Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
- Combine two sorted halves into sorted whole.

i = 6

↓   ↓

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves

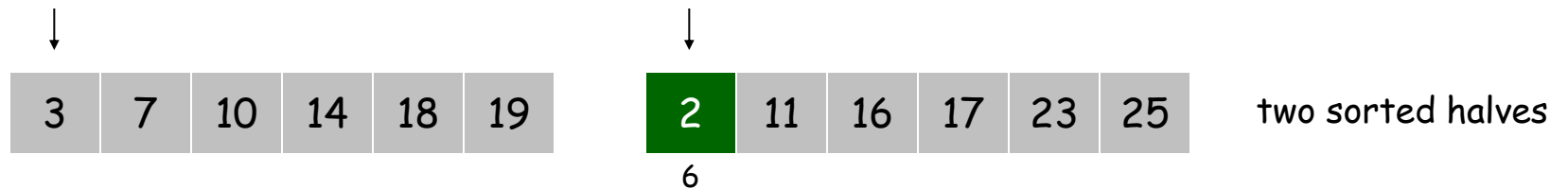| | | | | | | | | | | | | auxiliary array

Total:

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
- Combine two sorted halves into sorted whole.

i = 6

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves

6

| 2 | | | | | | | | | | | | | auxiliary array

Total: 6

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
- Combine two sorted halves into sorted whole.

i = 6

↓   ↓

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves

6

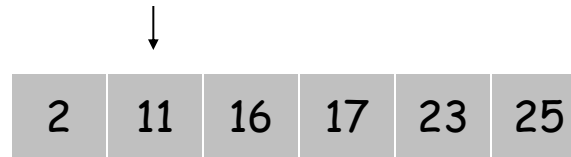| 2 | | | | | | | | | | | | auxiliary array

Total: 6

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
- Combine two sorted halves into sorted whole.

i = 6

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves
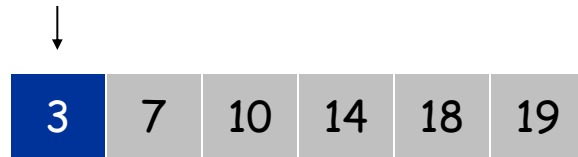
6

| 2 | 3 | | | | | | | | | | | auxiliary array

Total: 6

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
- Combine two sorted halves into sorted whole.

i = 5

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves
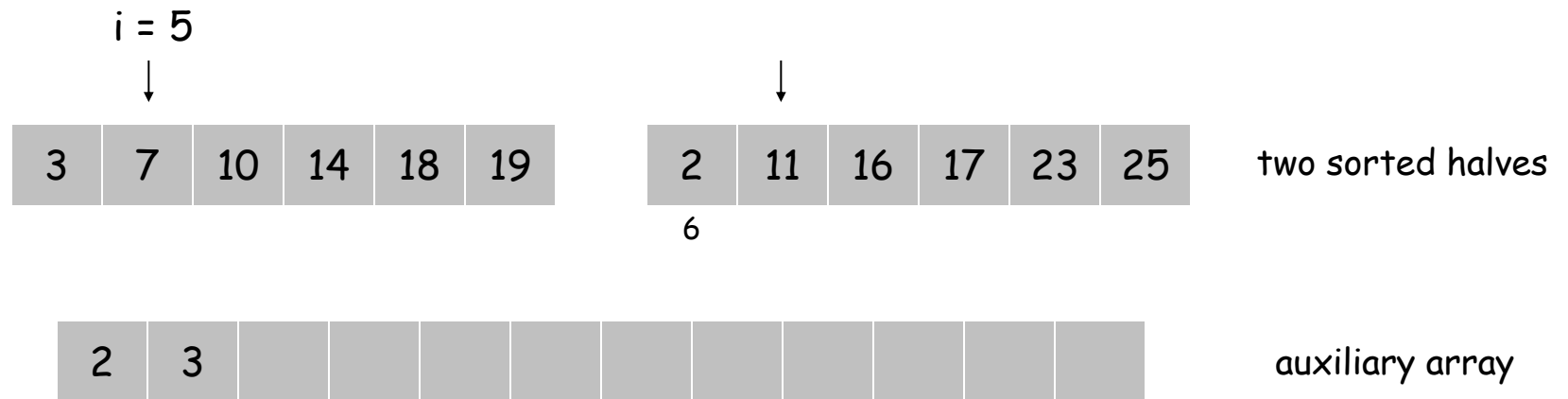
6

| 2 | 3 | | | | | | | | | | | | auxiliary array

Total: 6

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
- Combine two sorted halves into sorted whole.

i = 5

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves |

6

| 2 | 3 | 7 | | | | | | | | | | | auxiliary array |

Total: 6

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
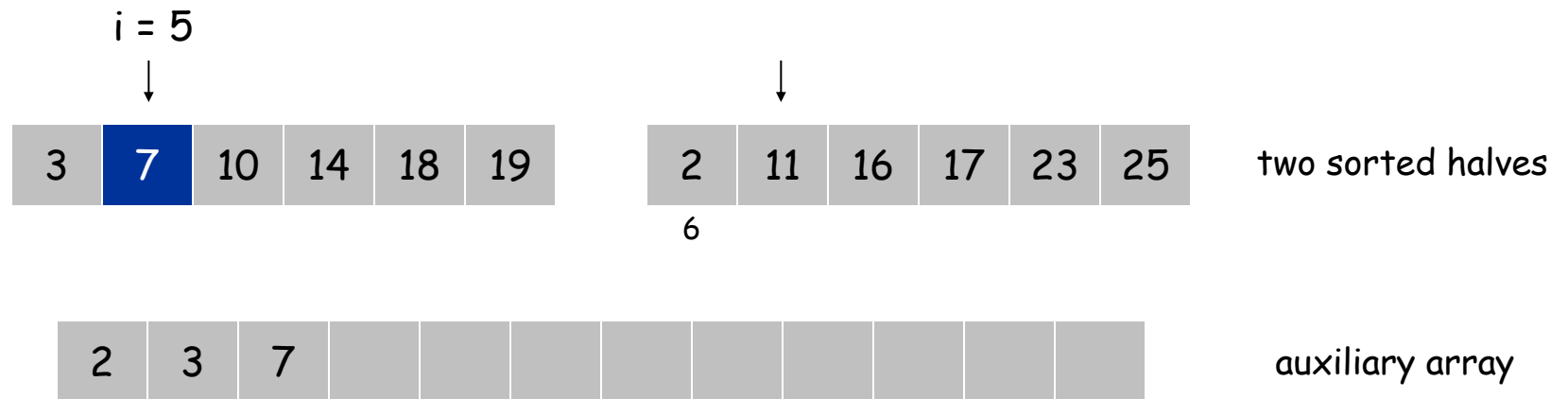- Combine two sorted halves into sorted whole.

