Algorithms

Robert Sedgewick | Kevin Wayne

http://algs4.cs.princeton.edu

2.3 Partitioning Demos

- *Sedgewick 2-way partitioning*
- *Dijkstra 3-way partitioning*
- *Bentley-McIlroy 3-way partitioning*
- *dual-pivot partitioning*

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Repeat until i and j pointers cross.

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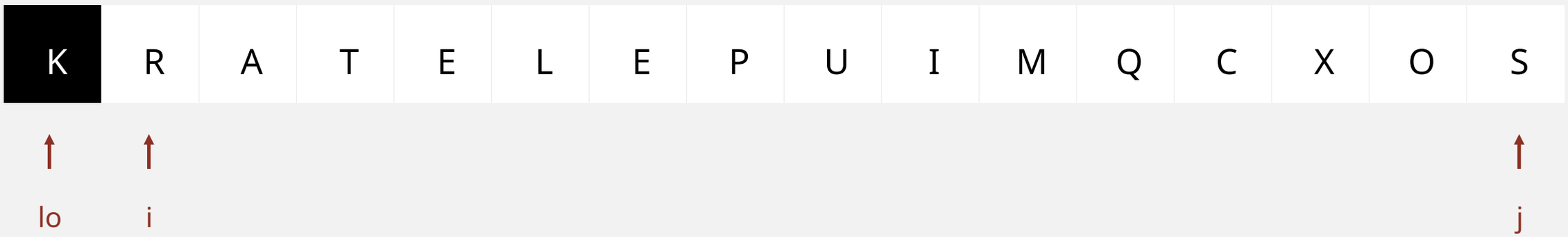

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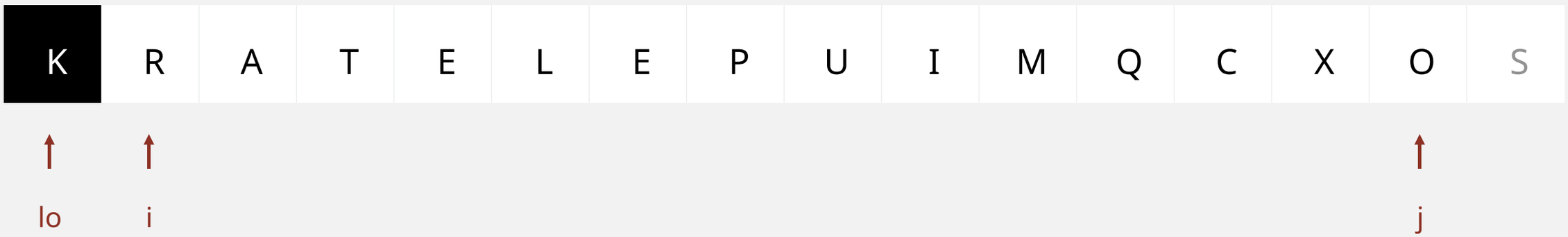

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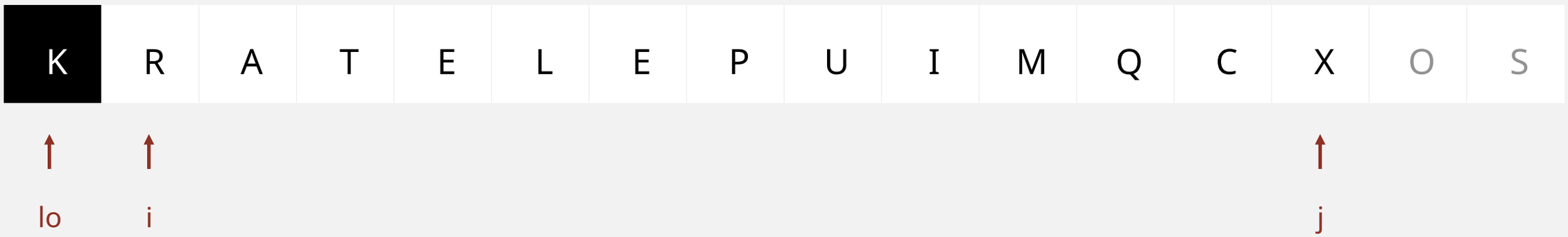

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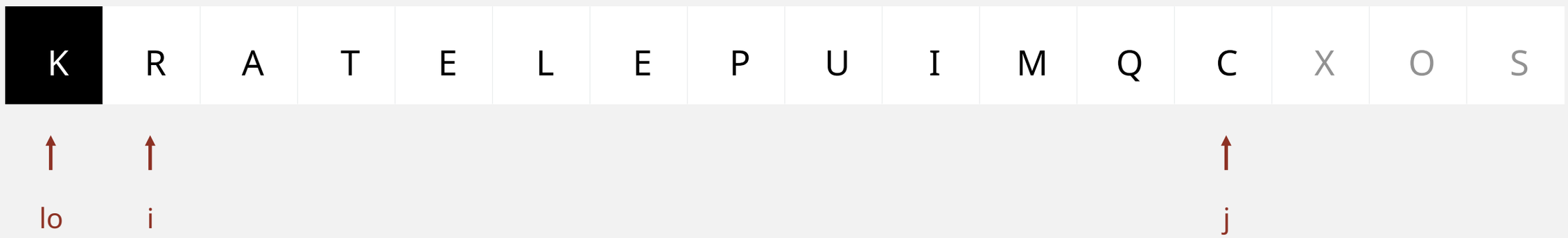

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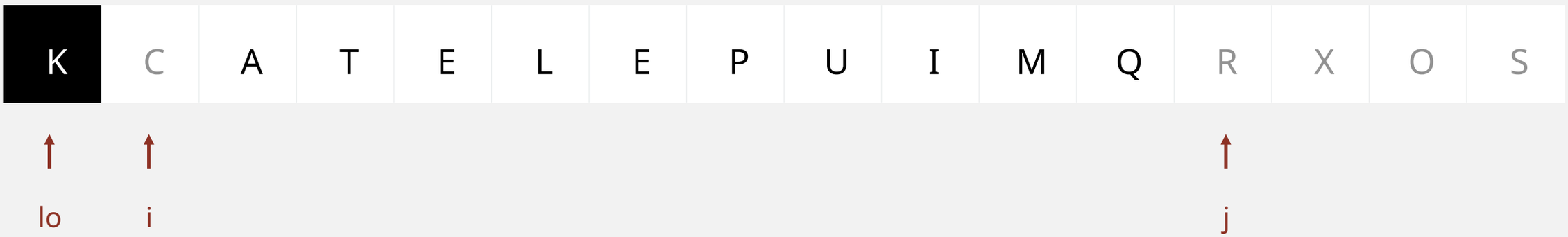

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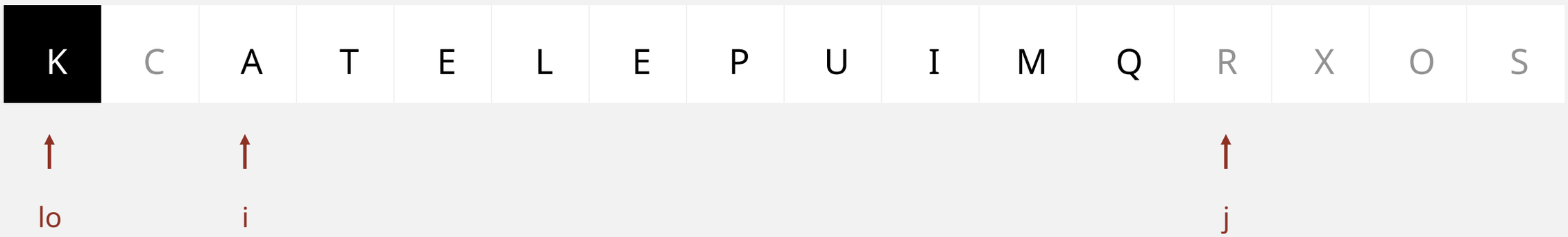

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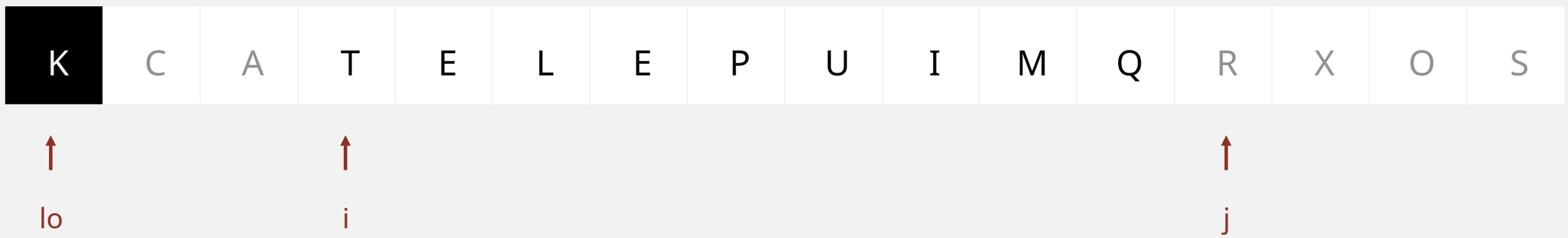

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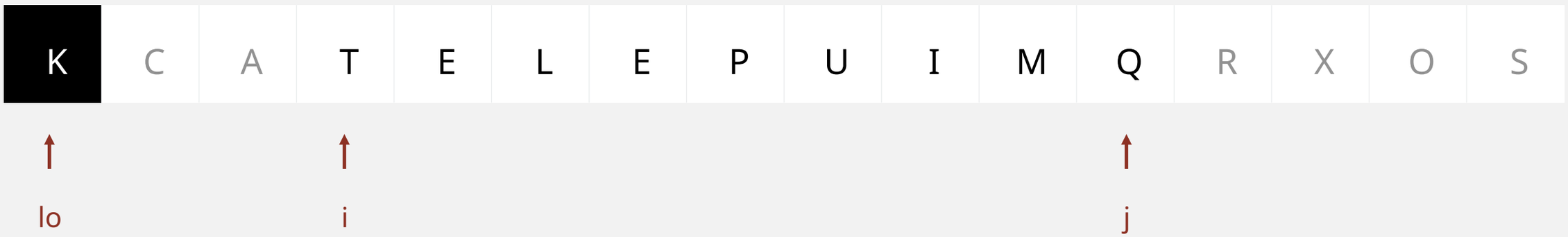

