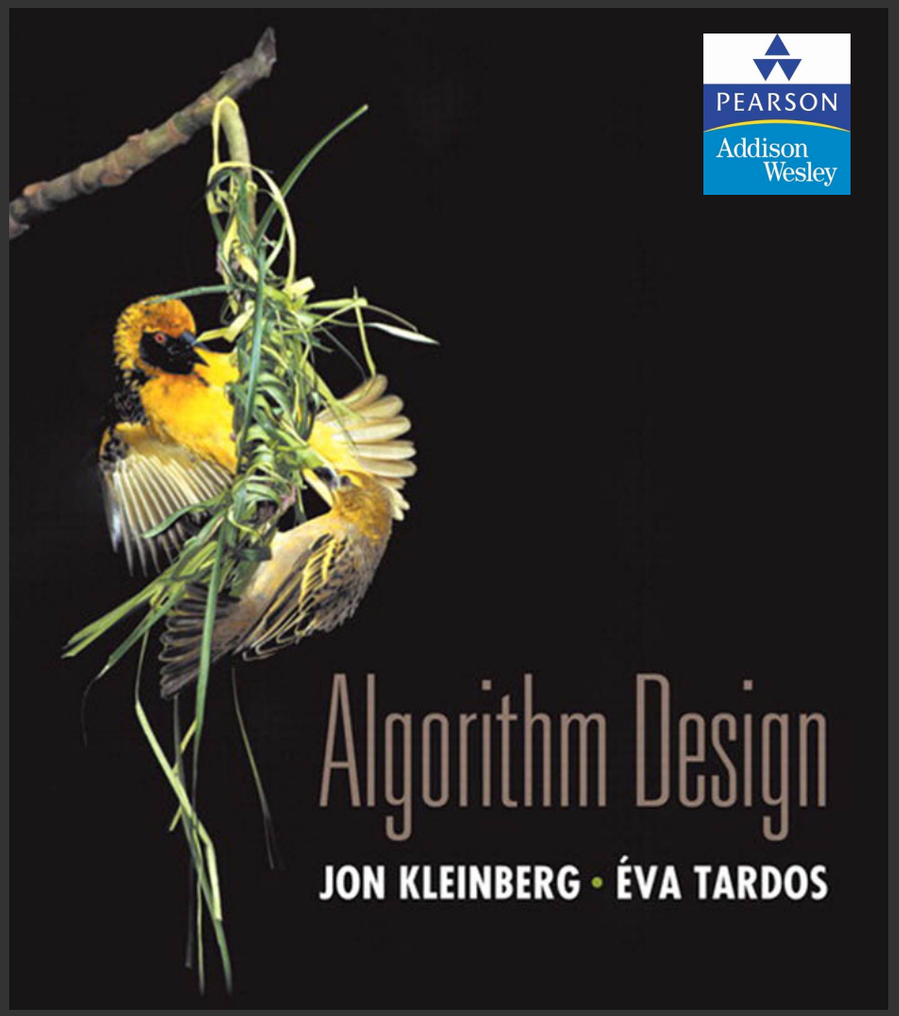


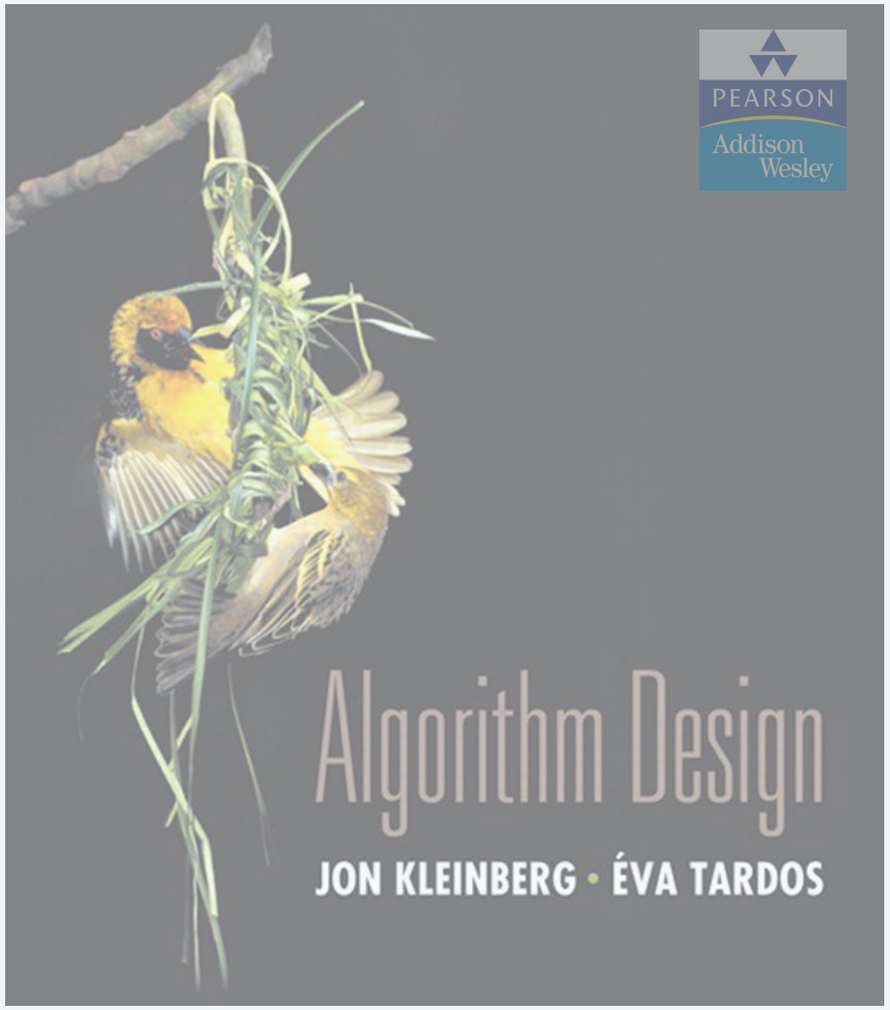
5. Divide and Conquer I

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

Lecture slides by Kevin Wayne

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

Last updated on 3/5/18 2:24 PM



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

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 3

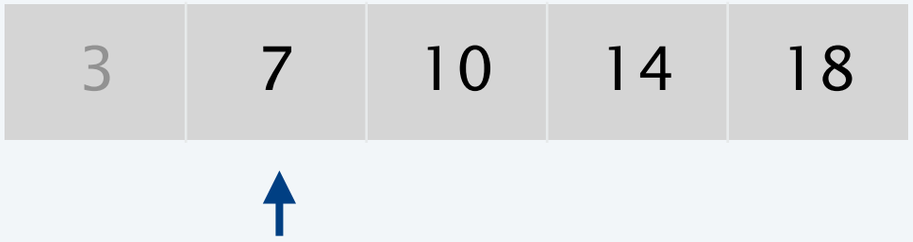