i = 4
↓

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves

6

| 2 | 3 | 7 | | | | | | | | | auxiliary array

Total: 6

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
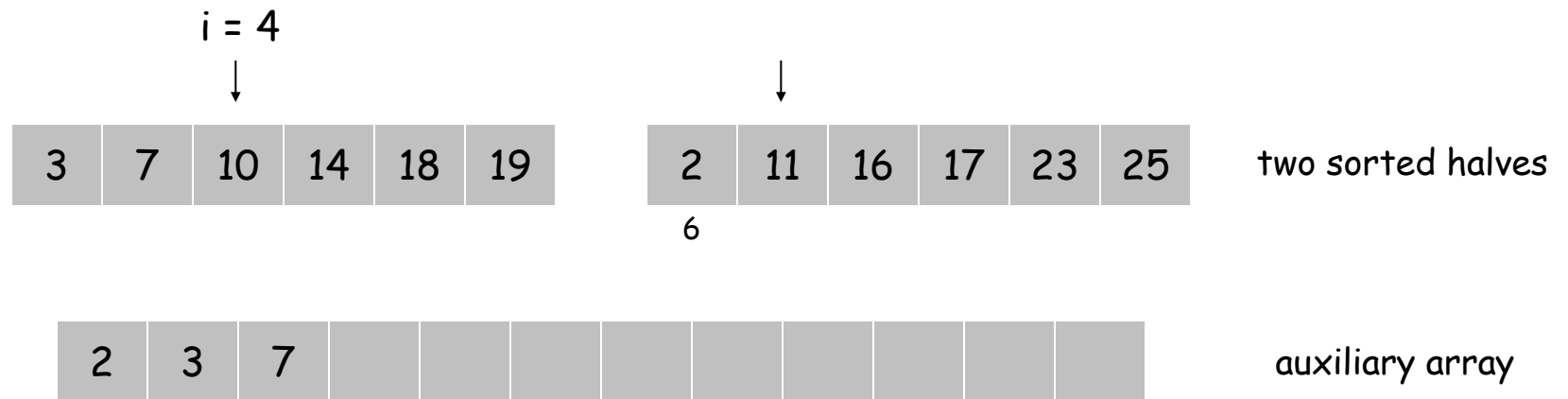- Combine two sorted halves into sorted whole.

i = 4

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves

6

| 2 | 3 | 7 | 10 | | | | | | | | | auxiliary array

Total: 6

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
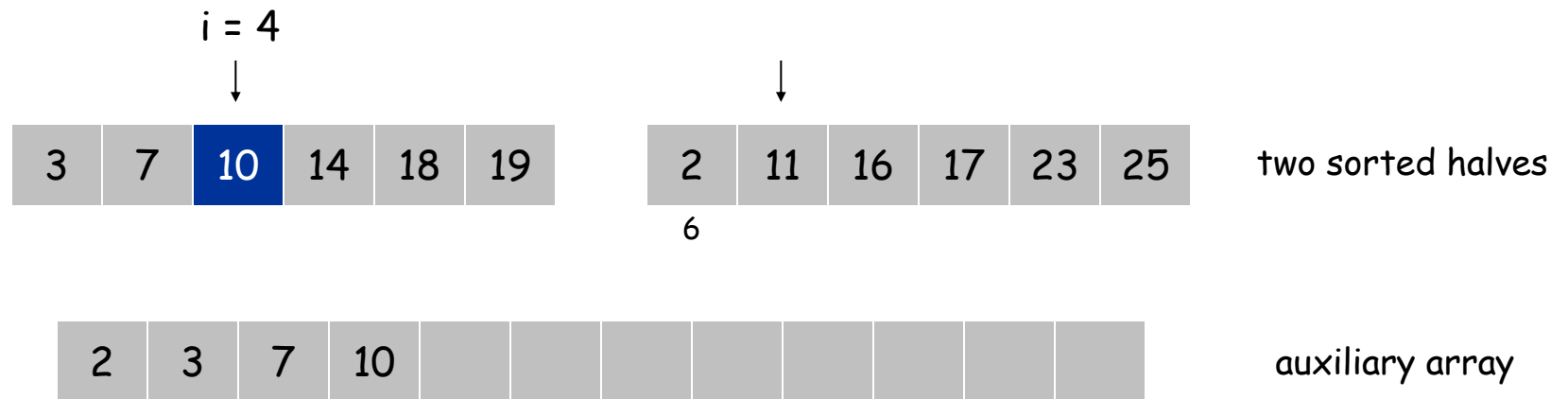- Combine two sorted halves into sorted whole.

i = 3

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves

6

| 2 | 3 | 7 | 10 | | | | | | | | | auxiliary array

Total: 6

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
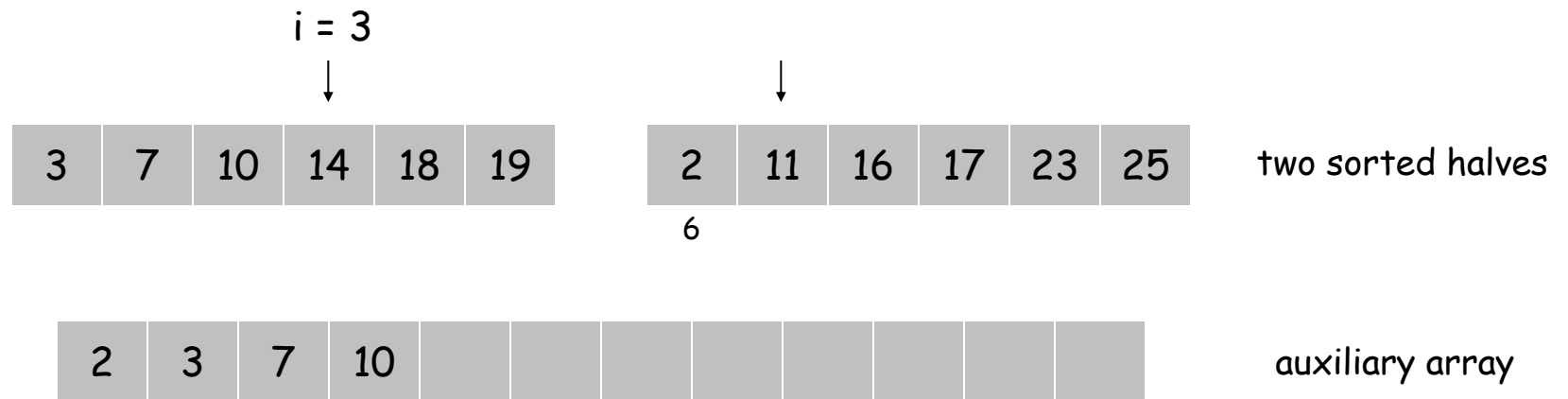- Combine two sorted halves into sorted whole.