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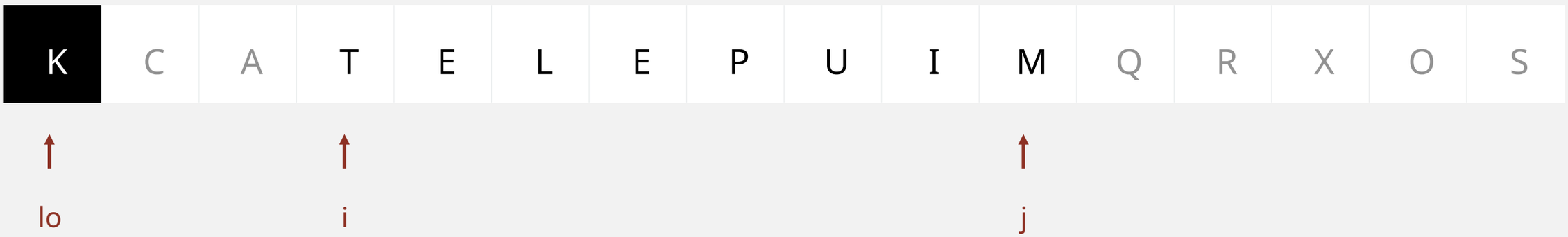

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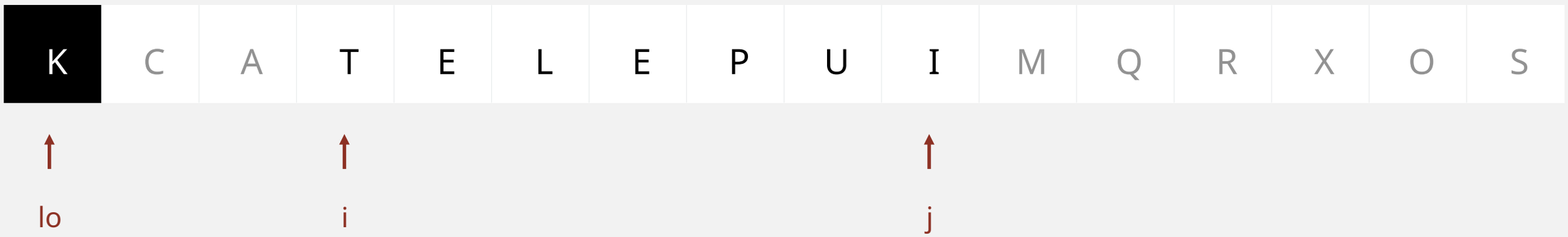

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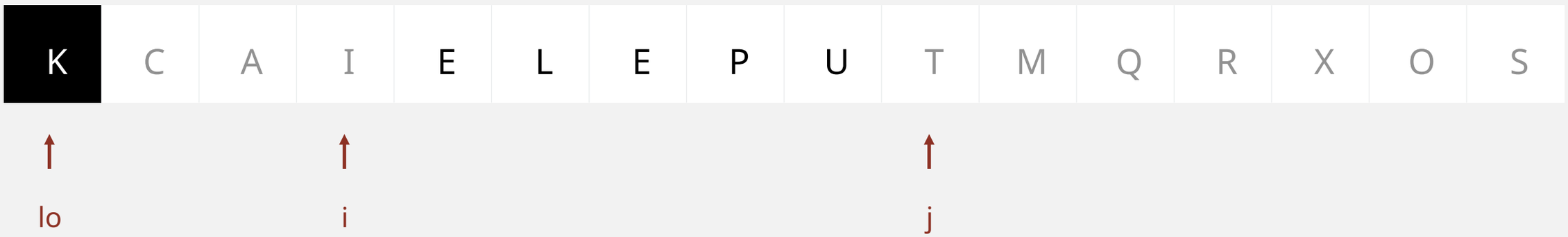

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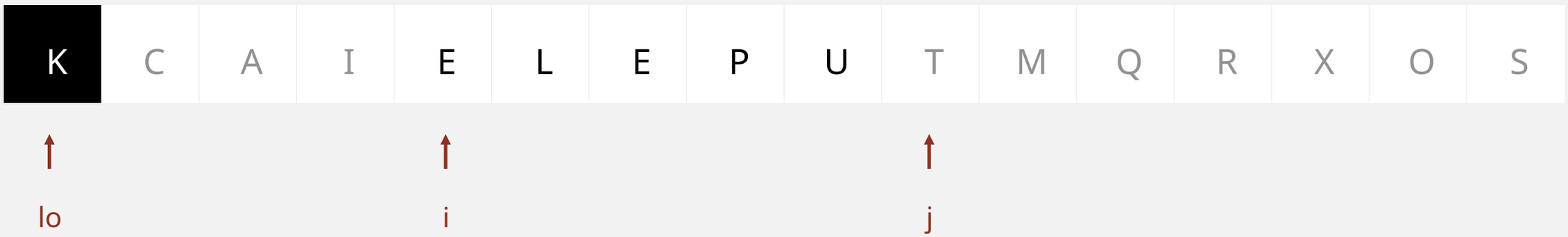

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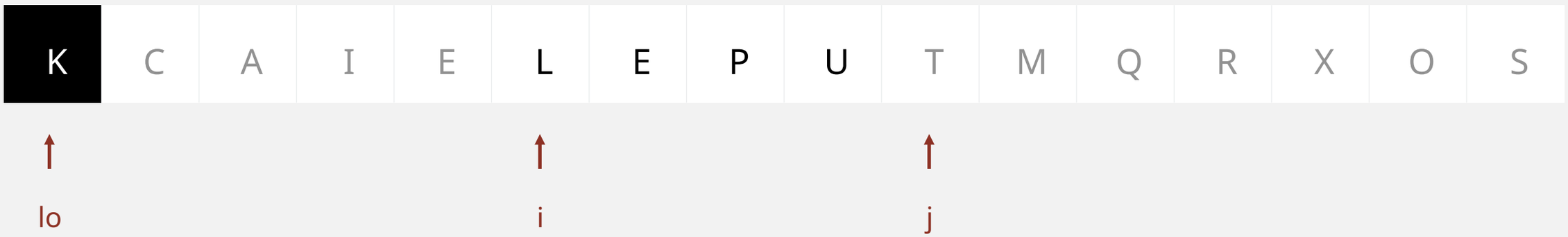

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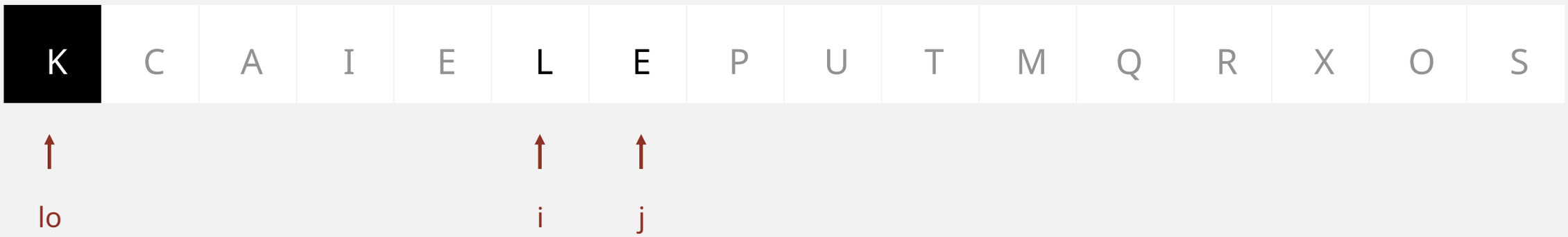

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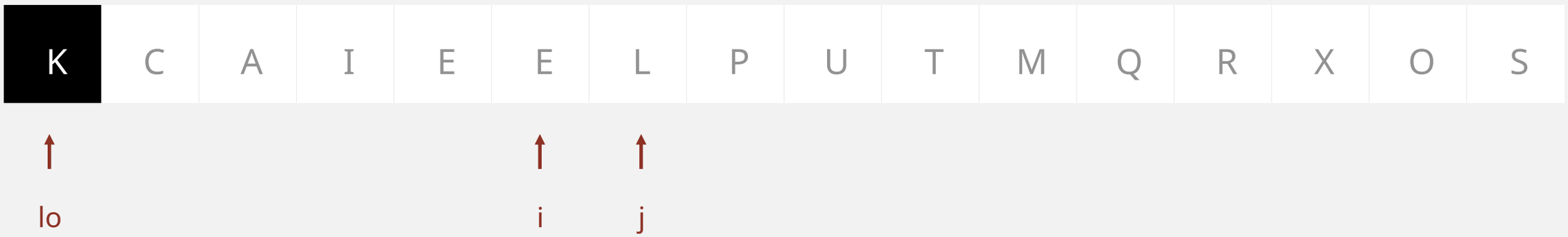

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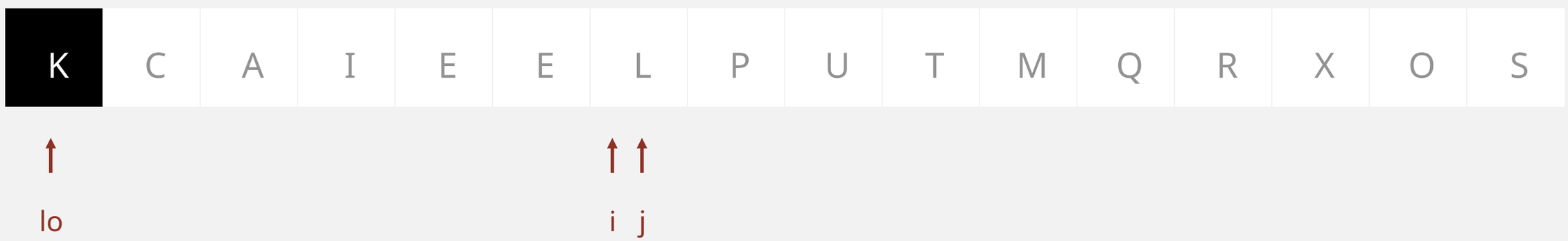

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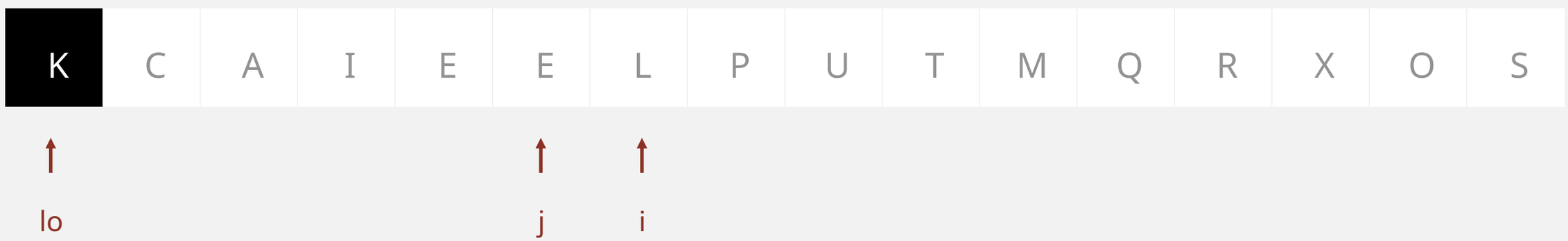

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When pointers cross.