sorted list C

2									

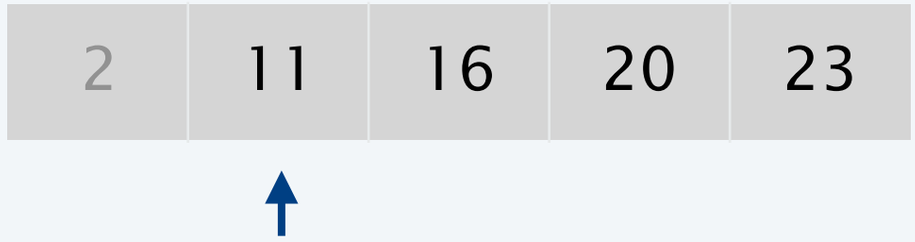
Merge demo

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

sorted list A

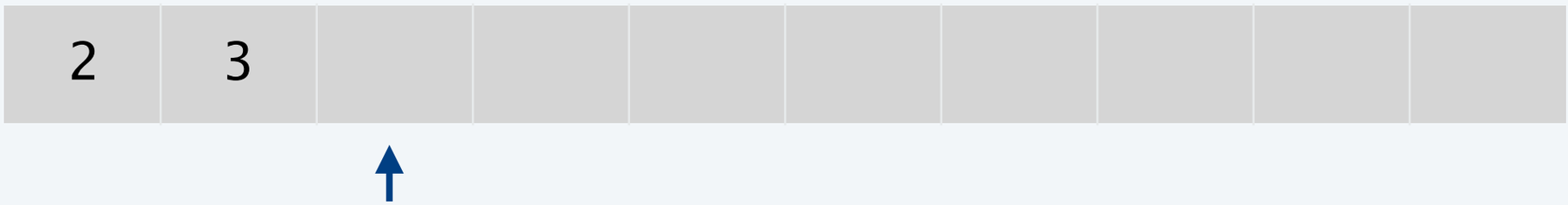


sorted list B



compare minimum entry in each list: copy 7

sorted list C



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 10

sorted list C

2	3	7							

Merge demo

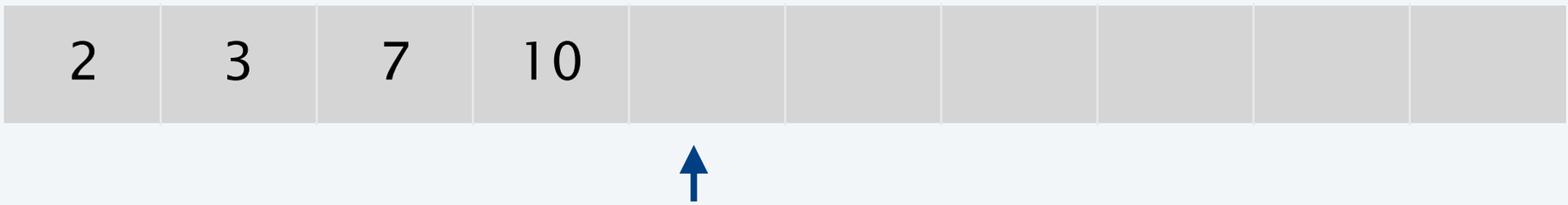