i = 3

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves

6   3

| 2 | 3 | 7 | 10 | 11 | | | | | | | | auxiliary array

Total: 6 + 3

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
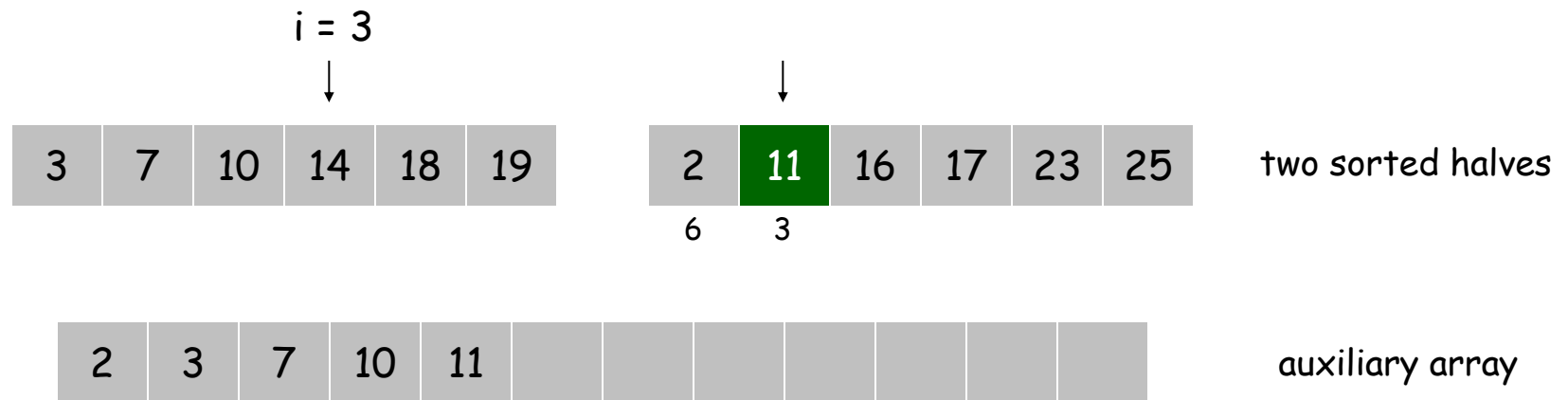- Combine two sorted halves into sorted whole.

i = 3

↓   ↓

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves

        6   3

| 2 | 3 | 7 | 10 | 11 | | | | | | | | auxiliary array

Total: 6 + 3

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
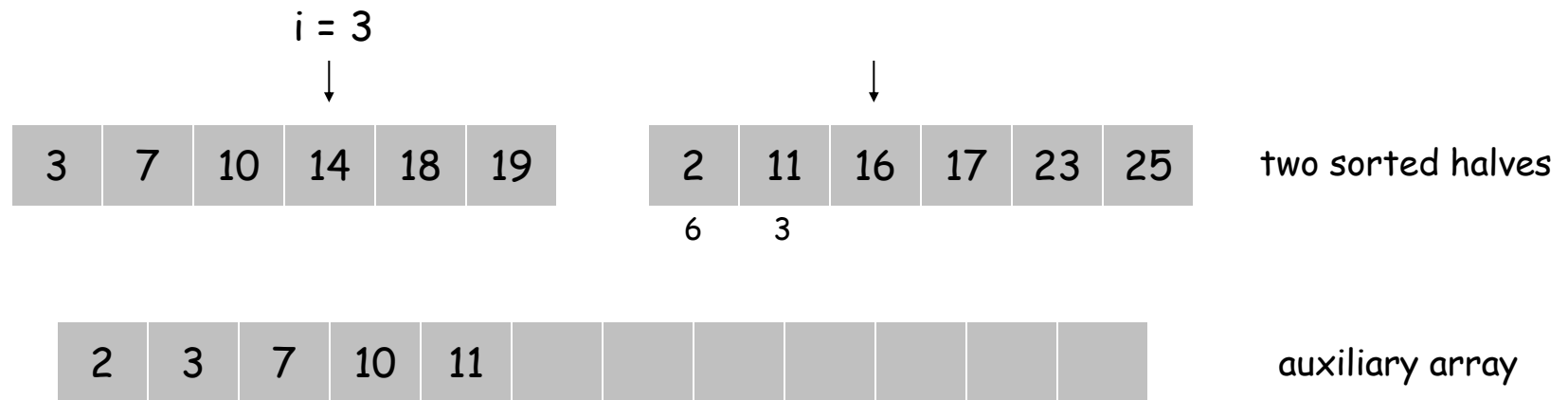- Combine two sorted halves into sorted whole.

