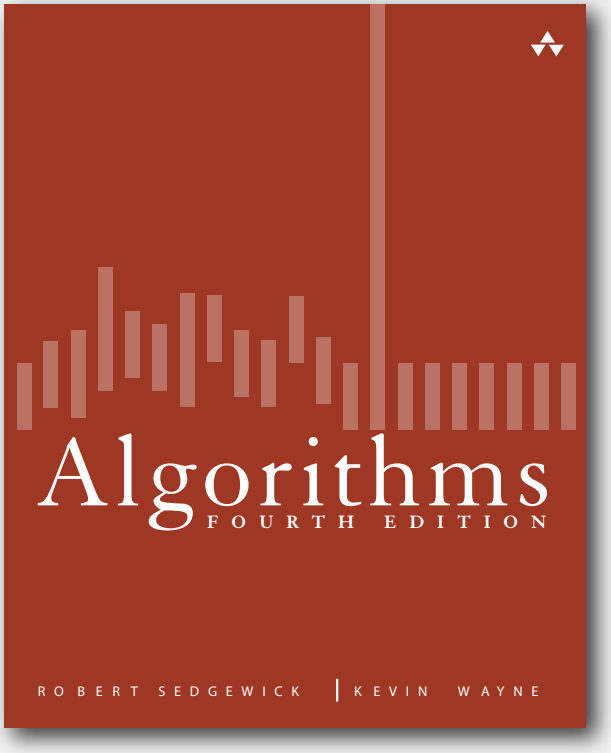
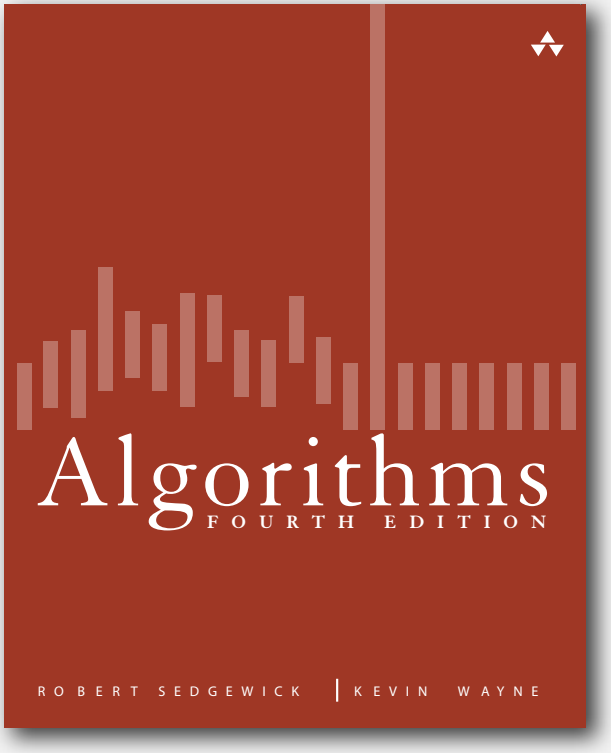
2.3 Quicksort Partitioning Demo



- Sedgewick 2-way
- Dijkstra 3-way
- Bentley-McIlroy 3-way

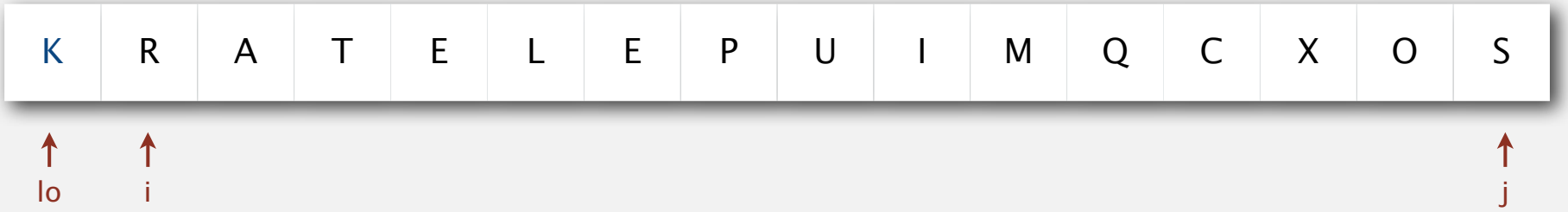
Sedgewick 2-way Partitioning



Quicksort partitioning

Repeat until `i` and `j` pointers cross.

- Scan `i` from left to right so long as `a[i] < a[lo]`.
- Scan `j` from right to left so long as `a[j] > a[lo]`.
- Exchange `a[i]` with `a[j]`.



stop `i` scan because `a[i] >= a[lo]`

Quicksort partitioning

Repeat until `i` and `j` pointers cross.

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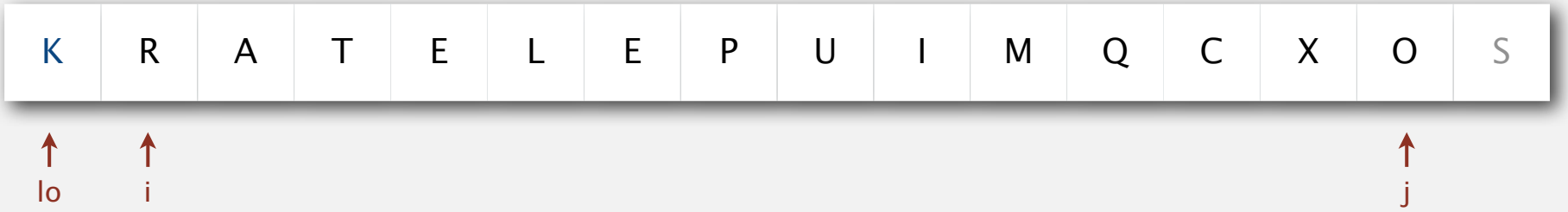

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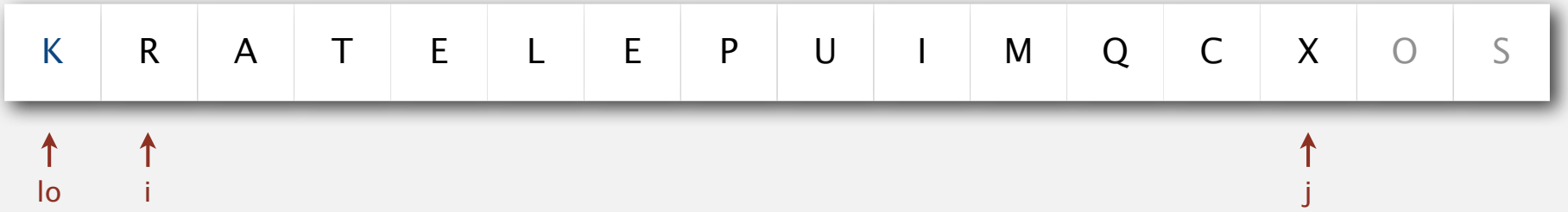

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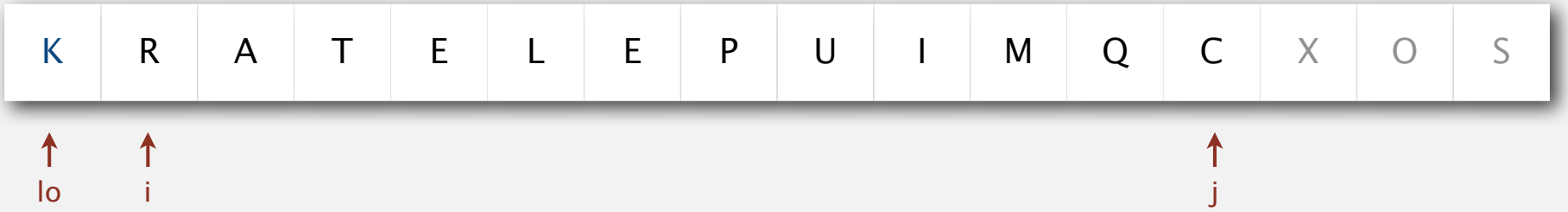

