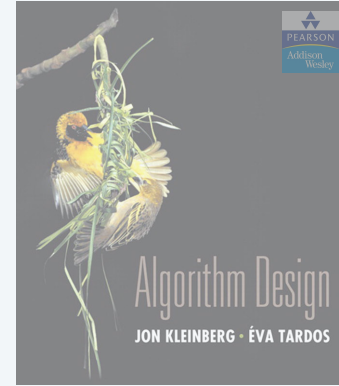


5. DIVIDE AND CONQUER I

- ▶ *merge demo*
- ▶ *merge-and-count demo*

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<http://www.cs.princeton.edu/~wayne/kleinberg-tardos>

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5. DIVIDE AND CONQUER

- ▶ *merge demo*
- ▶ *merge-and-count demo*

SECTIONS 5.1-5.2

Merge demo

Given two sorted lists A and B , merge into sorted list C .

sorted list A

3 7 10 14 18

sorted list B

2 11 16 20 23

Merge demo

Given two sorted lists A and B , merge into sorted list C .

sorted list A

3 7 10 14 18



sorted list B

2 11 16 20 23



compare minimum entry in each list: copy 2

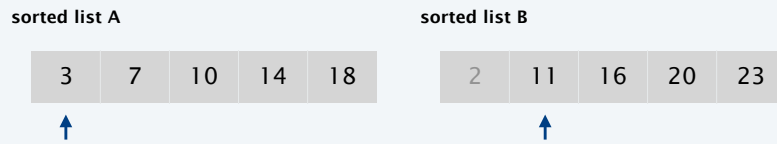
sorted list C

Empty array representation of sorted list C.



Merge demo

Given two sorted lists A and B , merge into sorted list C .



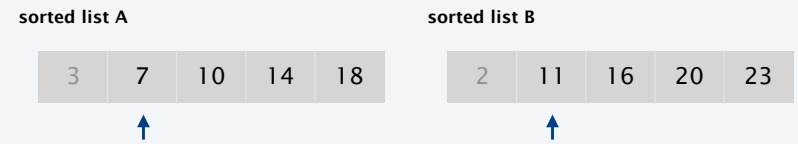
compare minimum entry in each list: copy 3



5

Merge demo

Given two sorted lists A and B , merge into sorted list C .



compare minimum entry in each list: copy 7



6

Merge demo

Given two sorted lists A and B , merge into sorted list C .



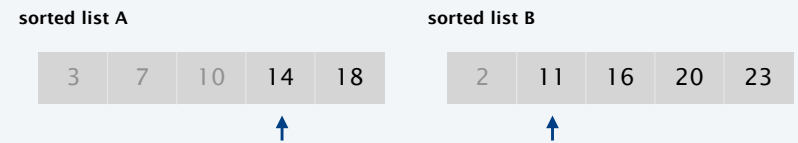
compare minimum entry in each list: copy 10



7

Merge demo

Given two sorted lists A and B , merge into sorted list C .



compare minimum entry in each list: copy 11



8

Merge demo

Given two sorted lists A and B , merge into sorted list C .

sorted list A

3 7 10 14 18



sorted list B

2 11 16 20 23



compare minimum entry in each list: copy 14

sorted list C

2 3 7 10 11



9

Merge demo

Given two sorted lists A and B , merge into sorted list C .

sorted list A

3 7 10 14 18



sorted list B

2 11 16 20 23



compare minimum entry in each list: copy 16

sorted list C

2 3 7 10 11 14



10

Merge demo

Given two sorted lists A and B , merge into sorted list C .

sorted list A

3 7 10 14 18



sorted list B

2 11 16 20 23



compare minimum entry in each list: copy 18

sorted list C

2 3 7 10 11 14 16



11

Merge demo

Given two sorted lists A and B , merge into sorted list C .

sorted list A

3 7 10 14 18



sorted list B

2 11 16 20 23



list A exhausted: copy 20

sorted list C

2 3 7 10 11 14 16 18



12

Merge-and-count demo

Given two sorted lists A and B ,

- Count number of inversions (a, b) with $a \in A$ and $b \in B$.
- Merge A and B into sorted list C .

sorted list A

3 7 10 14 18



sorted list B

2 11 16 20 23



compare minimum entry in each list: copy 2 and add x to inversion count

sorted list C



x = 5 ← number of elements remaining in A
inversions = 0

17

Merge-and-count demo

Given two sorted lists A and B ,

- Count number of inversions (a, b) with $a \in A$ and $b \in B$.
- Merge A and B into sorted list C .

sorted list A

3 7 10 14 18



sorted list B

2 11 16 20 23

5



compare minimum entry in each list: copy 3 and decrement x

sorted list C

2



x = 5
inversions = 5

18

Merge-and-count demo

Given two sorted lists A and B ,

- Count number of inversions (a, b) with $a \in A$ and $b \in B$.
- Merge A and B into sorted list C .

sorted list A

3 7 10 14 18



sorted list B

2 11 16 20 23

5



compare minimum entry in each list: copy 7 and decrement x

sorted list C

2 3



x = 4
inversions = 5

19

Merge-and-count demo

Given two sorted lists A and B ,

- Count number of inversions (a, b) with $a \in A$ and $b \in B$.
- Merge A and B into sorted list C .

sorted list A

3 7 10 14 18



sorted list B

2 11 16 20 23

5



compare minimum entry in each list: copy 10 and decrement x

sorted list C

2 3 7



x = 3
inversions = 5

20

Merge-and-count demo

Given two sorted lists A and B ,

- Count number of inversions (a, b) with $a \in A$ and $b \in B$.
- Merge A and B into sorted list C .

sorted list A

3 7 10 14 18



sorted list B

2 11 16 20 23

5



compare minimum entry in each list: copy 11 and add x to increment count

sorted list C

2 3 7 10



$x = 2$
inversions = 5

21

Merge-and-count demo

Given two sorted lists A and B ,

- Count number of inversions (a, b) with $a \in A$ and $b \in B$.
- Merge A and B into sorted list C .

sorted list A

3 7 10 14 18



sorted list B

2 11 16 20 23

5

2



compare minimum entry in each list: copy 14 and decrement x

sorted list C

2 3 7 10 11



$x = 2$
inversions = 7

22

Merge-and-count demo

Given two sorted lists A and B ,

- Count number of inversions (a, b) with $a \in A$ and $b \in B$.
- Merge A and B into sorted list C .

sorted list A

3 7 10 14 18



sorted list B

2 11 16 20 23

5

2



compare minimum entry in each list: copy 16 and add x to increment count

sorted list C

2 3 7 10 11 14



$x = 1$
inversions = 7

23

Merge-and-count demo

Given two sorted lists A and B ,

- Count number of inversions (a, b) with $a \in A$ and $b \in B$.
- Merge A and B into sorted list C .

sorted list A

3 7 10 14 18



sorted list B

2 11 16 20 23

5

2

1



compare minimum entry in each list: copy 18 and decrement x

sorted list C

2 3 7 10 11 14 16



$x = 1$
inversions = 8

24