i = 3

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves

6   3

| 2 | 3 | 7 | 10 | 11 | 14 | | | | | | | auxiliary array

Total: 6 + 3

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
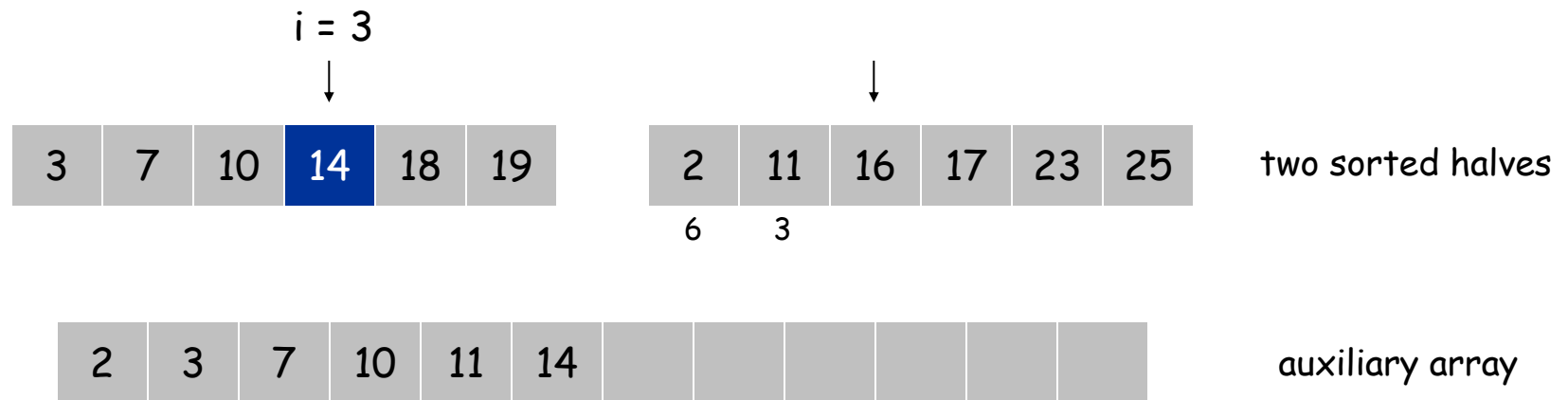- Combine two sorted halves into sorted whole.

i = 2

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves

6   3

| 2 | 3 | 7 | 10 | 11 | 14 | | | | | | | auxiliary array

Total: 6 + 3

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
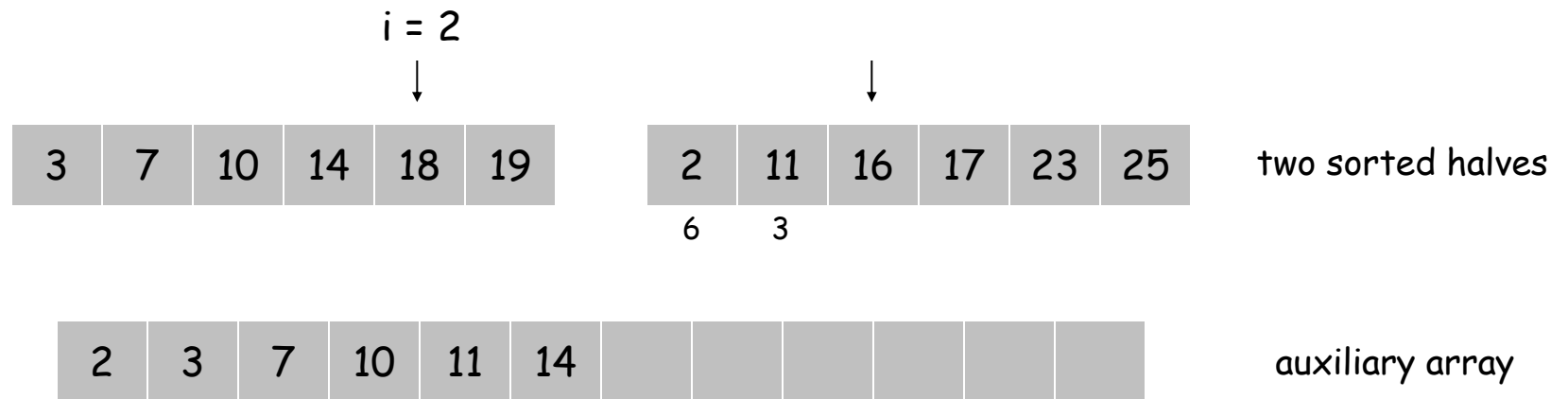- Combine two sorted halves into sorted whole.

i = 2

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves

6   3   2

| 2 | 3 | 7 | 10 | 11 | 14 | 16 | | | | | | auxiliary array

Total: 6 + 3 + 2

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
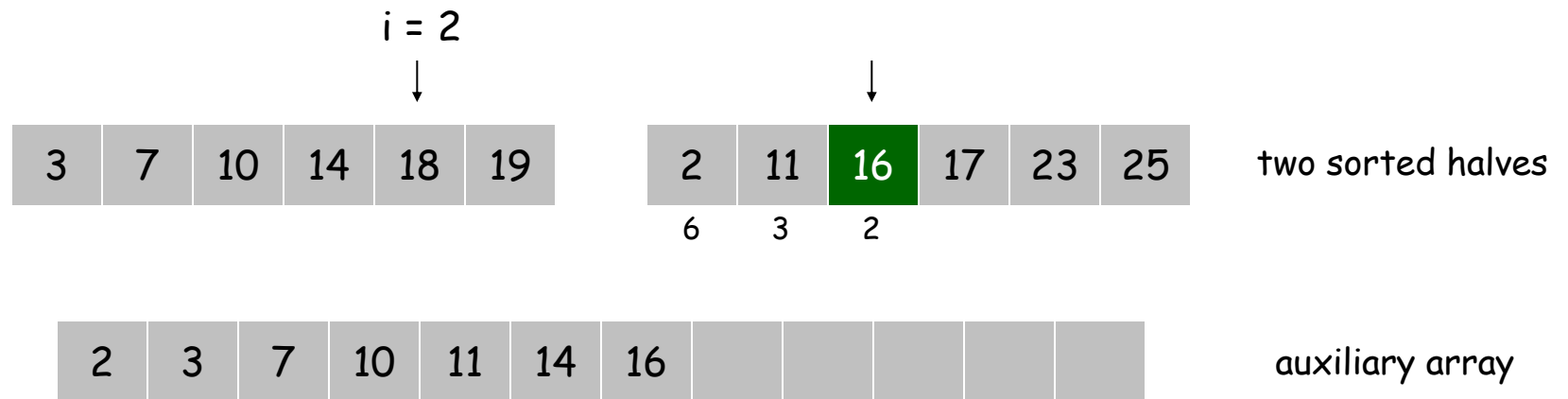- Combine two sorted halves into sorted whole.