Given two sorted lists A and B, merge into sorted list C.

sorted list A

sorted list B

compare minimum entry in each list: copy 11

sorted list C



Merge demo

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

sorted list A

sorted list B

compare minimum entry in each list: copy 14

sorted list C

Merge demo

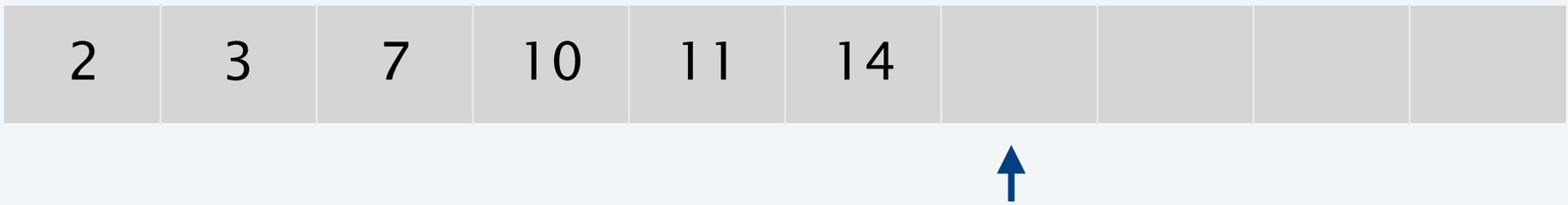
Given two sorted lists A and B, merge into sorted list C.