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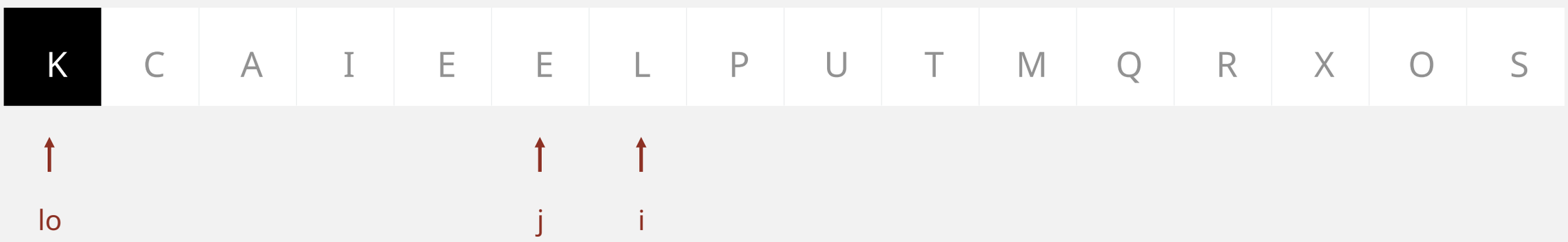

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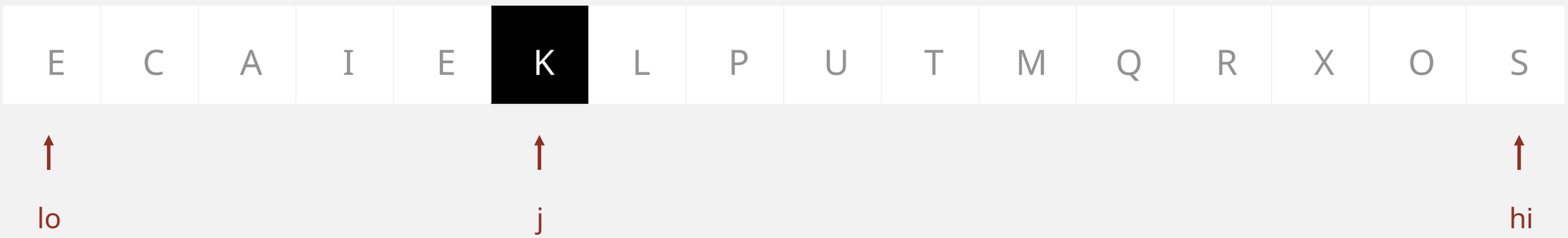

partitioned!

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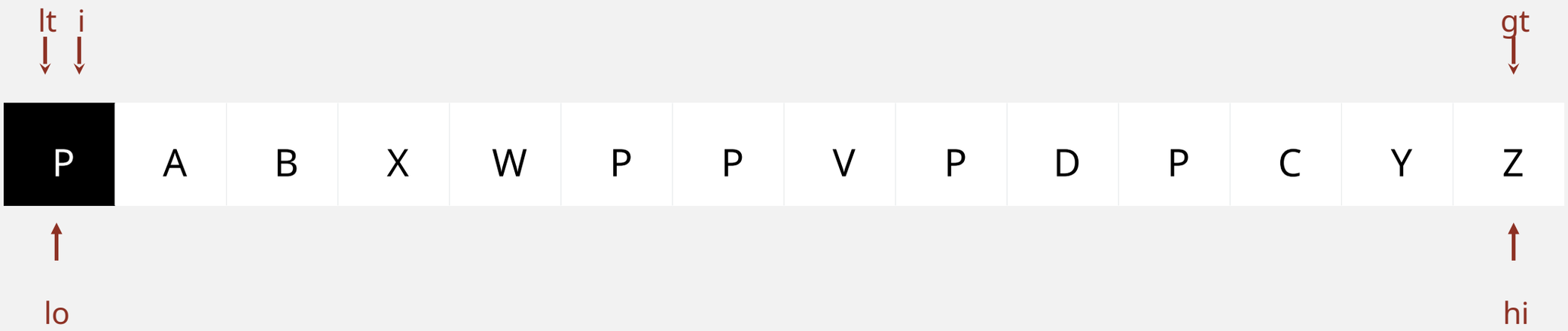

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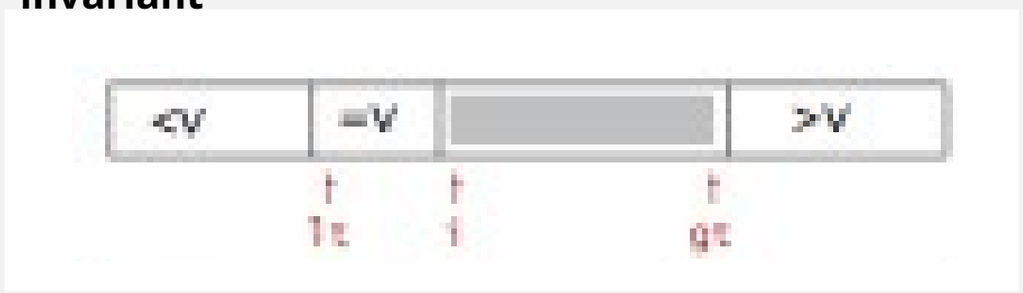

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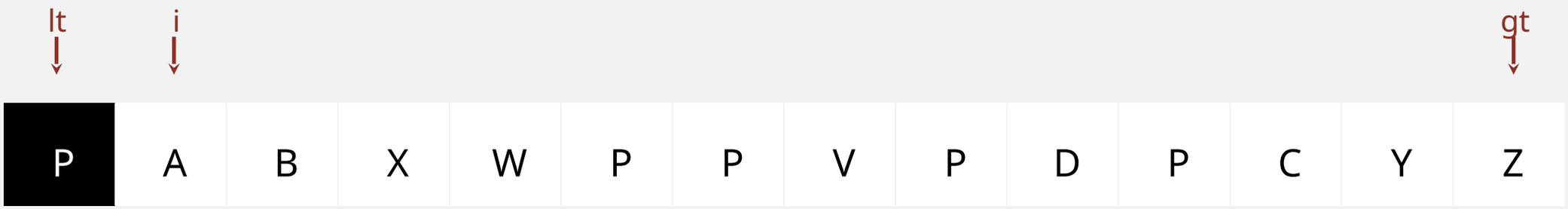

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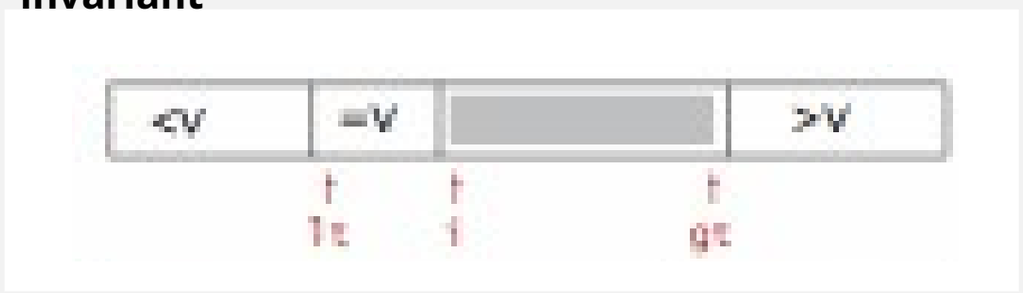

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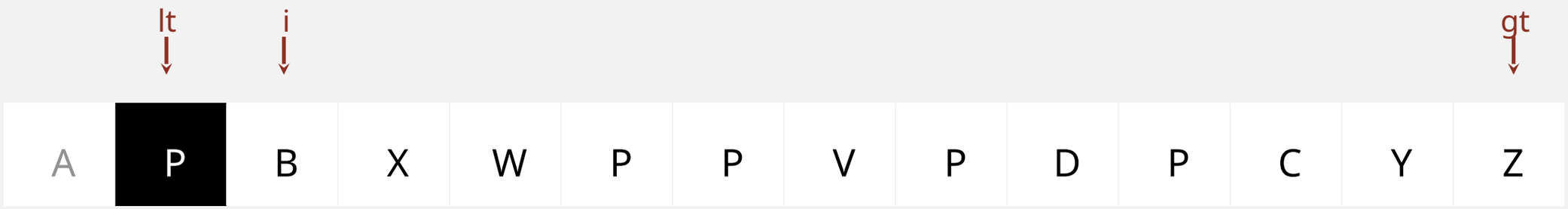

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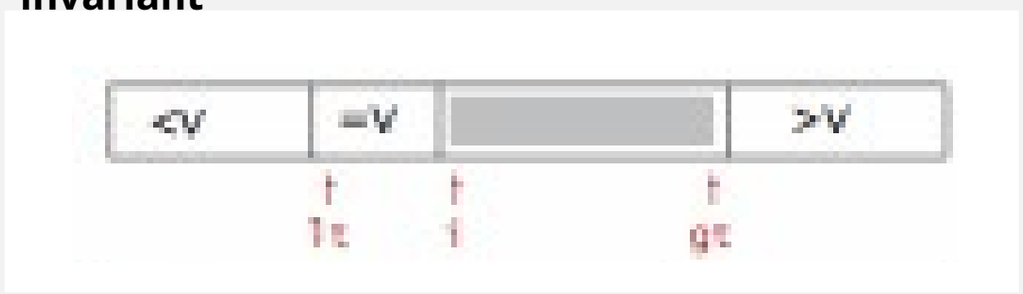