i = 2

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves

6   3   2

| 2 | 3 | 7 | 10 | 11 | 14 | 16 | | | | | | auxiliary array

Total: 6 + 3 + 2

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
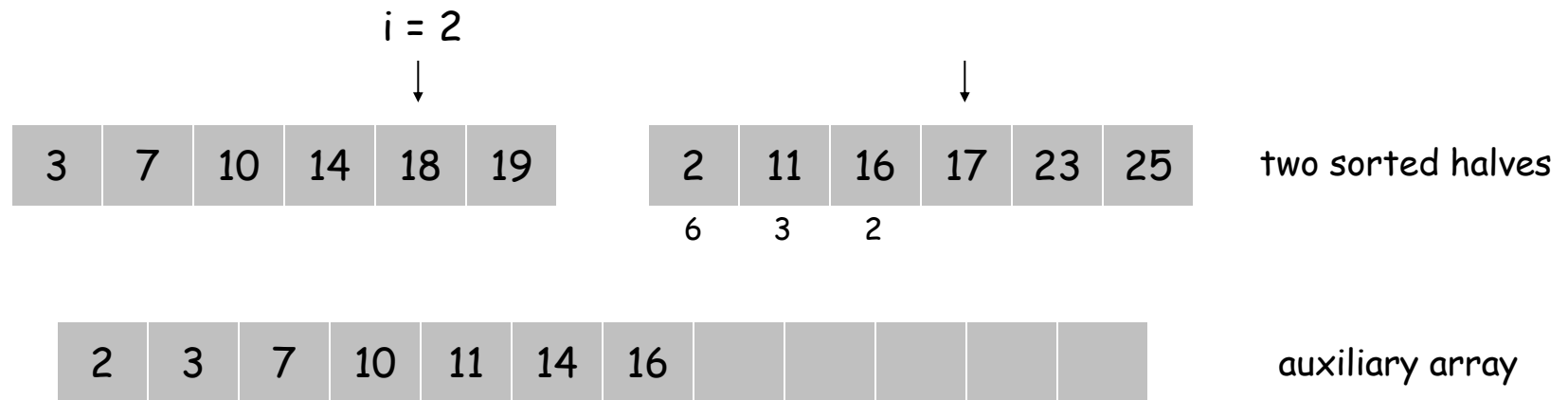- Combine two sorted halves into sorted whole.

i = 2

↓

| 3 | 7 | 10 | 14 | 18 | 19 |

| 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves

6   3   2   2

| 2 | 3 | 7 | 10 | 11 | 14 | 16 | 17 | | | | | auxiliary array

Total: 6 + 3 + 2 + 2

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
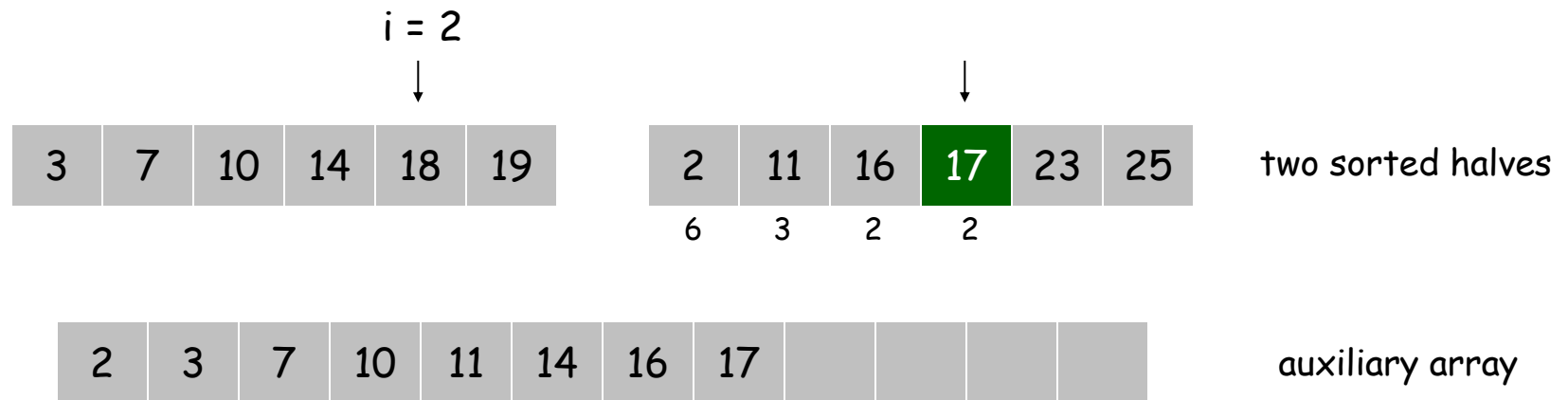- Combine two sorted halves into sorted whole.

i = 2

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves |

6 3 2 2

| 2 | 3 | 7 | 10 | 11 | 14 | 16 | 17 | | | | | auxiliary array |

Total: 6 + 3 + 2 + 2

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
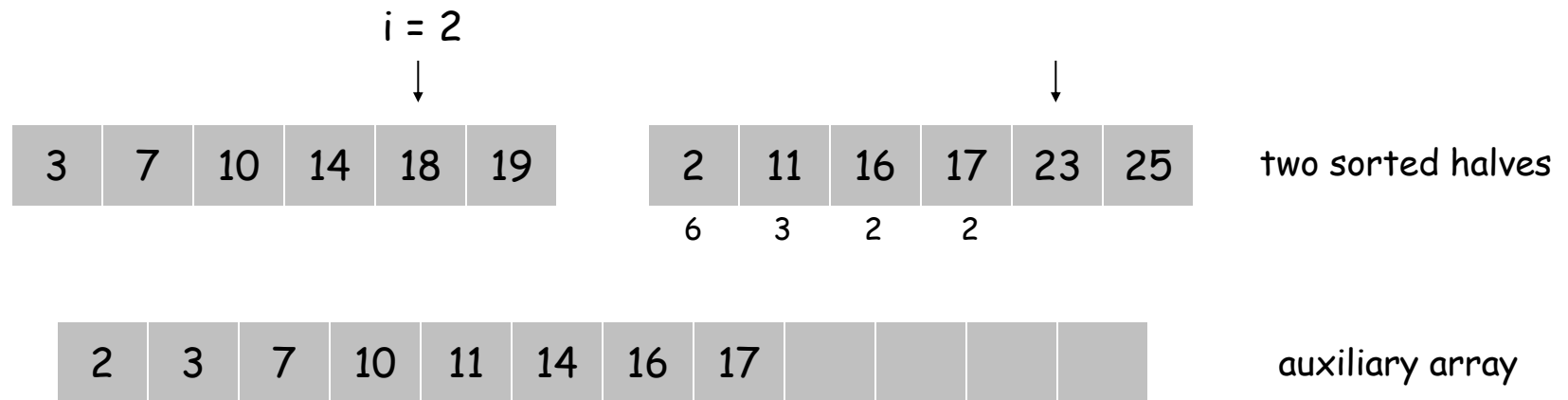- Combine two sorted halves into sorted whole.