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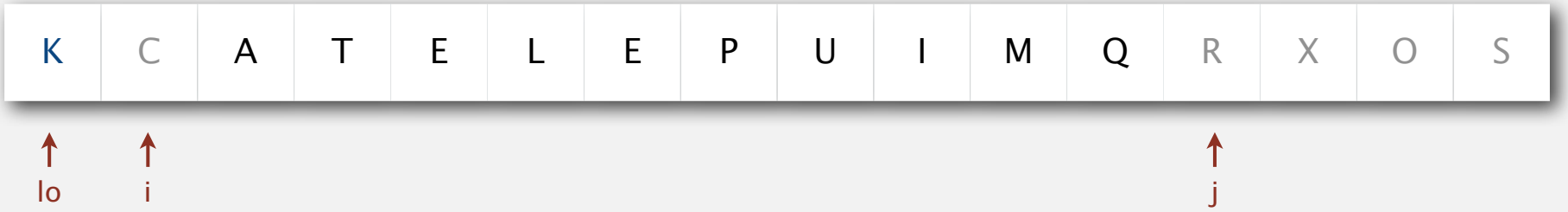

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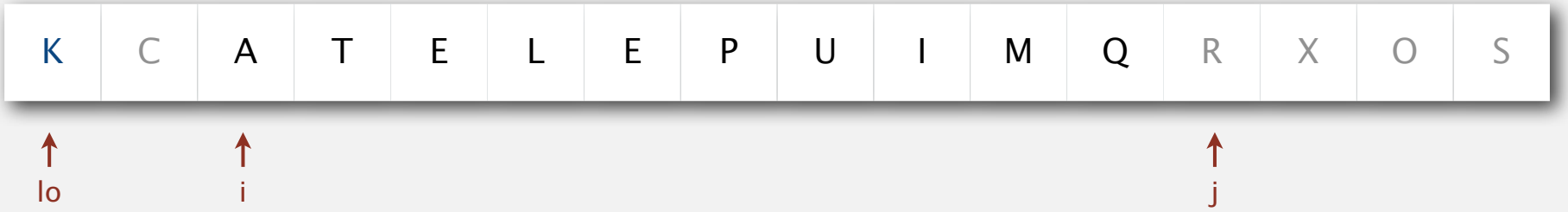

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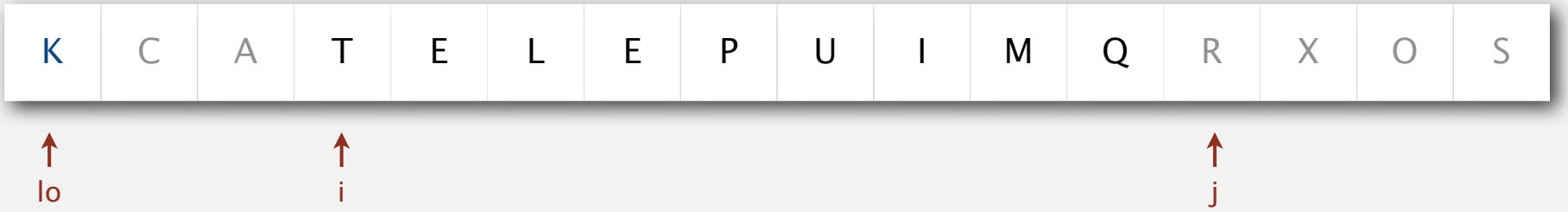

stop `i` scan because `a[i] >= a[lo]`

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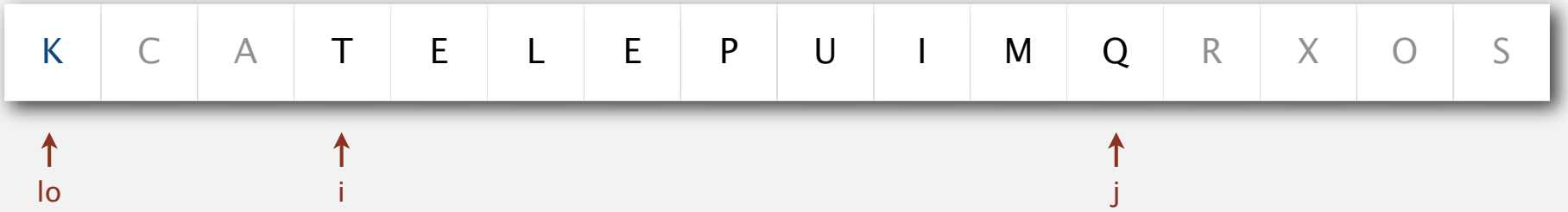

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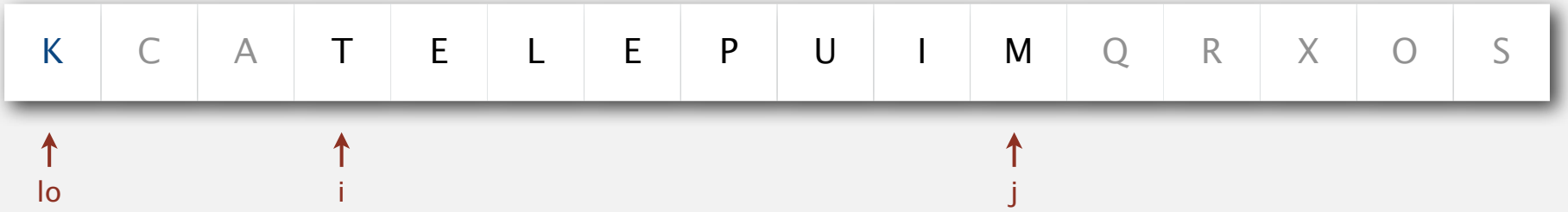

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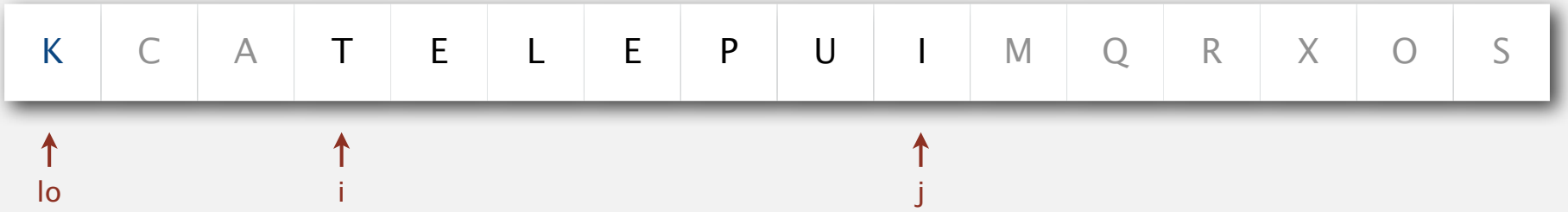

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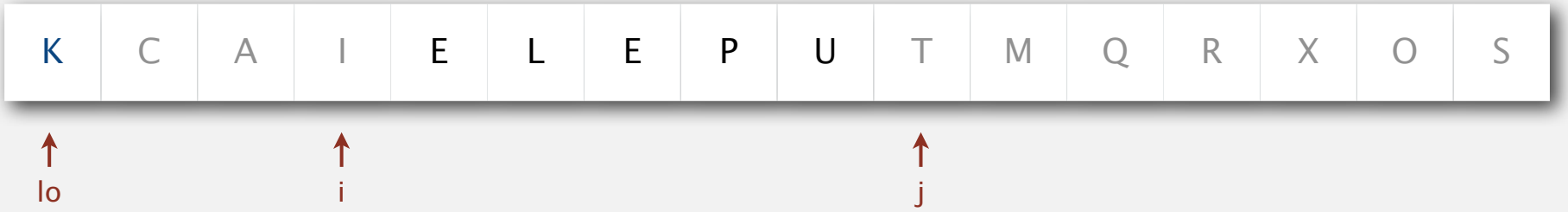

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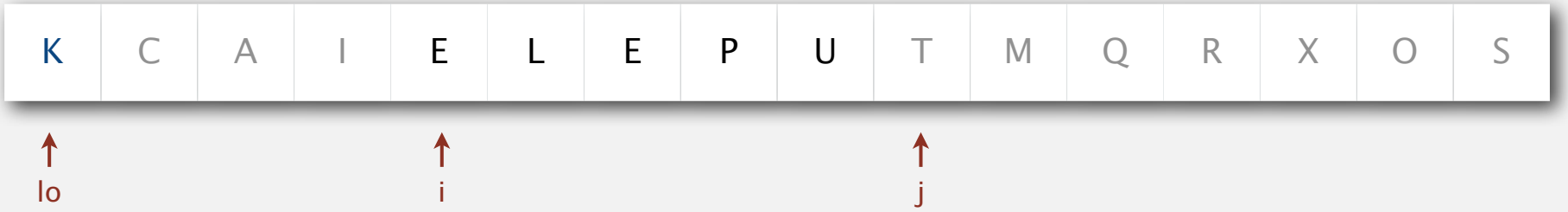