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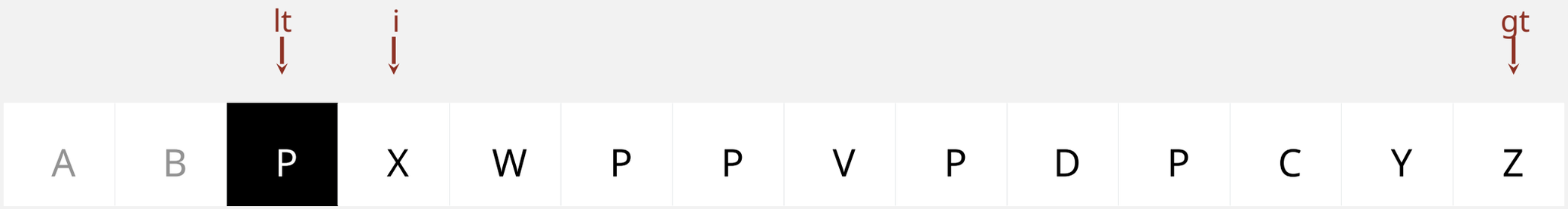

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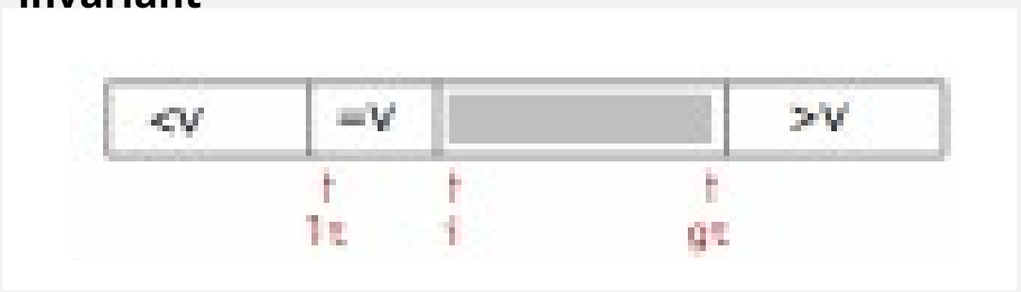

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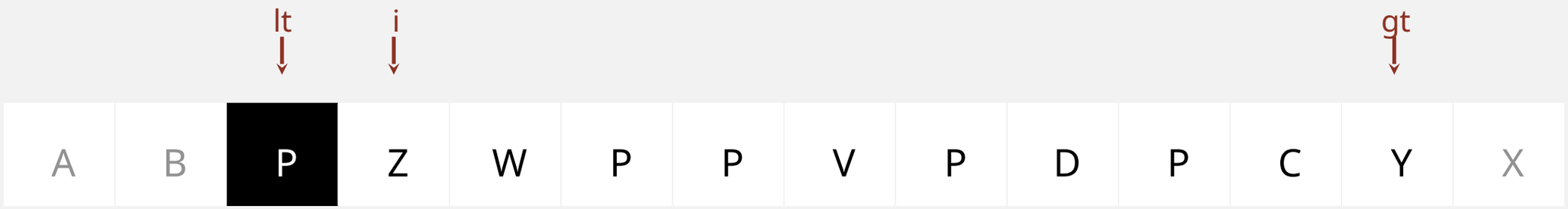

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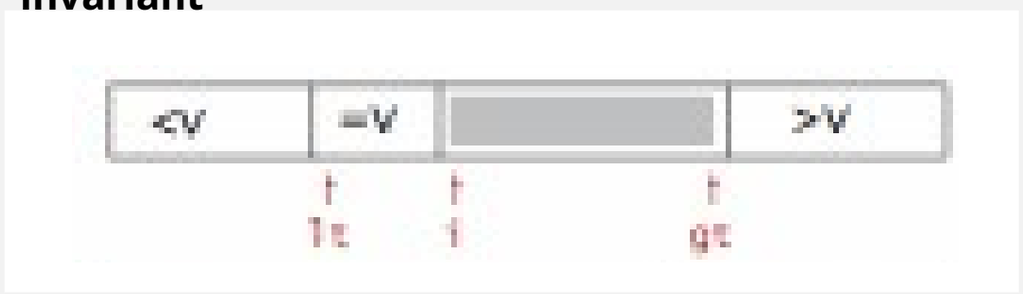

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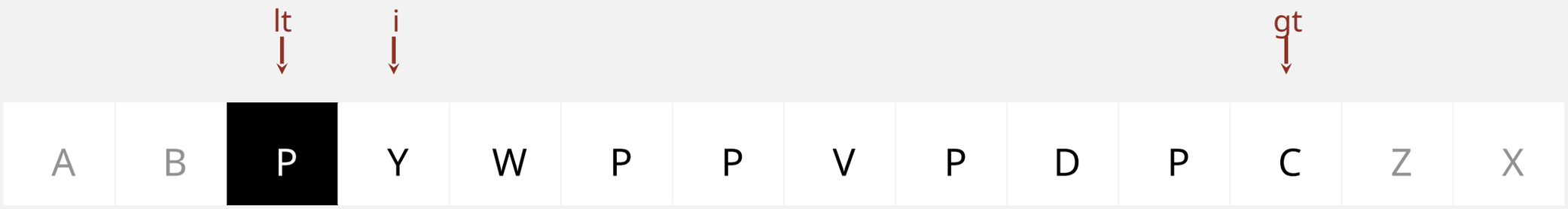

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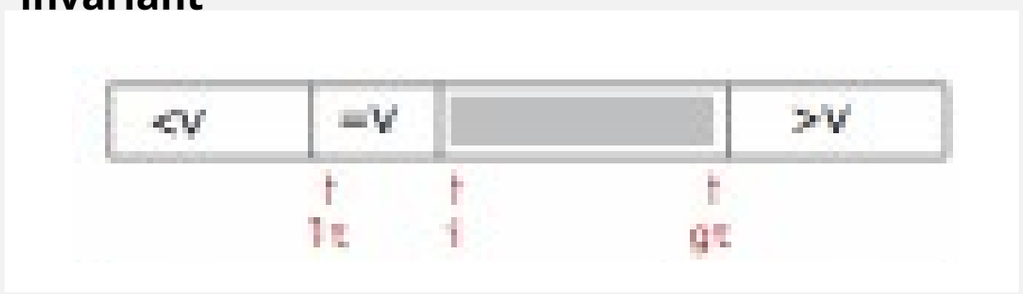

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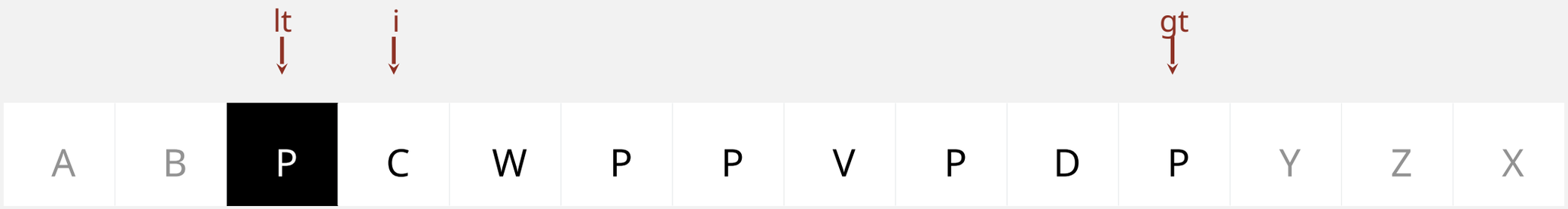

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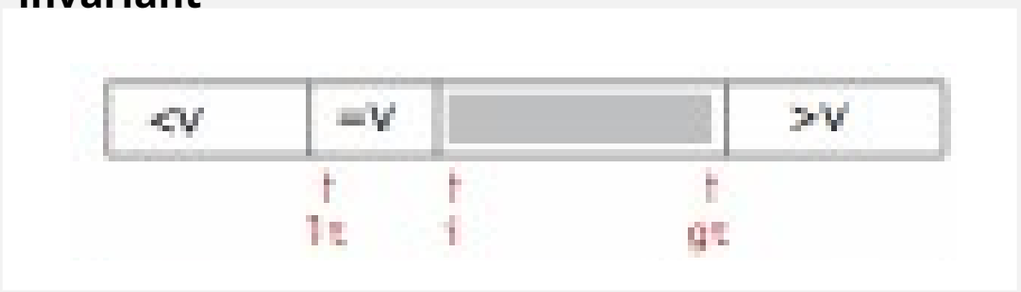

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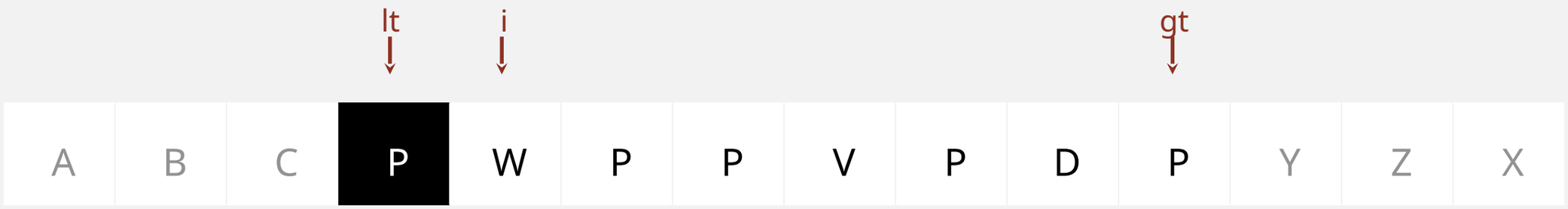