i = 2

3	7	10	14	18	19		2	11	16	17	23	25	two sorted halves

6   3   2   2

2	3	7	10	11	14	16	17	18				auxiliary array

Total: 6 + 3 + 2 + 2

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
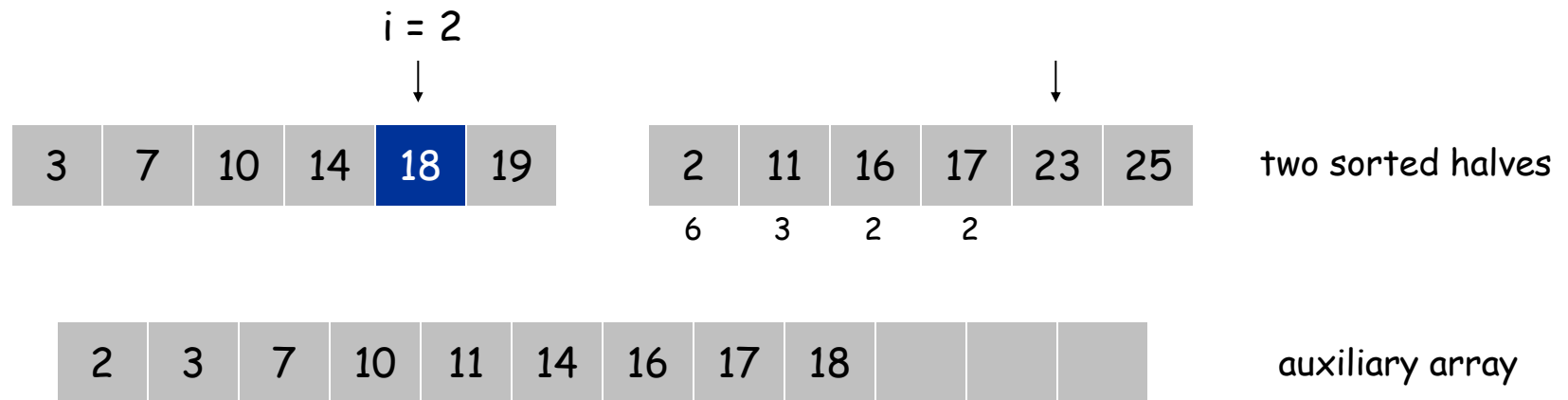- Combine two sorted halves into sorted whole.

i = 1
↓

3	7	10	14	18	19		2	11	16	17	23	25

↓

two sorted halves

6   3   2   2

| 2 | 3 | 7 | 10 | 11 | 14 | 16 | 17 | 18 | | | |

auxiliary array

Total: 6 + 3 + 2 + 2

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
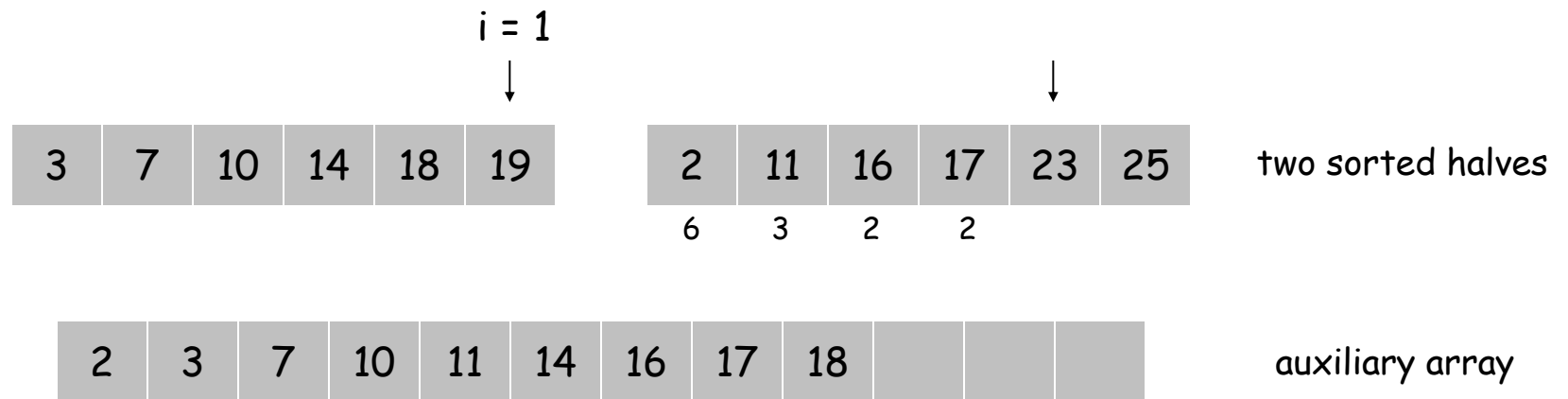- Combine two sorted halves into sorted whole.

i = 1

↓   ↓

| 3 | 7 | 10 | 14 | 18 | **19** | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves |