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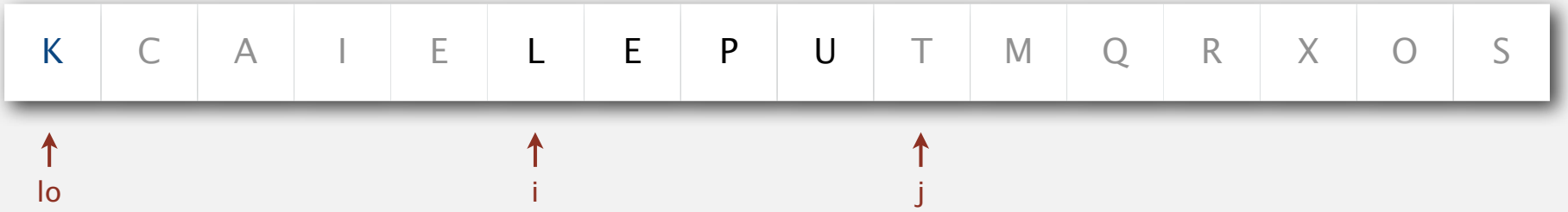

stop `i` scan because `a[i] >= a[lo]`

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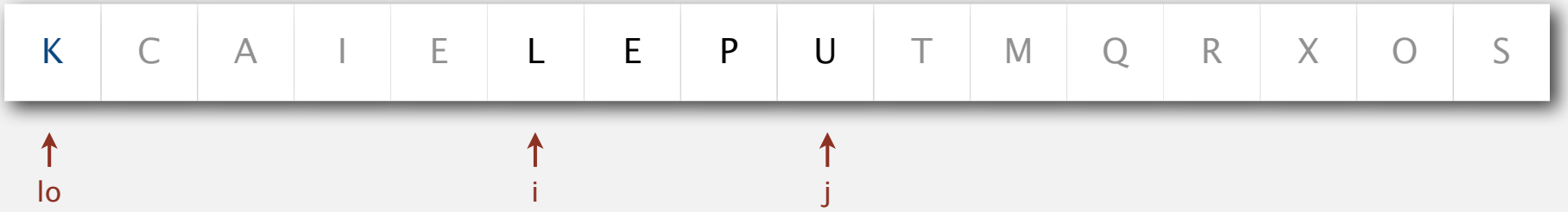

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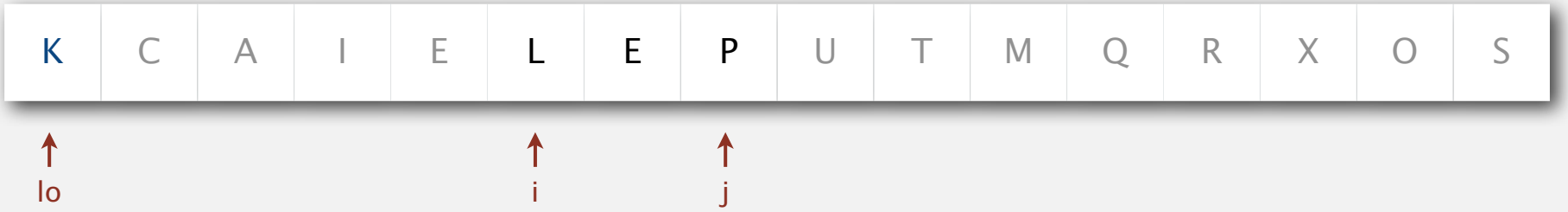

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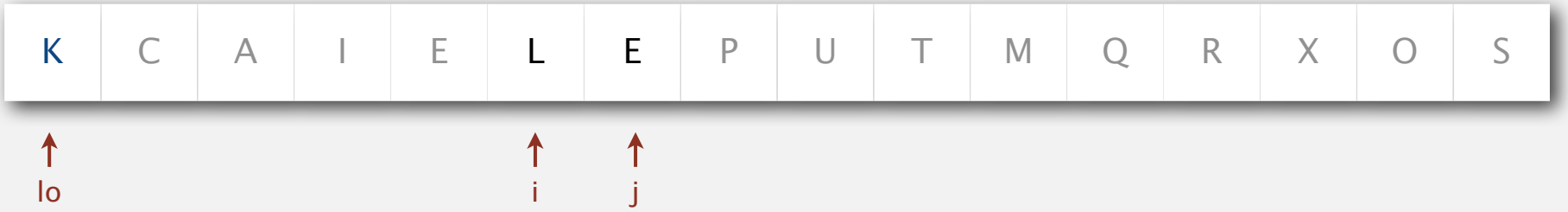

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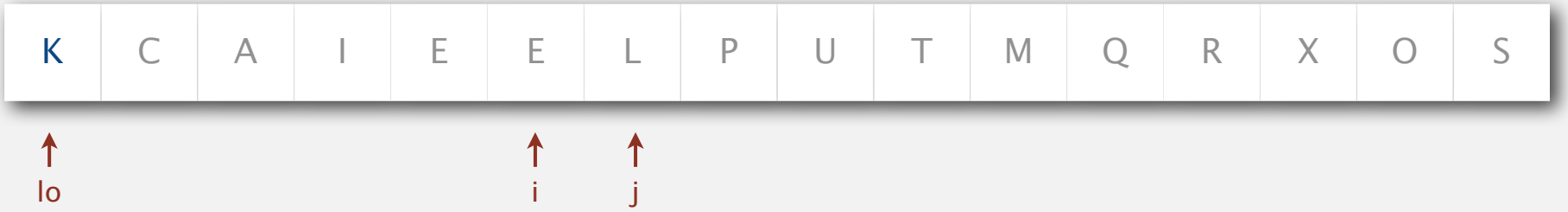

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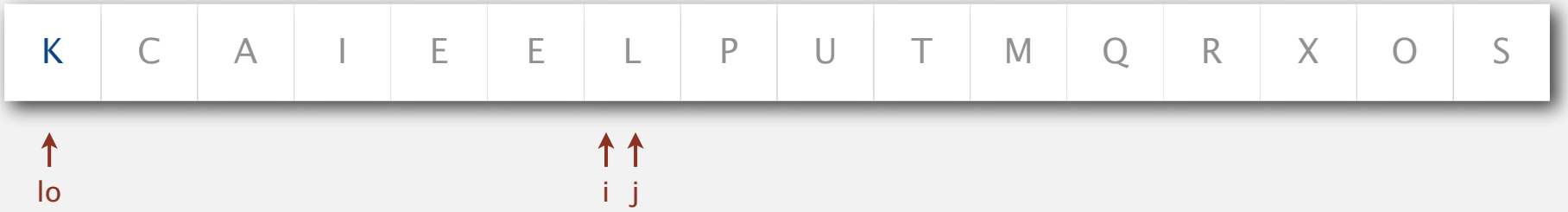

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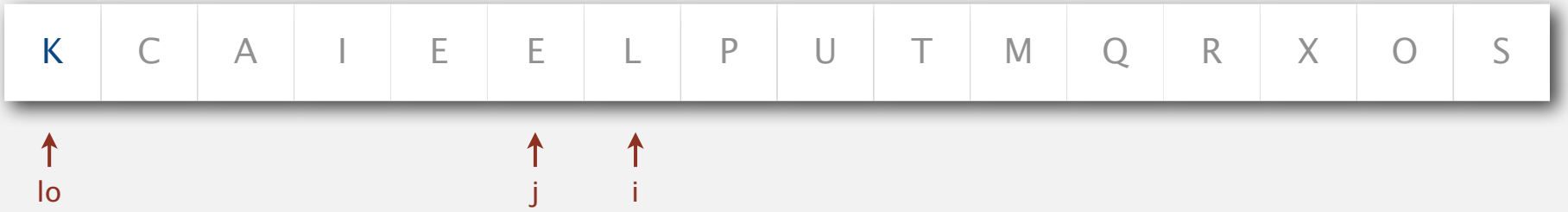

stop `j` scan because `a[j] <= a[lo]`

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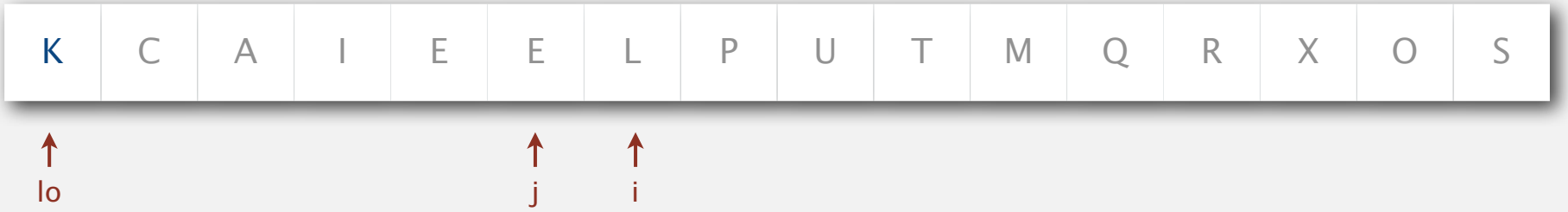
- Exchange `a[i]` with `a[j]`.