sorted list A

sorted list B

compare minimum entry in each list: copy 16

sorted list C



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			

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		

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 23

sorted list C

2	3	7	10	11	14	16	18	20	

Merge demo

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

sorted list A

3	7	10	14	18

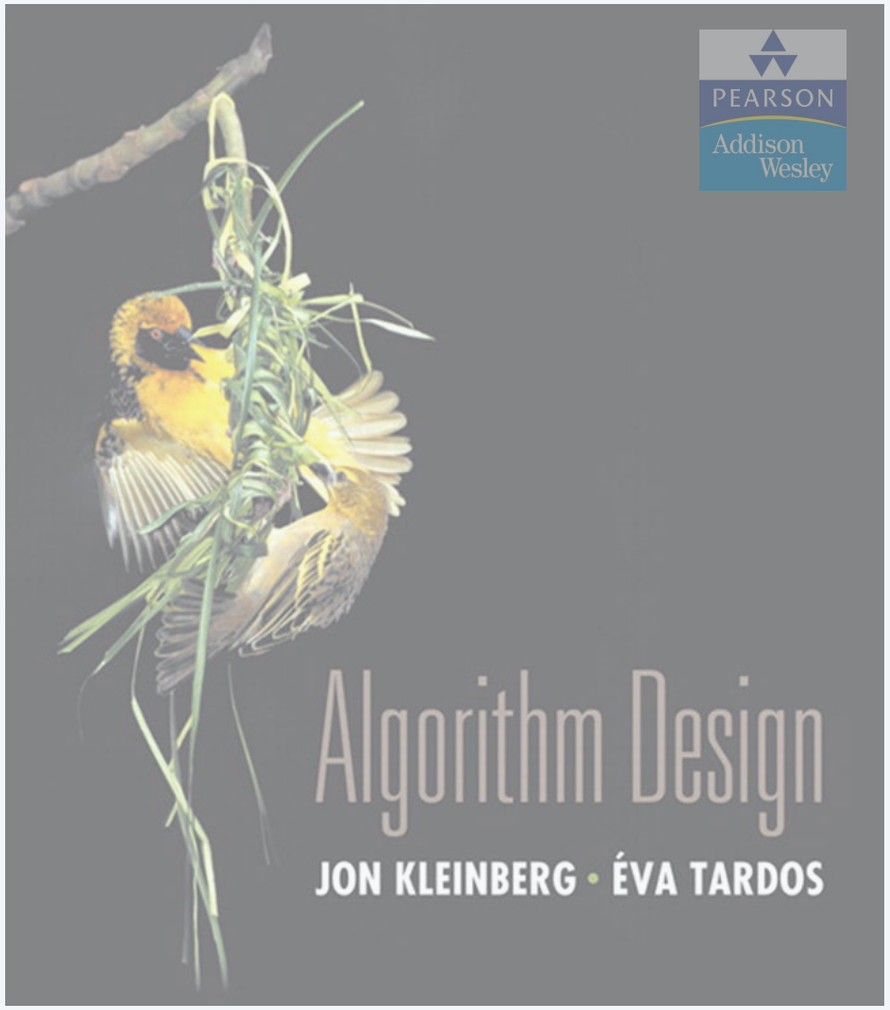
sorted list B

2	11	16	20	23

done

sorted list C

2	3	7	10	11	14	16	18	20	23



5. Divide and Conquer

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

Section 5.3

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

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

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

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								

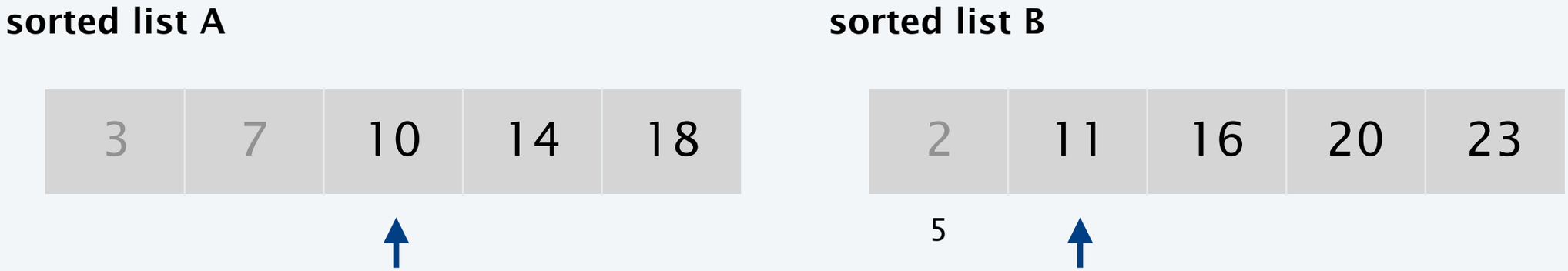
x = 4

inversions = 5

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.