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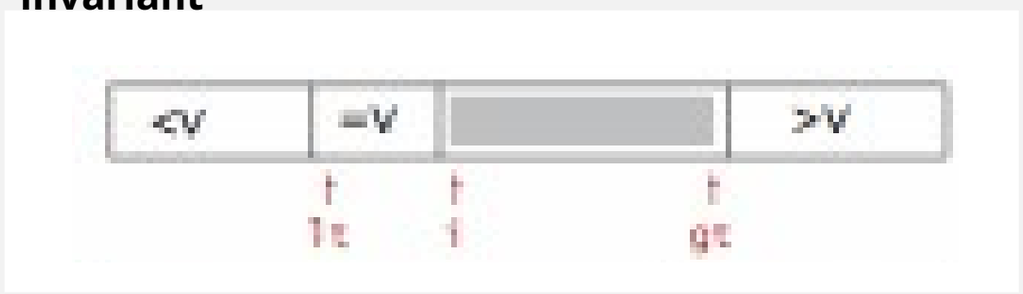

Dijkstra 3-way partitioning demo

- Let v be partitioning item a[lo].
- Scan i from left to right.
  - (a[i] < v): exchange a[lt] with a[i]; increment both lt and i
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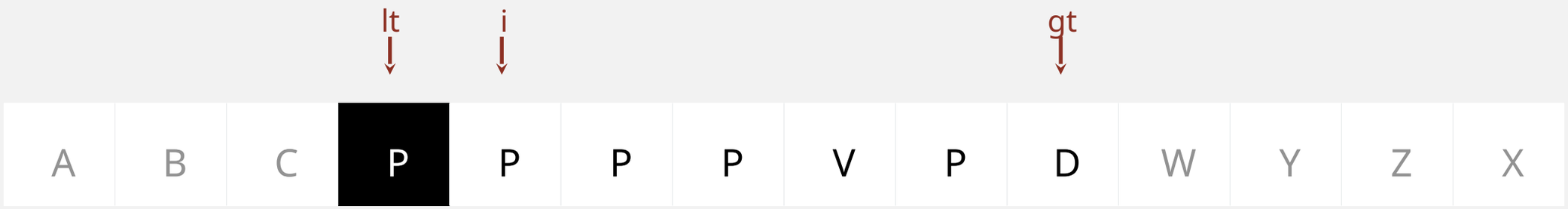
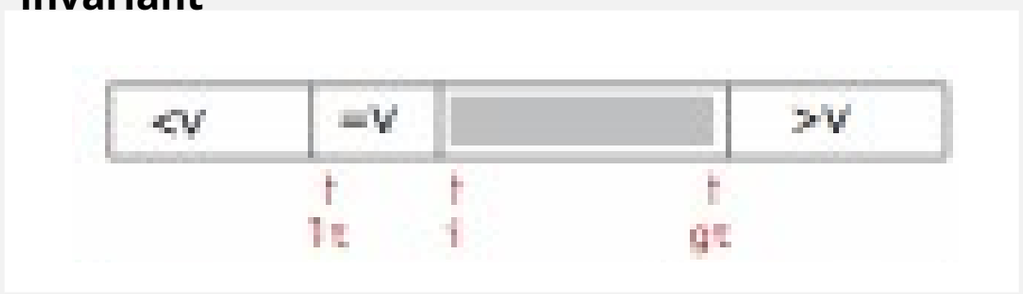


invariant



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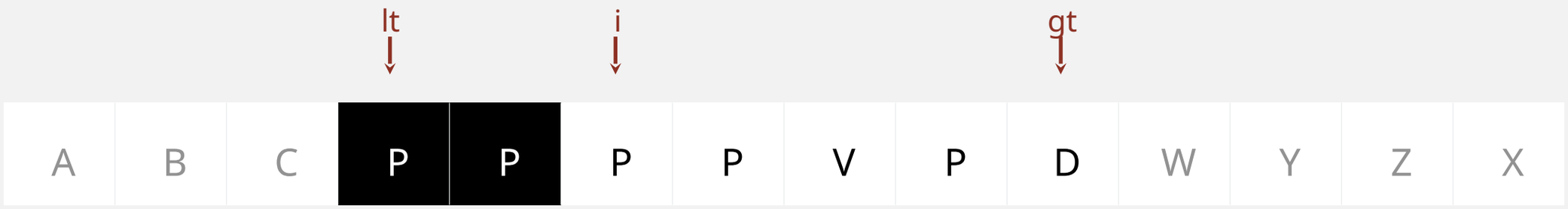
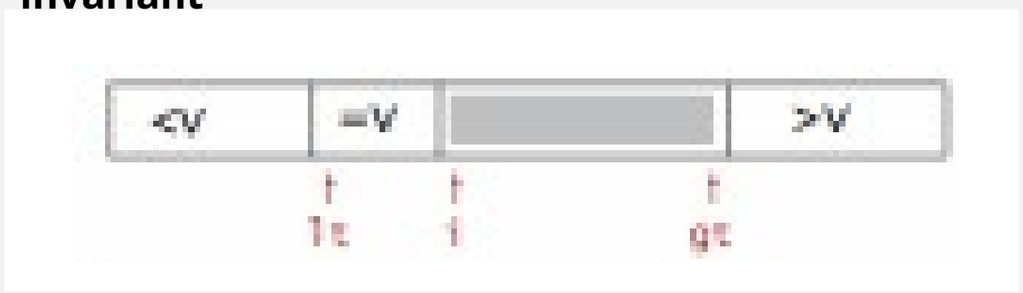


invariant



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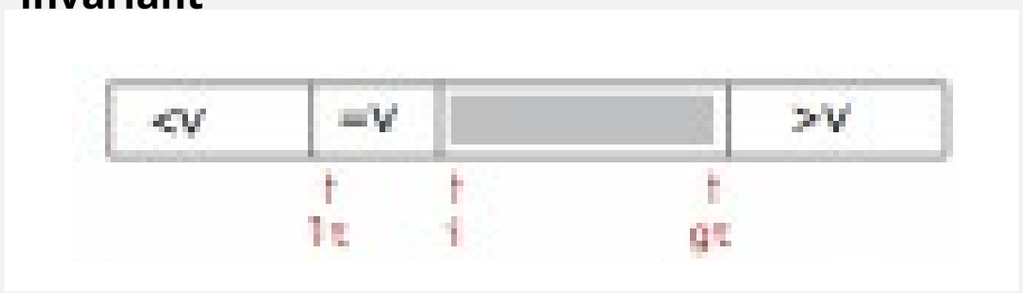

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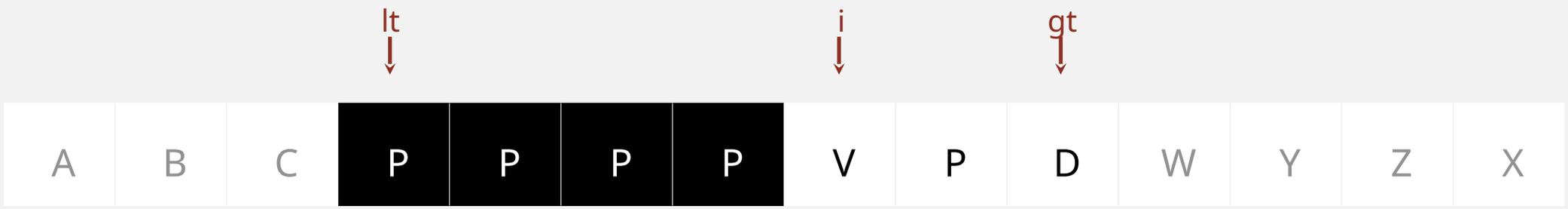
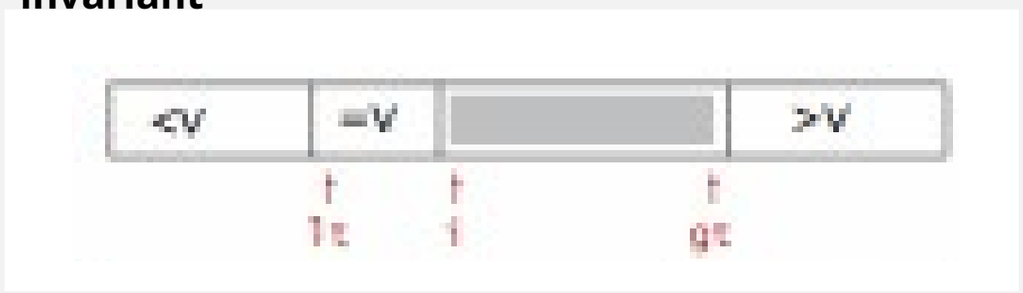


invariant



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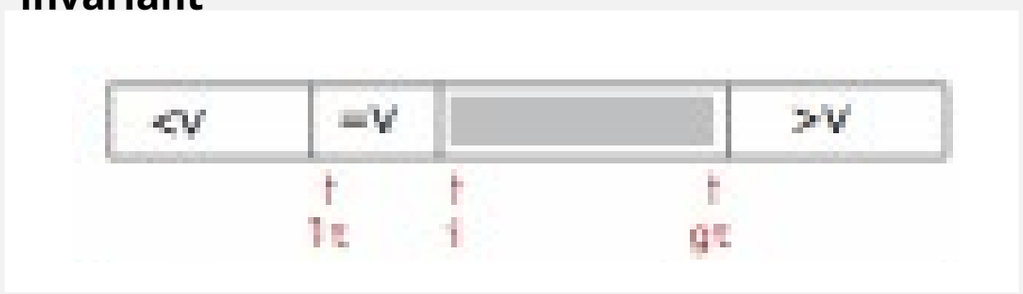
invariant