When pointers cross.

- Exchange `a[lo]` with `a[j]`.



pointers cross: exchange `a[lo]` with `a[j]`

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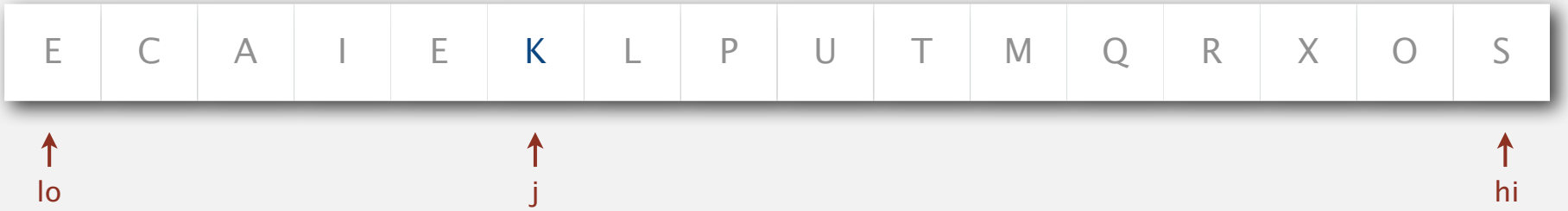
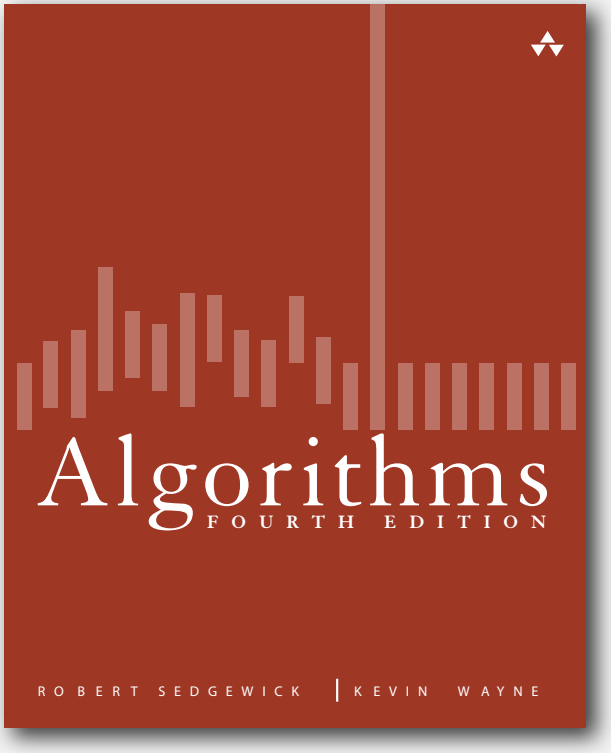


partitioned!

Dijkstra 3-Way Partitioning



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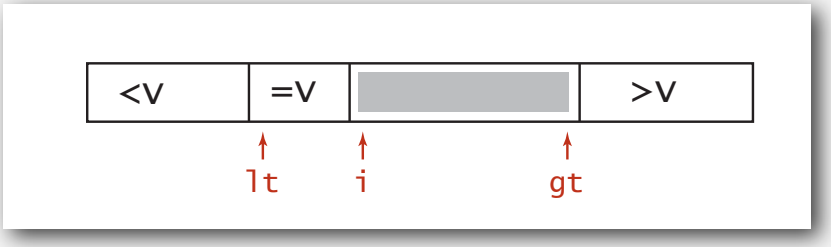
invariant



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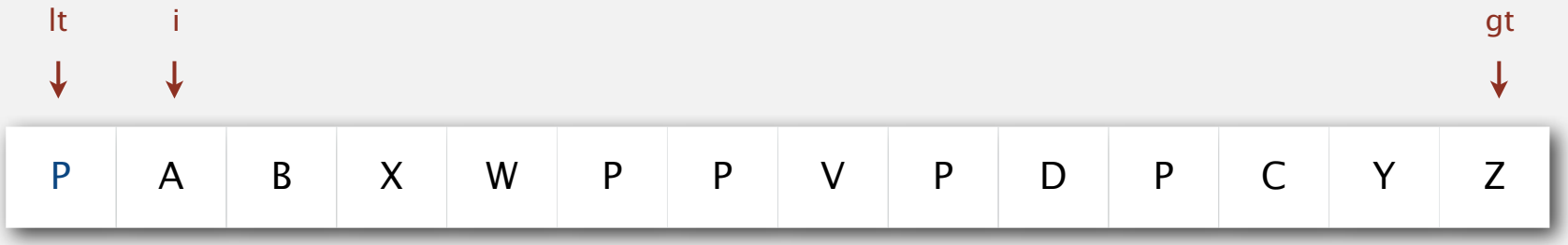

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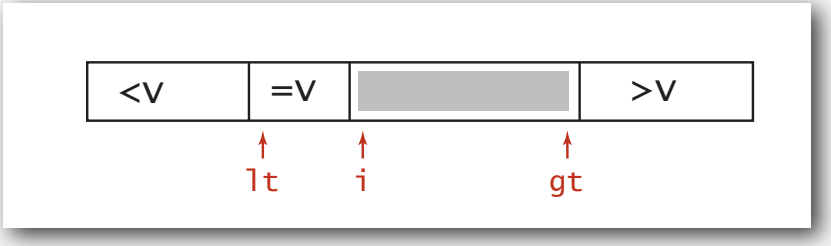

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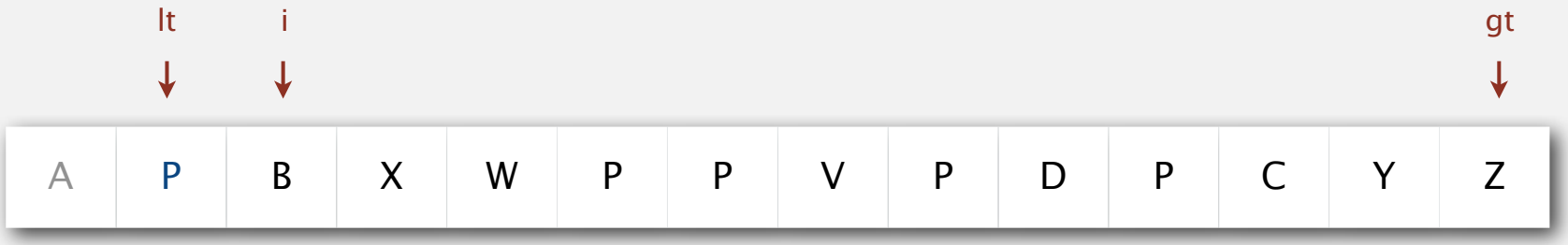

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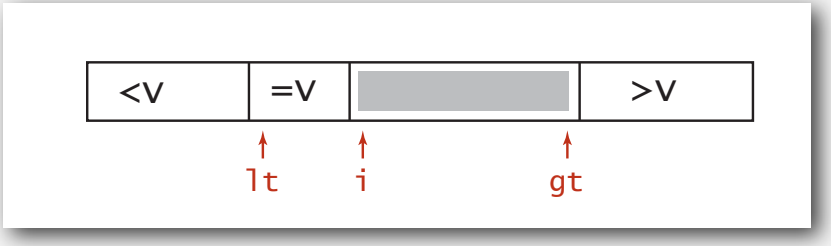

