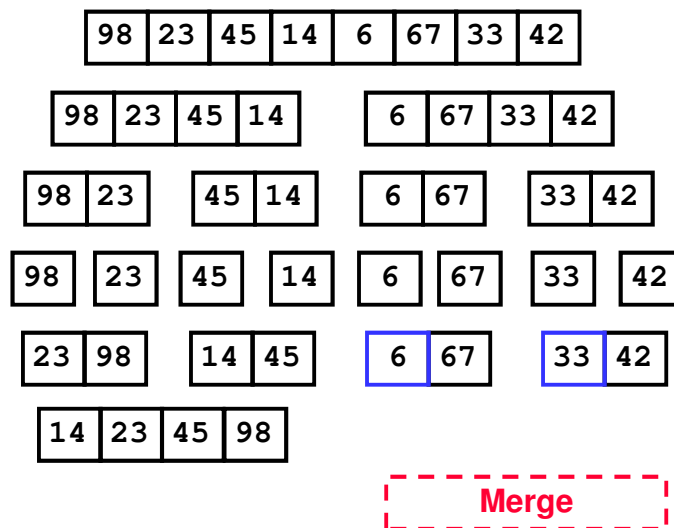
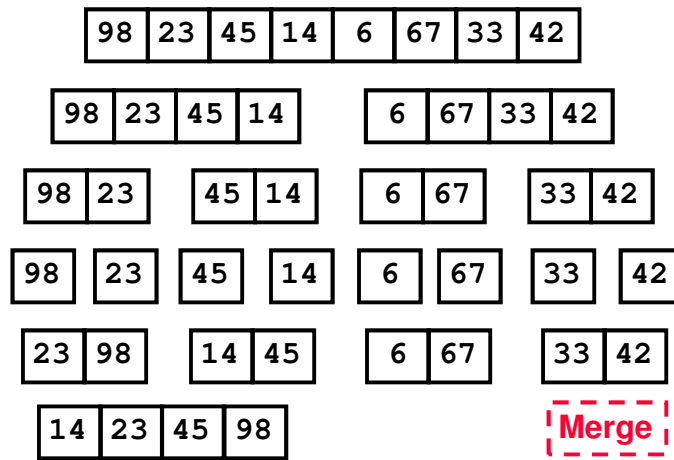
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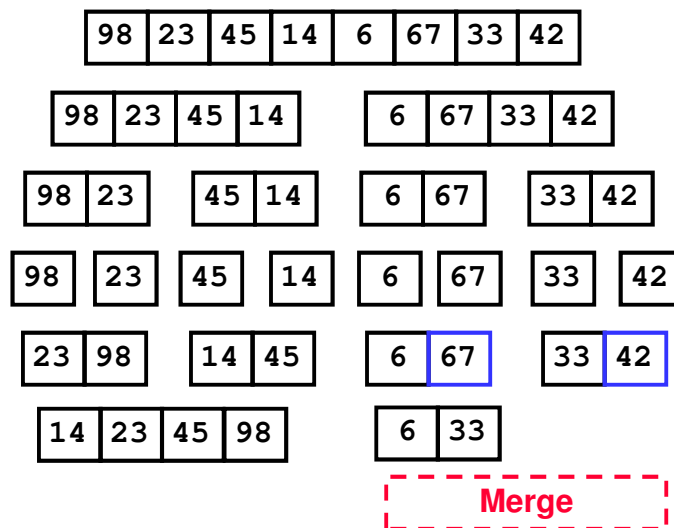
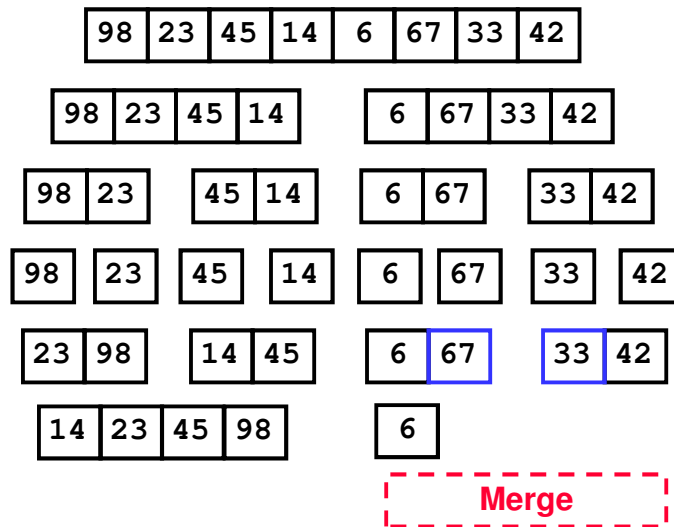
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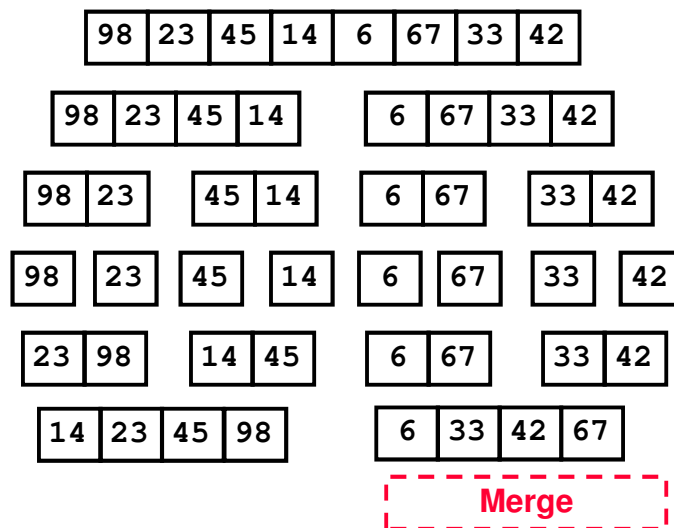
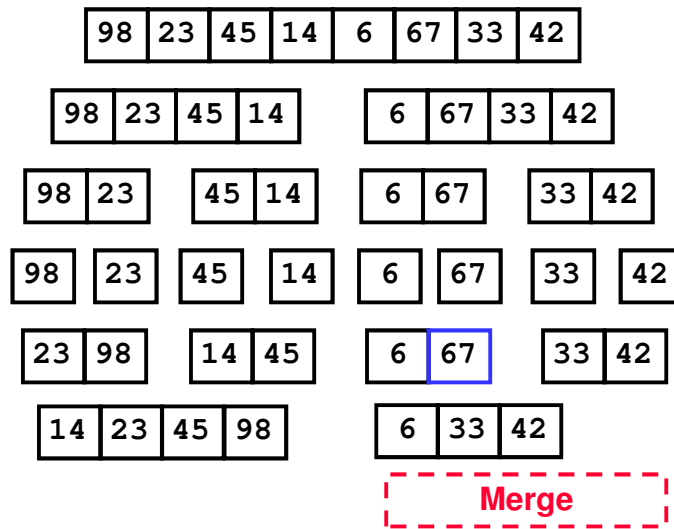