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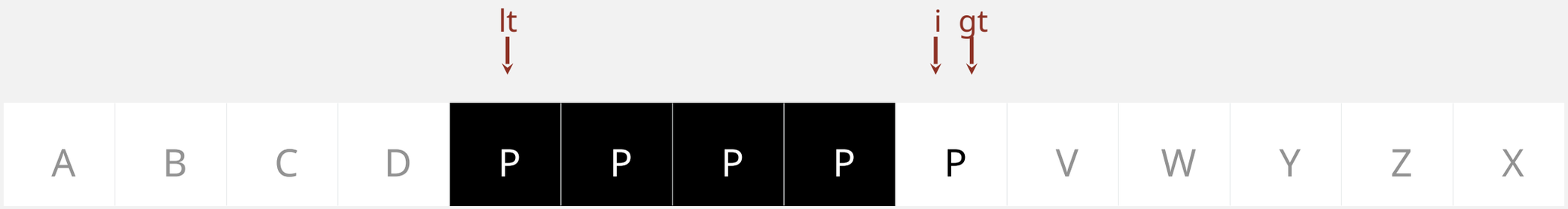
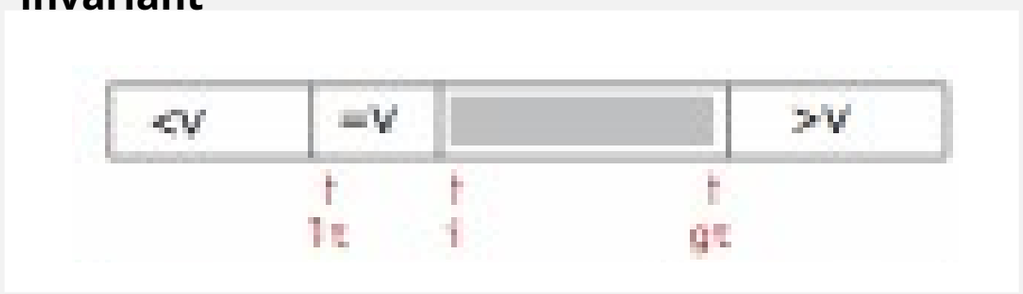


invariant



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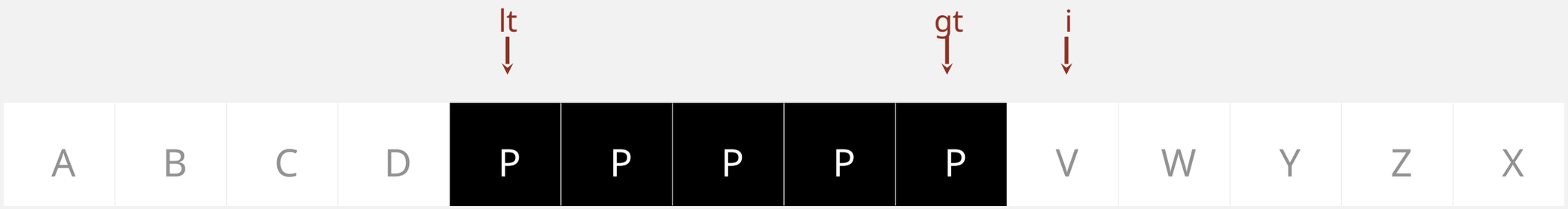
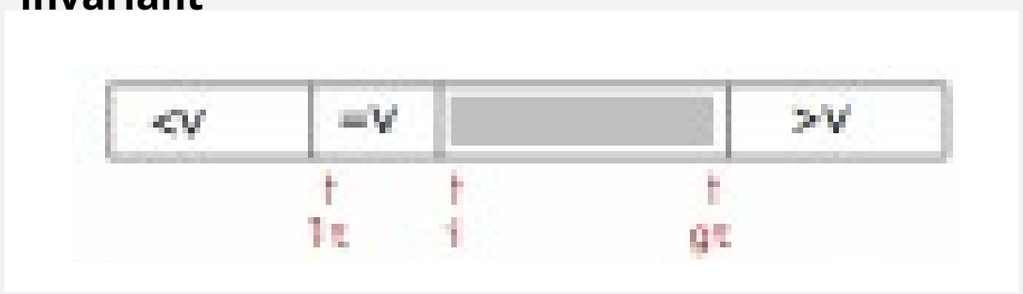


invariant



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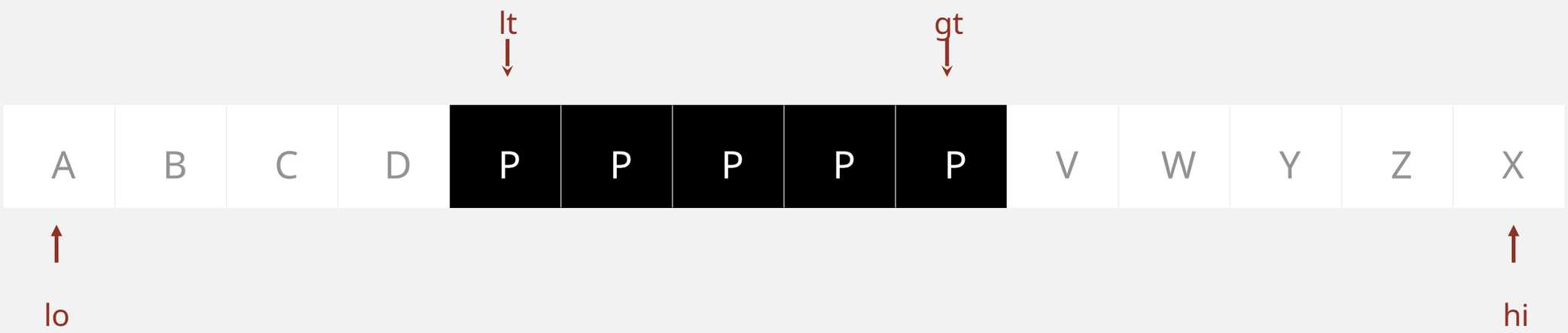
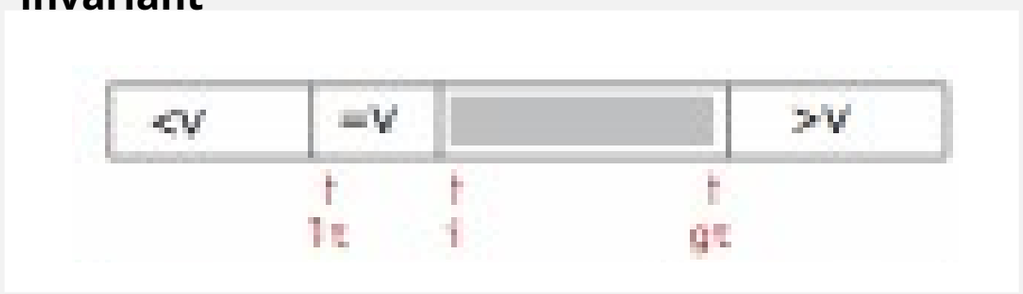


invariant



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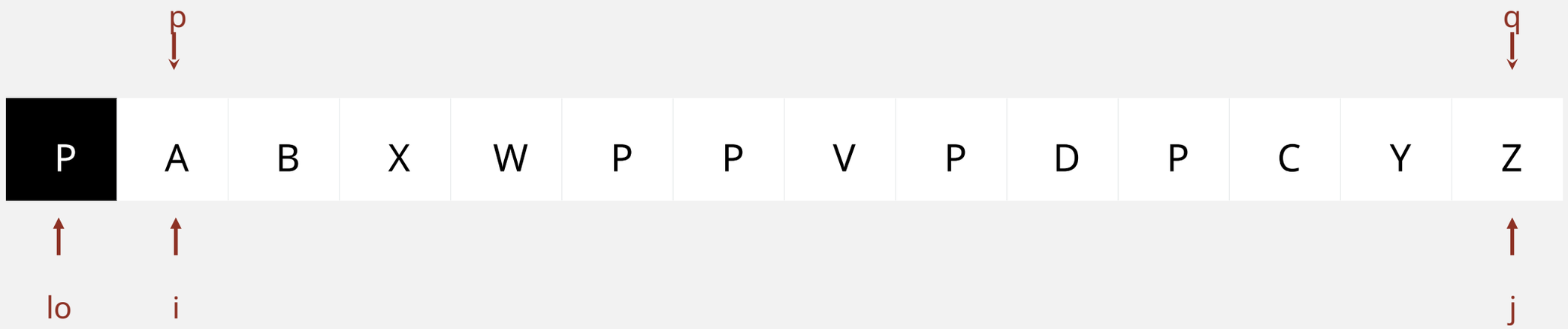
2.3 Partitioning Demos

- *Sedgewick 2-way partitioning*
- *Dijkstra 3-way partitioning*
- *Bentley-McIlroy 3-way partitioning*
- *dual-pivot partitioning*

Bentley-McIlroy 3-way partitioning demo

Phase I. 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[i] > a[lo]).
- Exchange a[i] with a[j].
- If (a[i] == a[lo]), exchange a[i] with a[p] and increment p.
- If (a[j] == a[lo]), exchange a[j] with a[q] and decrement q.



Bentley-McIlroy 3-way partitioning demo

Phase I. Repeat until i and j pointers cross.

- Scan i from left to right so long as (a[i] < a[lo]).
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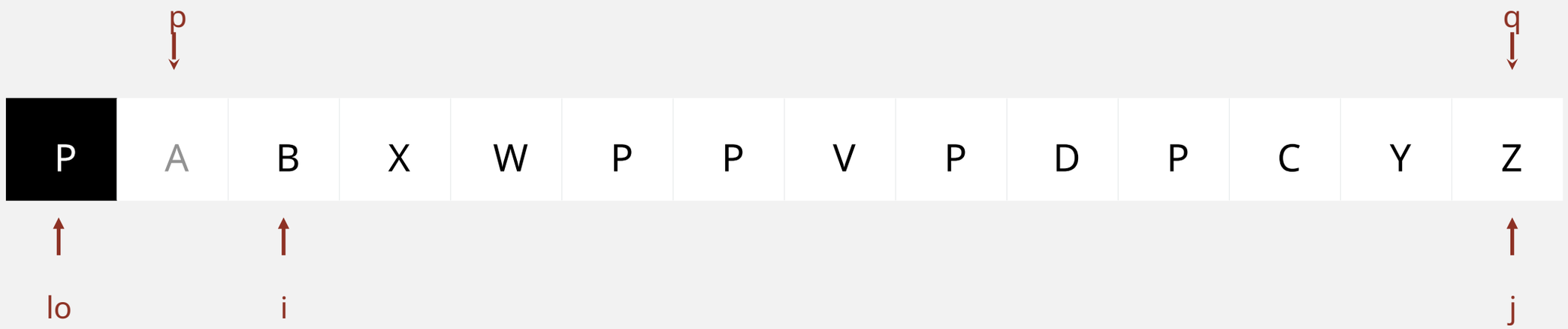

Bentley-McIlroy 3-way partitioning demo

Phase I. Repeat until i and j pointers cross.