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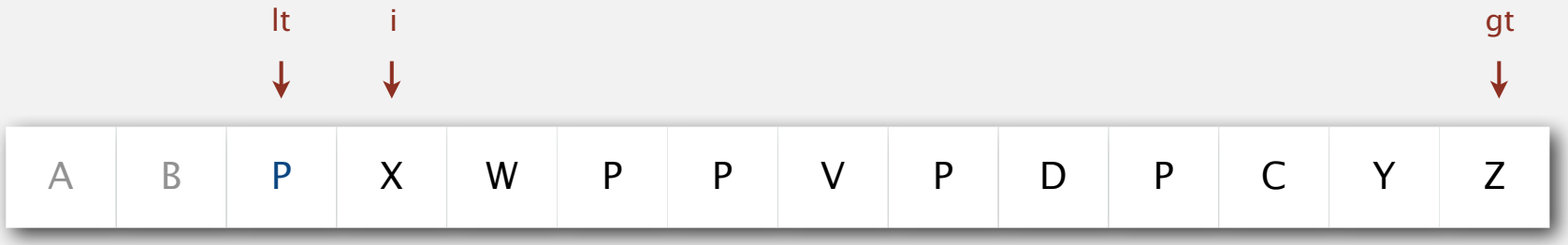

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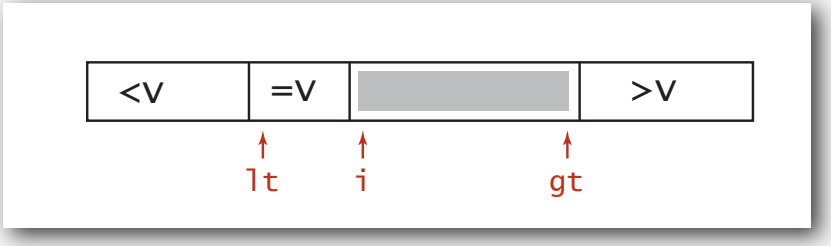

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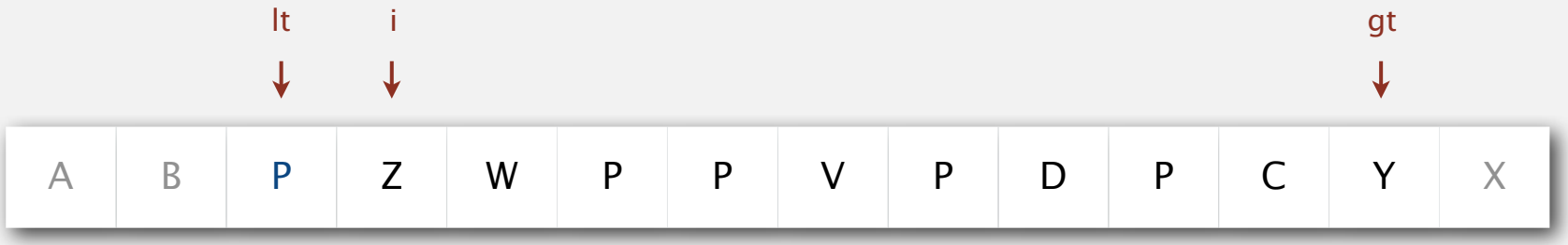

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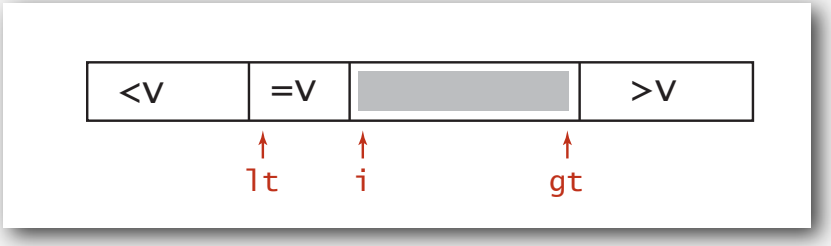

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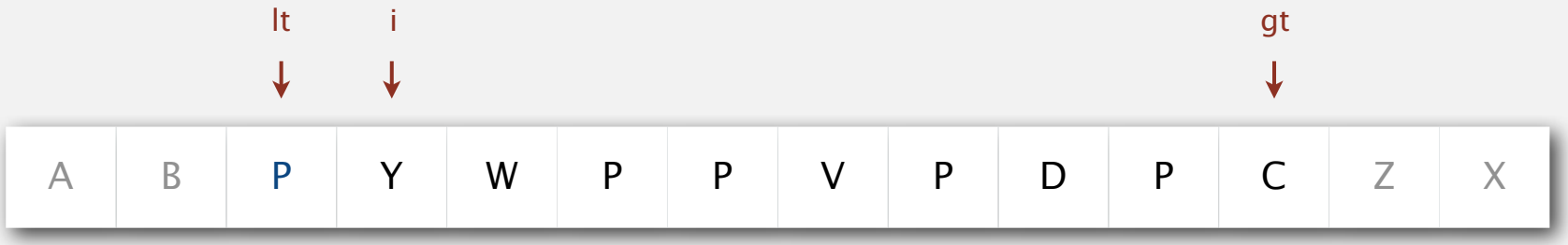

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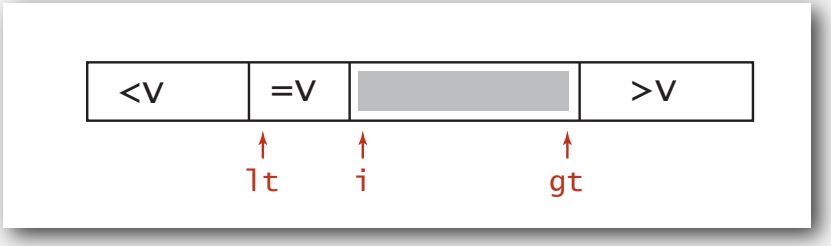

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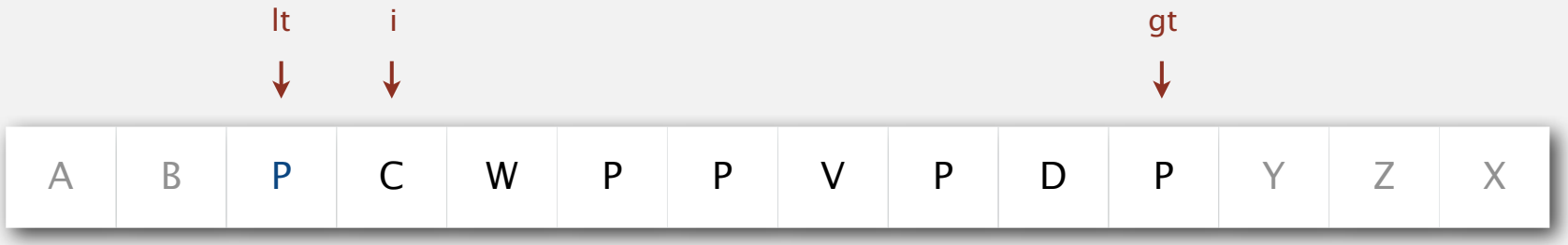

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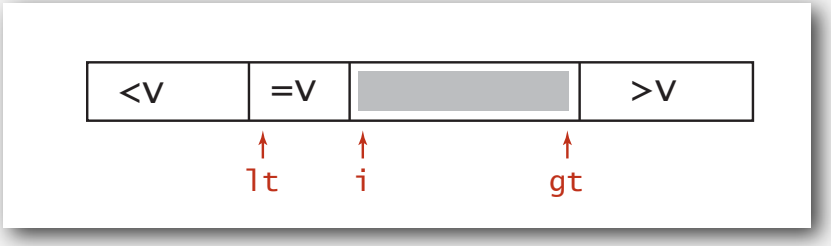