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

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						

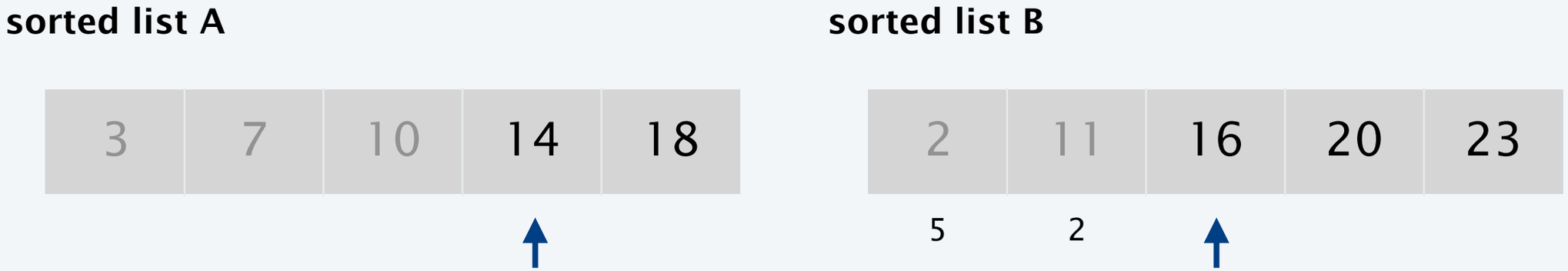
x = 2

inversions = 5

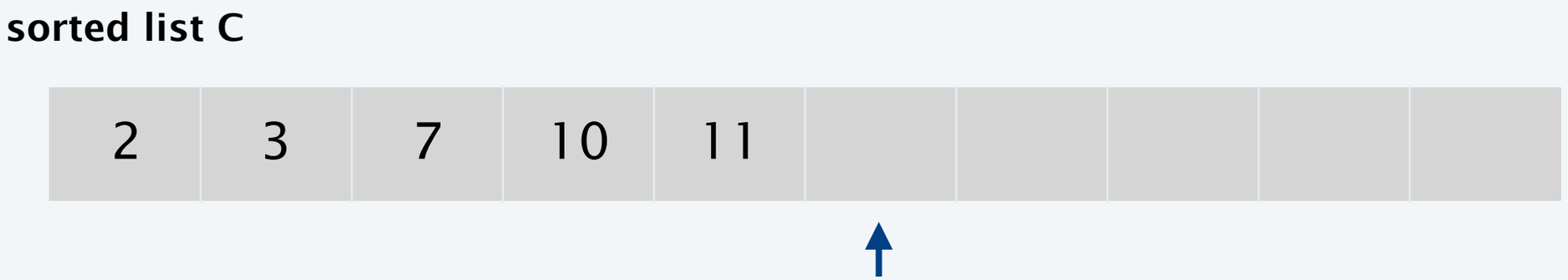
Merge-and-count demo

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.



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



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

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

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

list A exhausted: copy 20

sorted list C

2	3	7	10	11	14	16	18		

x = 0

inversions = 8

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 0

list A exhausted: copy 23

sorted list C

2	3	7	10	11	14	16	18	20	

x = 0

inversions = 8

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 0 0

done: return 8 inversions

sorted list C

2	3	7	10	11	14	16	18	20	23

x = 0

inversions = 8