- Scan i from left to right so long as (a[i] < a[lo]).
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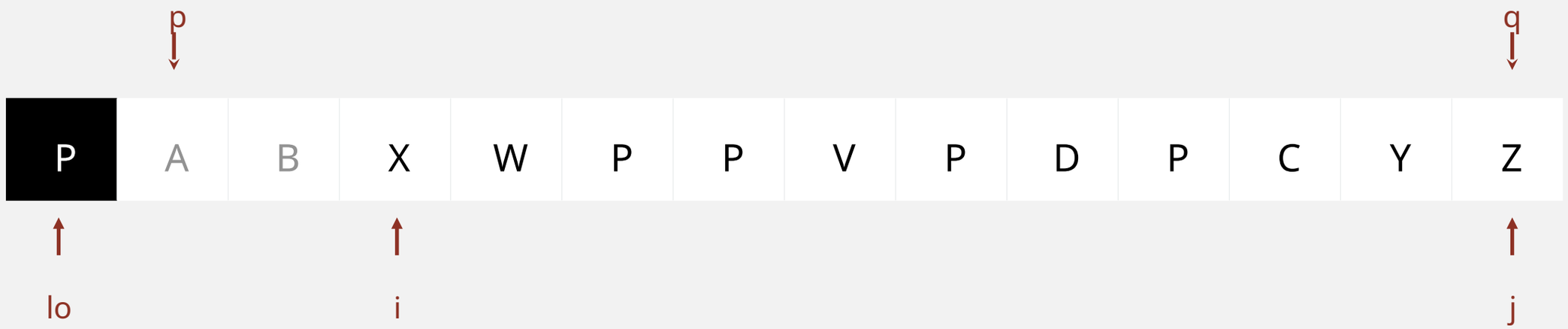

Bentley-McIlroy 3-way partitioning demo

Phase I. Repeat until i and j pointers cross.

- Scan i from left to right so long as (a[i] < a[lo]).
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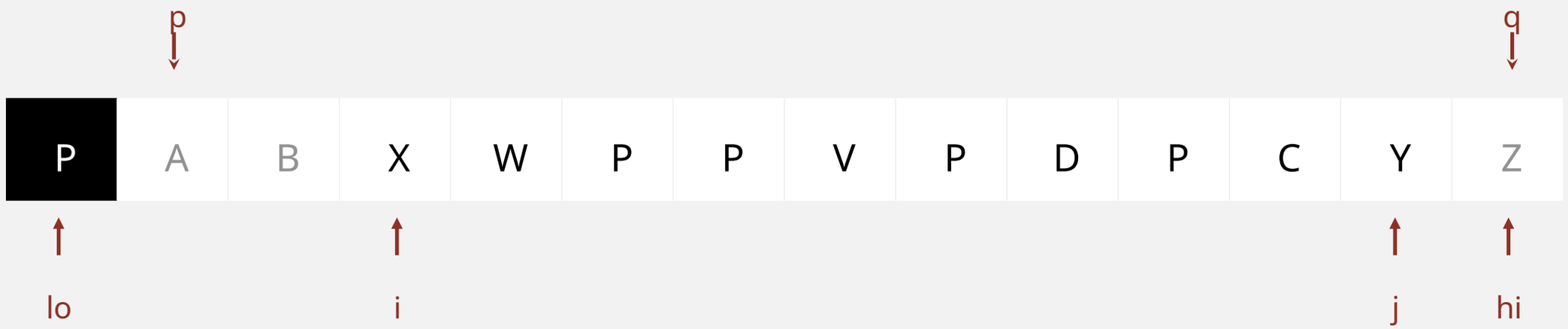

Bentley-McIlroy 3-way partitioning demo

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- Scan i from left to right so long as (a[i] < a[lo]).
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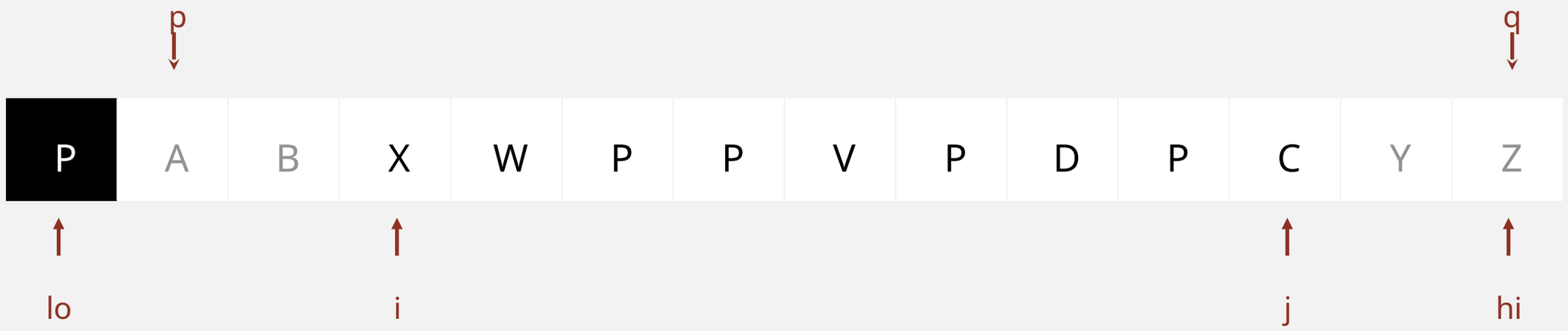

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Bentley-McIlroy 3-way partitioning demo

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- Scan i from left to right so long as (a[i] < a[lo]).
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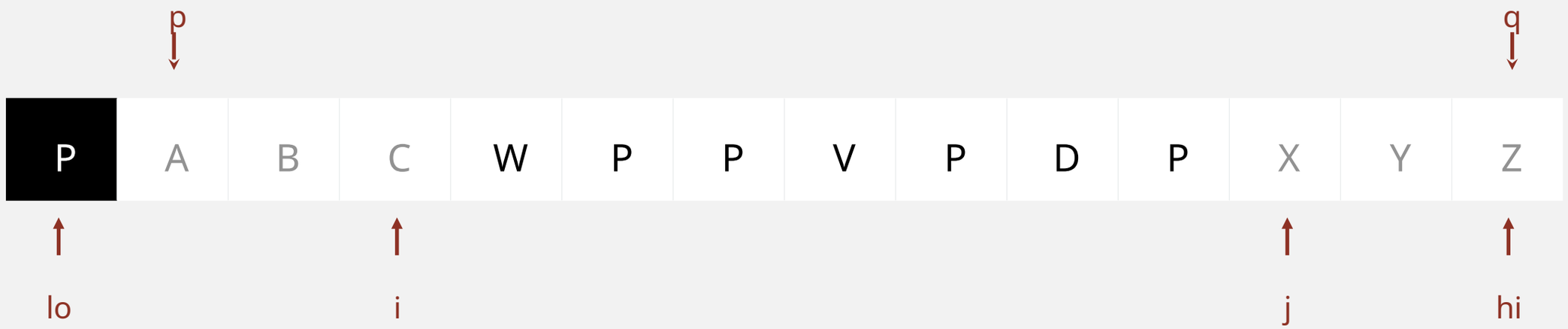

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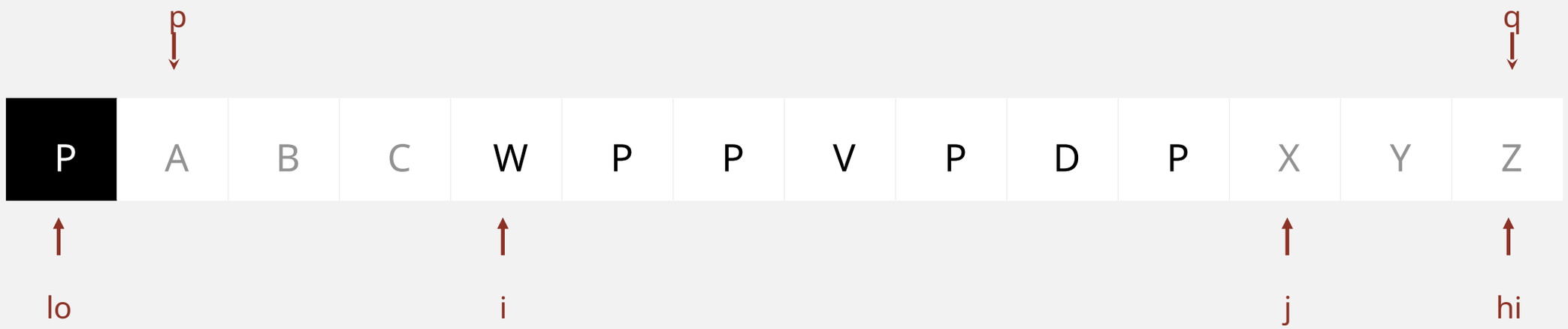

Bentley-McIlroy 3-way partitioning demo

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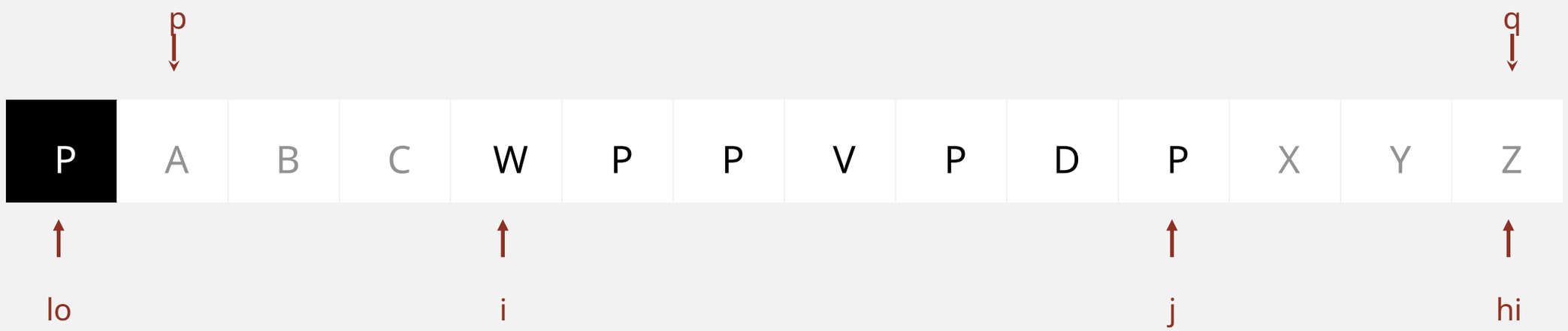