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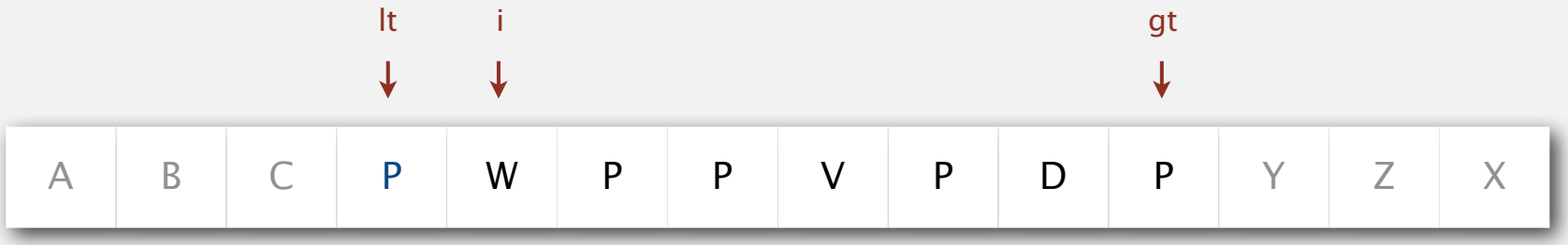
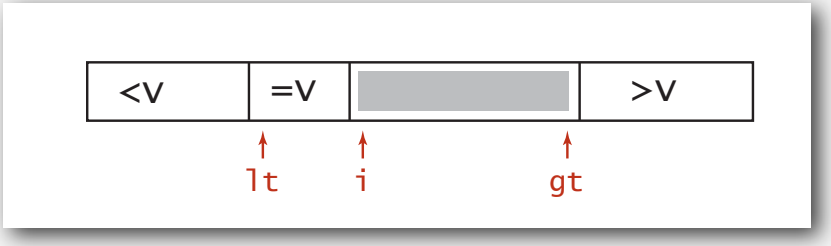


invariant



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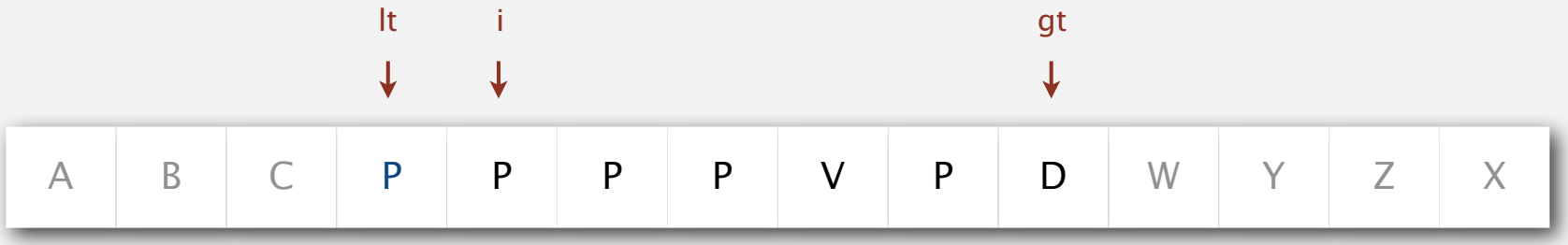

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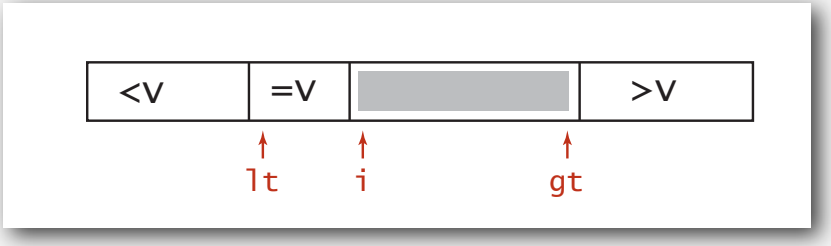

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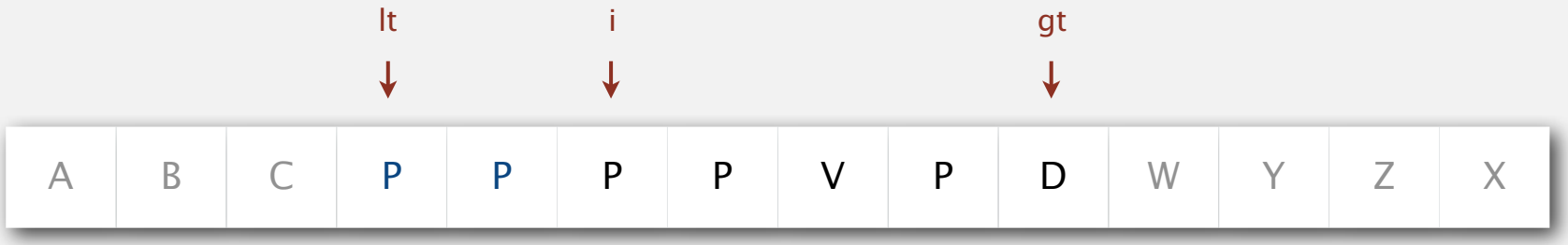

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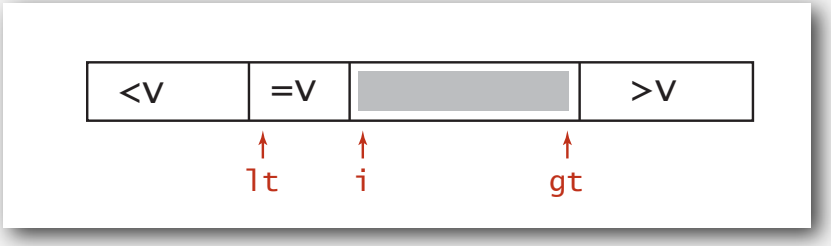

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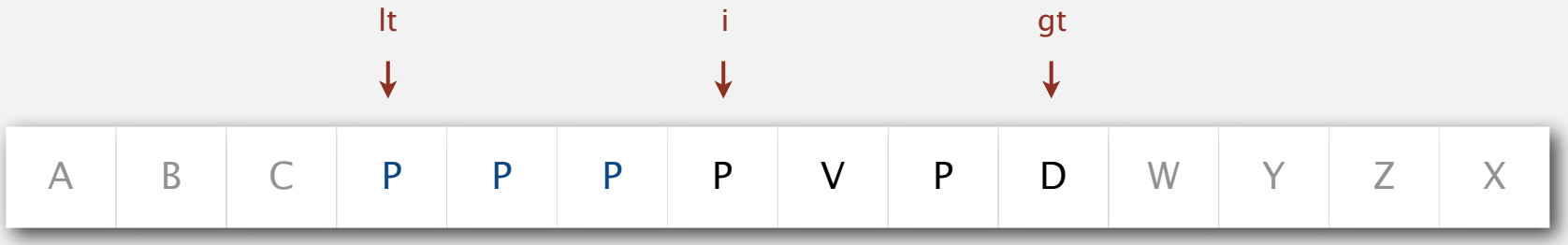

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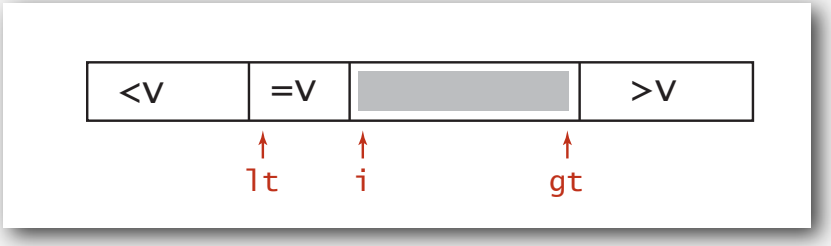

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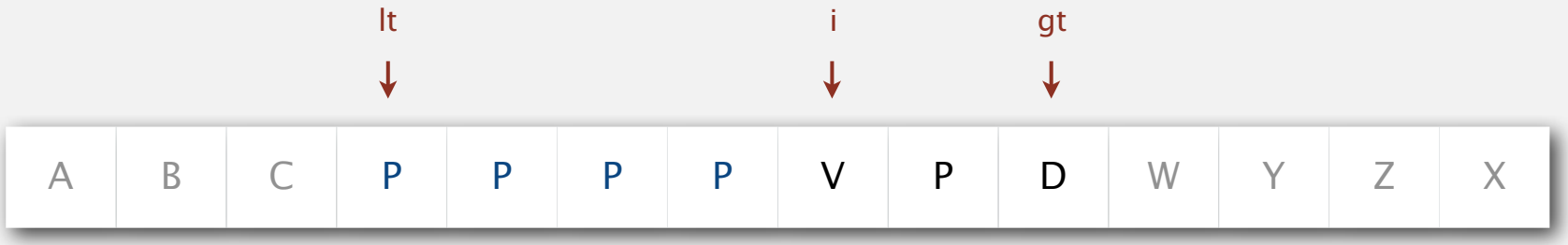