                               6   3   2   2

| 2 | 3 | 7 | 10 | 11 | 14 | 16 | 17 | 18 | 19 | | | auxiliary array |

Total: 6 + 3 + 2 + 2

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
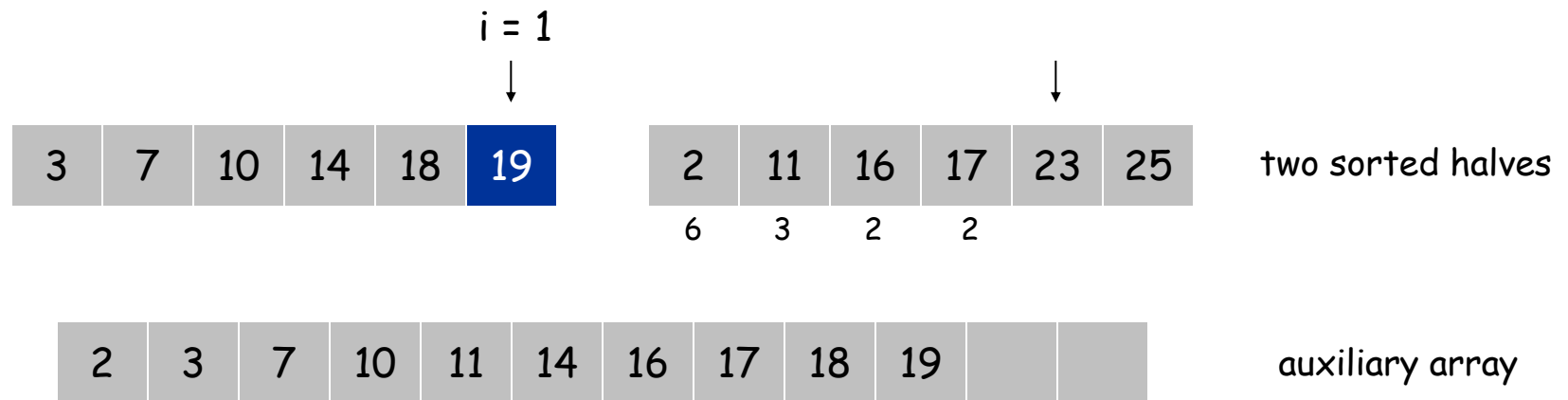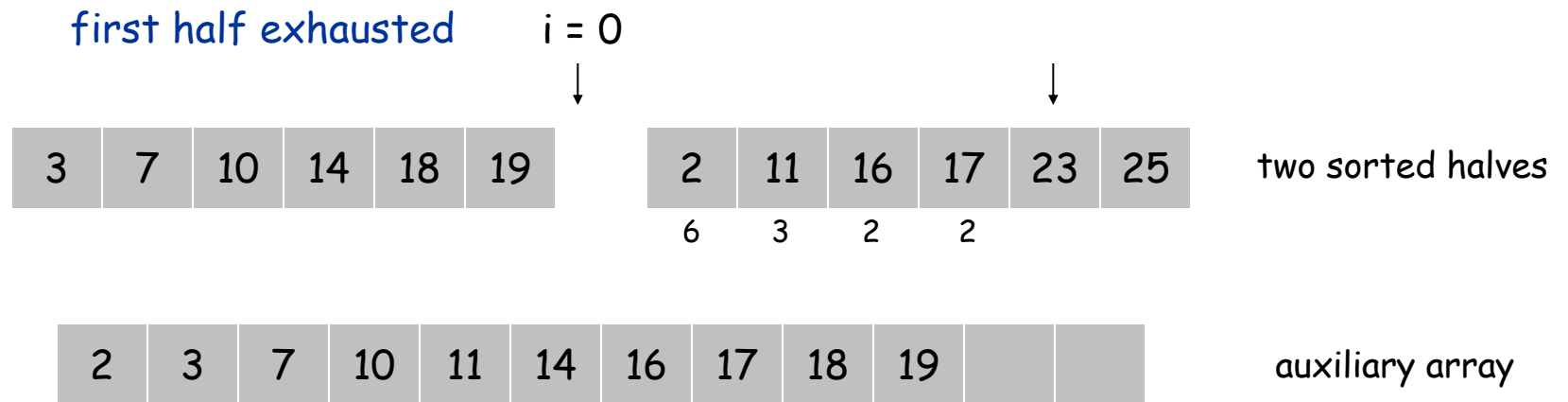- Combine two sorted halves into sorted whole.

first half exhausted   i = 0

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves |

                         6   3   2   2

| 2 | 3 | 7 | 10 | 11 | 14 | 16 | 17 | 18 | 19 | | | auxiliary array |

Total: 6 + 3 + 2 + 2

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
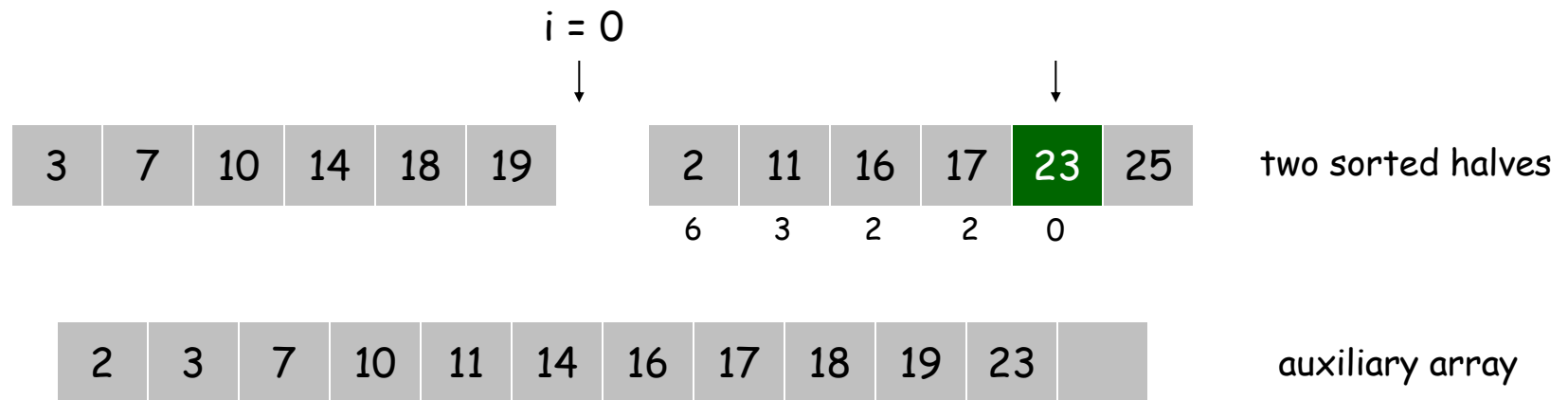- Combine two sorted halves into sorted whole.