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Merge



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98	23	45	14	6	67	33	42
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6	14	23	33	42	45	67	98
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Algoritma Merge Sort

```
void MergeSortRekursif(l, r)
```

1. jika $(l < r)$ maka kerjakan baris 2-5
2. $med = (l+r) / 2 ;$
3. `MergeSortRekursif(l, med);`
4. `MergeSortRekursif(med+1, r);`
5. `Merge(l, med, r);`



Fungsi Merge

```
void Merge(left, median, right)
1. kiri1 ← left
2. kanan1 ← median
3. kiri2 ← median+1
4. kanan2 ← right
5. i ← left;
6. selama (kiri1<=kanan1) dan (kiri2<=kanan2) kerjakan 7-13
7.     jika (Data[kiri1] <= Data[kiri2]) kerjakan 8-9
8.         hasil[i] = Data[kiri1];
9.         kiri1++
10.    jika tidak kerjakan baris 11-12
11.        hasil[i] = Data[kiri2];
12.        kiri2++
13.    i++
```



```
14. selama (kiri1<=kanan1) kerjakan baris 15-17
15.     hasil[i] = Data[kiri1]
16.     kiri1++
17.     i++

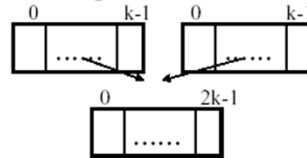
18. selama (kiri2<=kanan2) kerjakan baris 19-21
19.     hasil[i] = Data[kiri2]
20.     i++
21.     kiri2++

22. j ← left
23. selama (j <=right) kerjakan baris 24-25
24.     Data[j] = hasil[j]
25.     j++
```




Mergesort – Analysis of Merge (cont.)

Merging two sorted arrays of size k



- **Best-case:**

- All the elements in the first array are smaller (or larger) than all the elements in the second array.
- The number of moves: $2k + 2k$
- The number of key comparisons: k

- **Worst-case:**

- The number of moves: $2k + 2k$
- The number of key comparisons: $2k-1$



Summary

- **Divide** the unsorted collection **into two**
- **Until** the sub-arrays only **contain one element**
- **Then merge** the sub-problem solutions **together**