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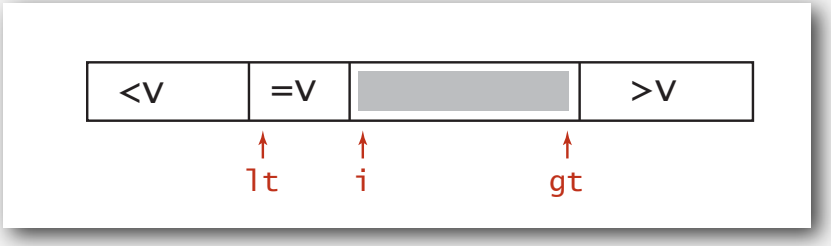

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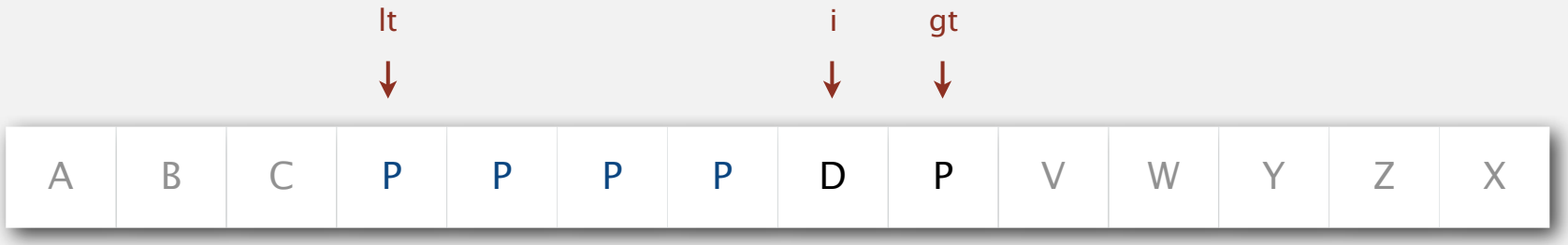

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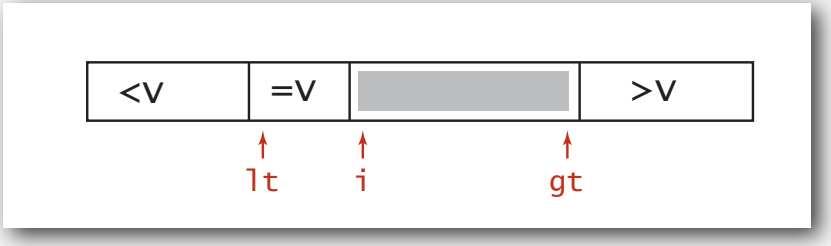

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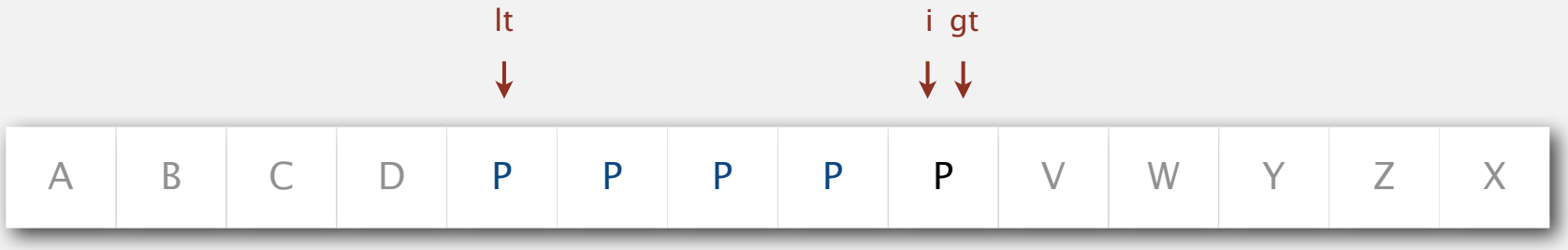

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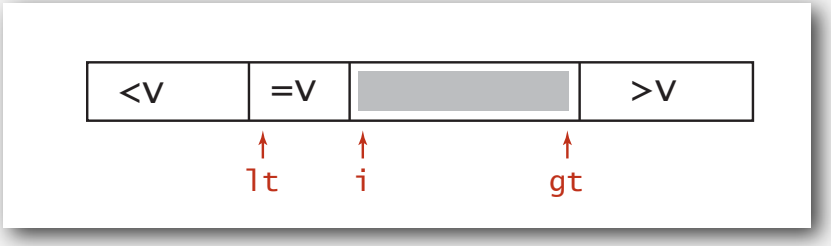

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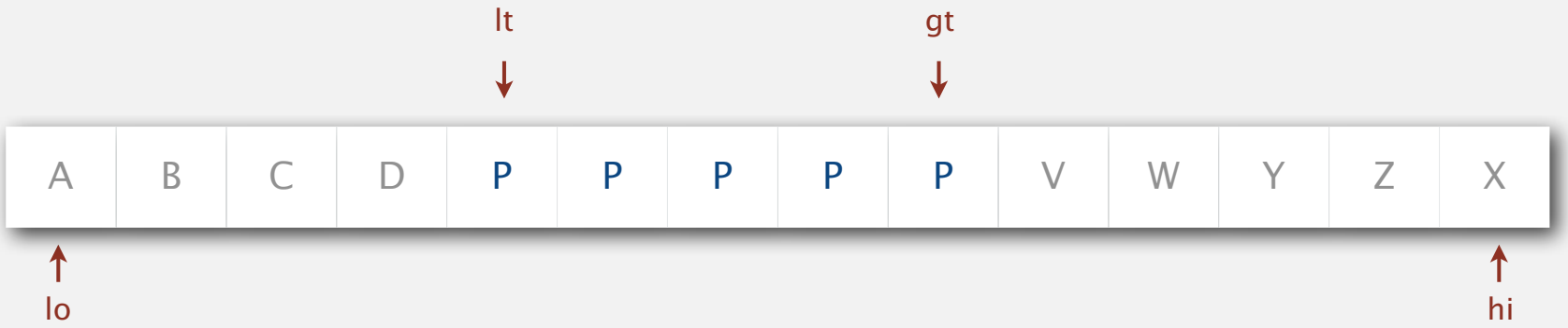

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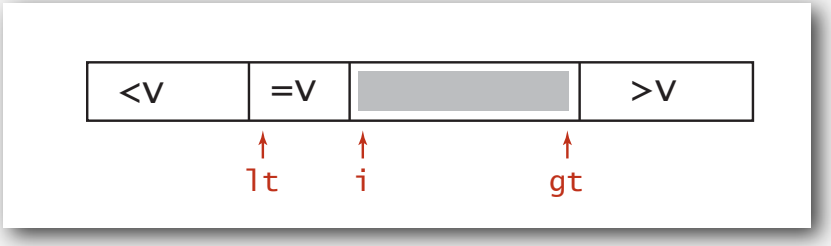
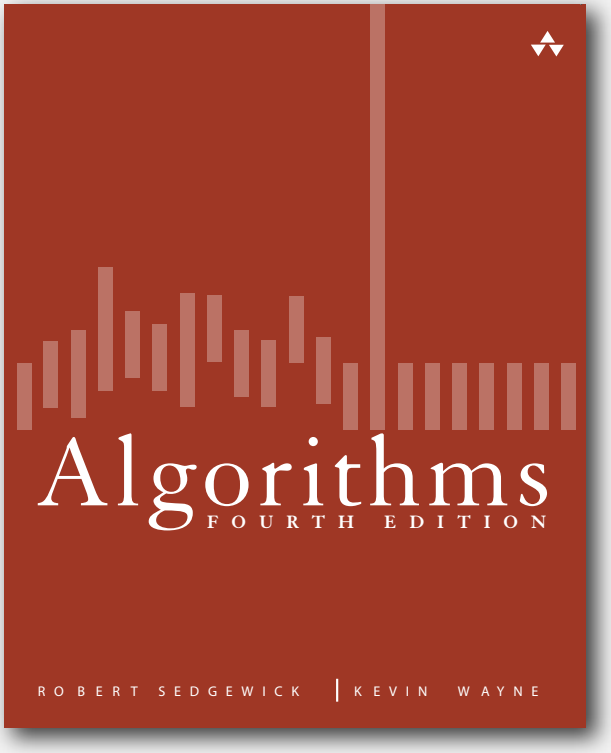


Bentley-McIlroy 3-Way Partitioning



Bentley-McIlroy 3-way partitioning

Repeat until `i` and `j` pointers cross.