i = 0

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves |

6   3   2   2   0

| 2 | 3 | 7 | 10 | 11 | 14 | 16 | 17 | 18 | 19 | 23 | | auxiliary array |

Total: 6 + 3 + 2 + 2 + 0

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
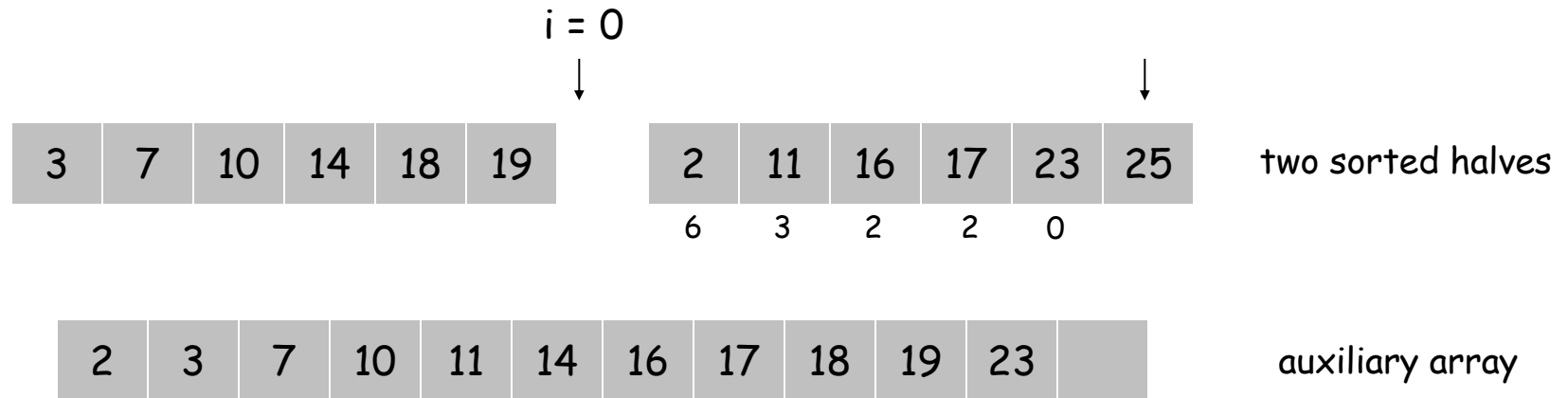- Combine two sorted halves into sorted whole.

i = 0
↓   ↓

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves

6   3   2   2   0

| 2 | 3 | 7 | 10 | 11 | 14 | 16 | 17 | 18 | 19 | 23 | | auxiliary array

Total: 6 + 3 + 2 + 2 + 0

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
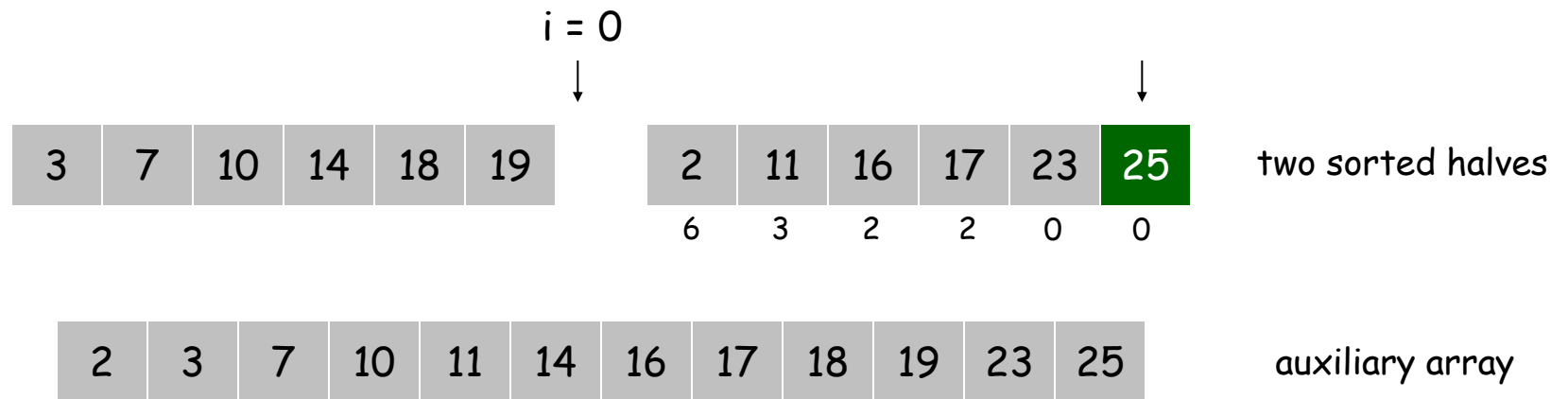- Combine two sorted halves into sorted whole.

i = 0

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves |

| | | | | | | | 6 | 3 | 2 | 2 | 0 | 0 | |

| 2 | 3 | 7 | 10 | 11 | 14 | 16 | 17 | 18 | 19 | 23 | 25 | auxiliary array |

Total: 6 + 3 + 2 + 2 + 0 + 0

Merge and Count

Merge and count step.

- Given two sorted halves, count number of inversions where a_i and a_j are in different halves.
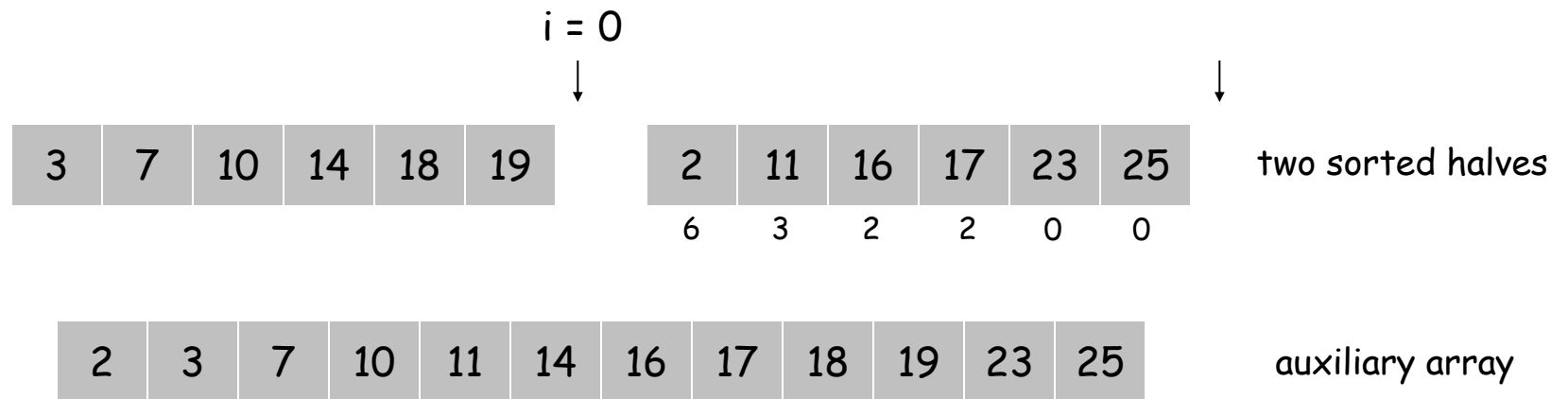- Combine two sorted halves into sorted whole.

i = 0
↓   ↓

| 3 | 7 | 10 | 14 | 18 | 19 | | 2 | 11 | 16 | 17 | 23 | 25 | two sorted halves

6   3   2   2   0   0

| 2 | 3 | 7 | 10 | 11 | 14 | 16 | 17 | 18 | 19 | 23 | 25 | auxiliary array

Total: 6 + 3 + 2 + 2 + 0 + 0 = 13