- Scan `i` from left to right so long as `a[i] < a[lo]`.
- Scan `j` from right to left so long as `a[j] > a[lo]`.
- Exchange `a[i]` with `a[j]`.
- If `a[i] == a[lo]`, exchange `a[i]` with `a[p]` and increment `p`.
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Bentley-McIlroy 3-way partitioning

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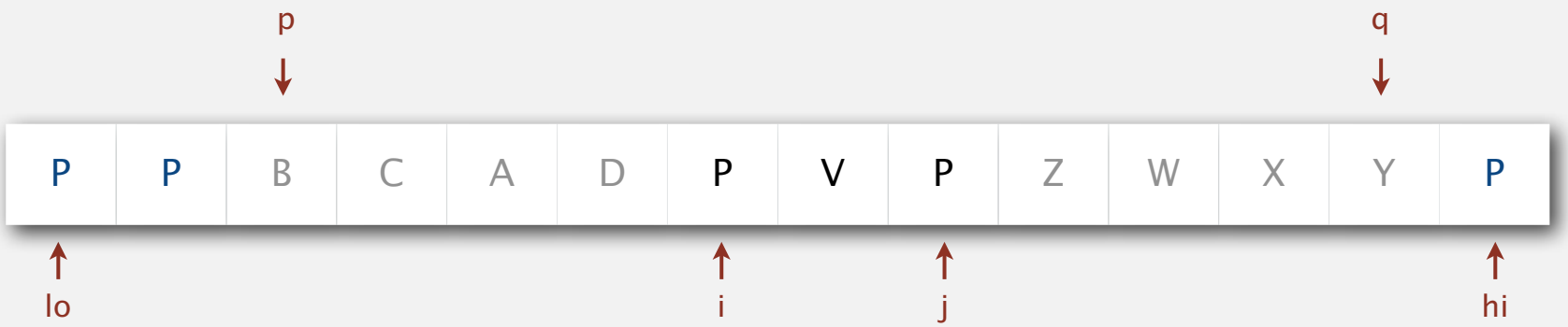

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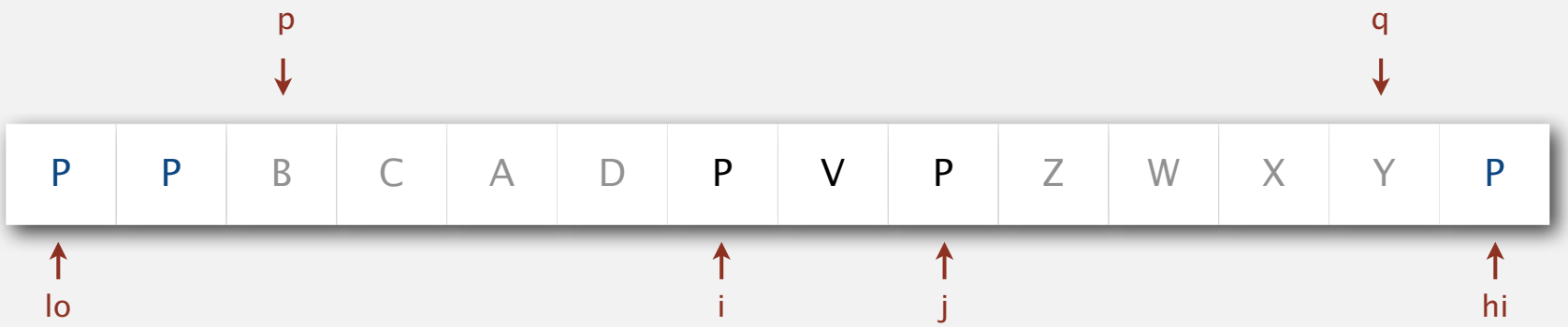

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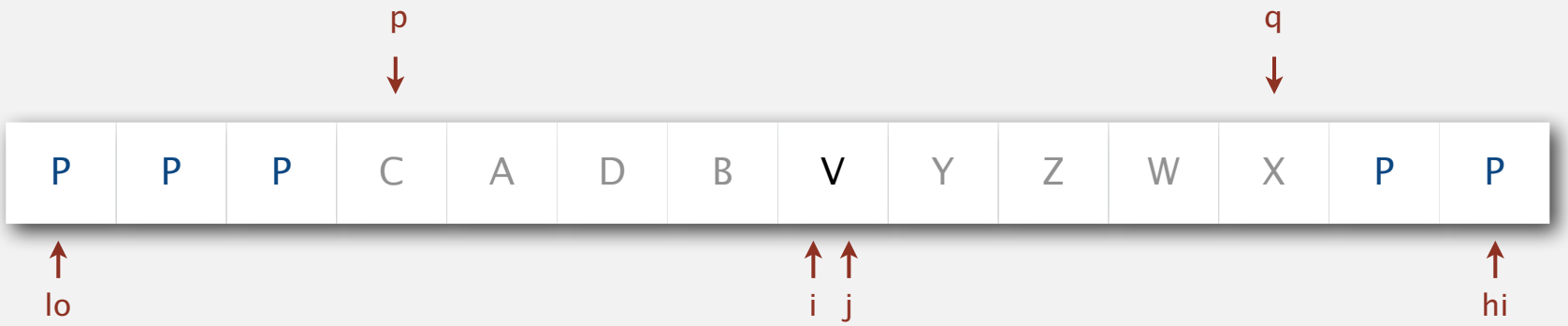

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pointers cross

Bentley-McIlroy 3-way partitioning

Afterwards, swap equal keys to the center.

- Scan `j` and `p` from right to left and exchange `a[j]` with `a[p]`.
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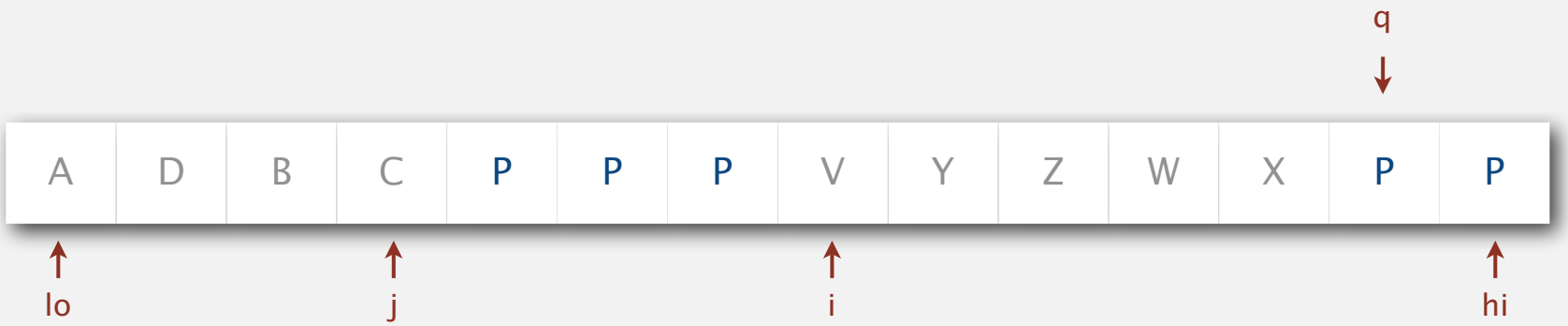

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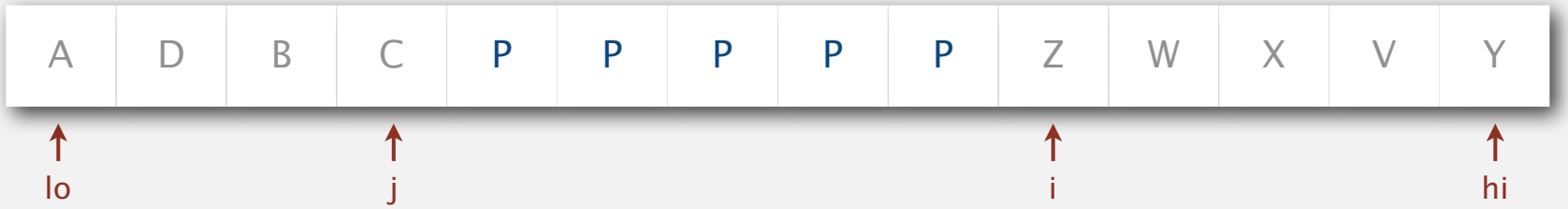

3-way partitioned