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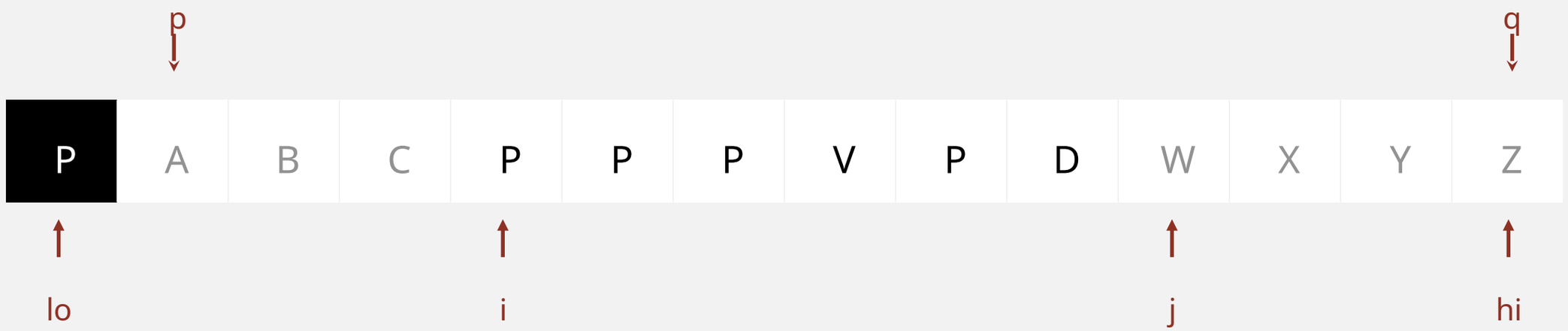

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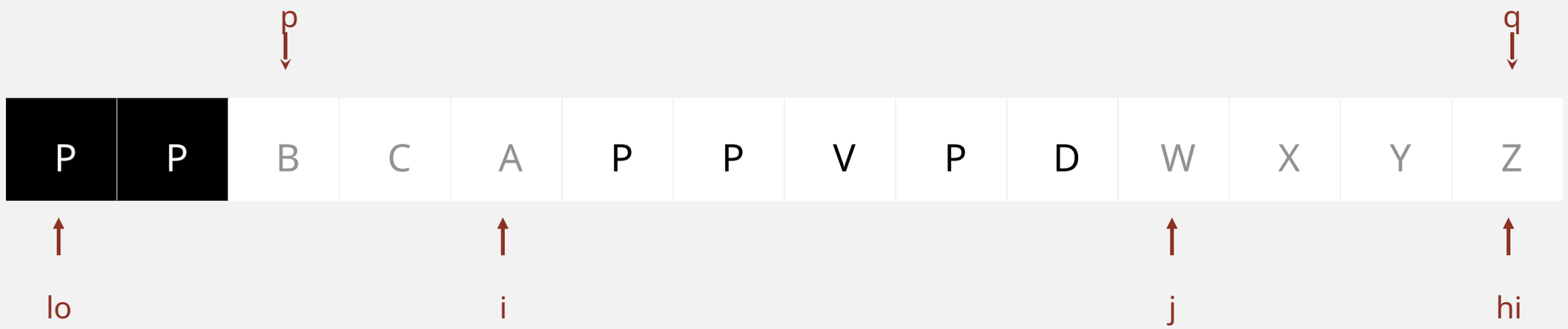

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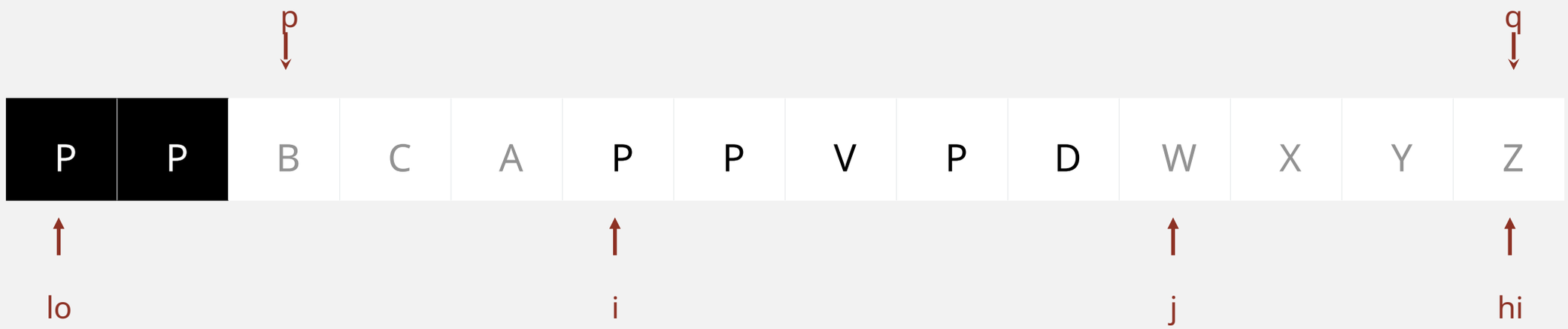

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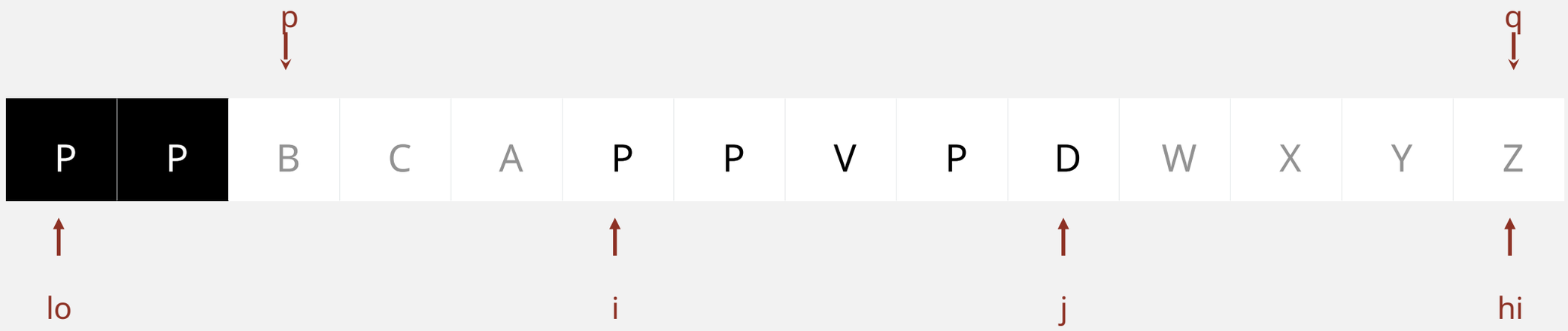

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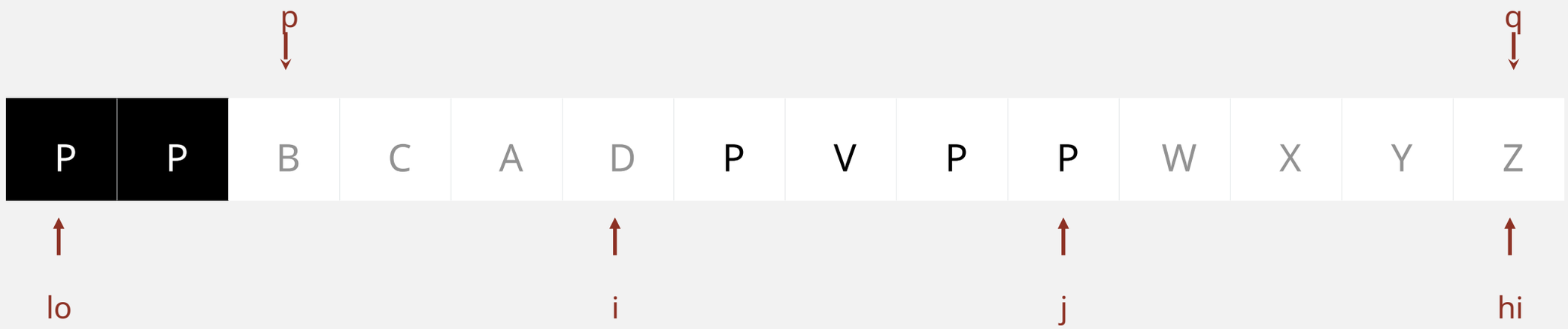

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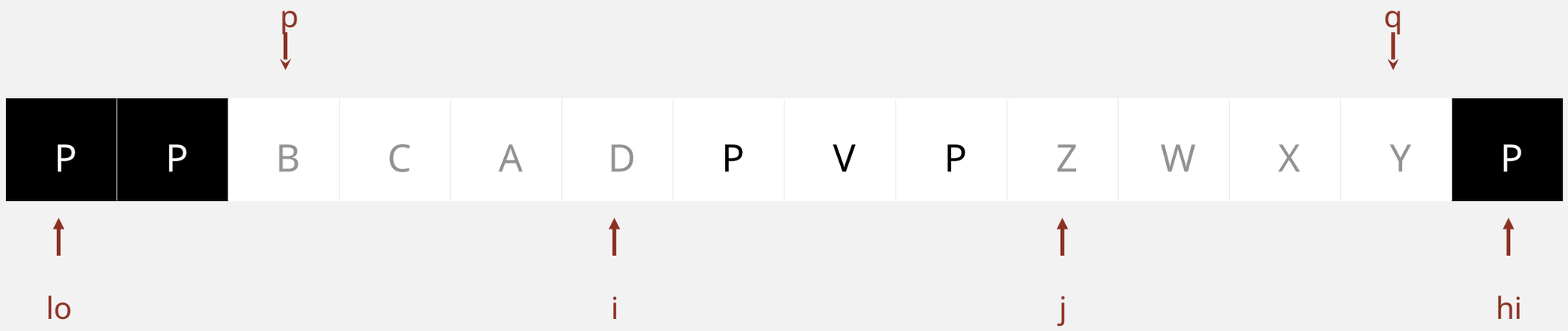

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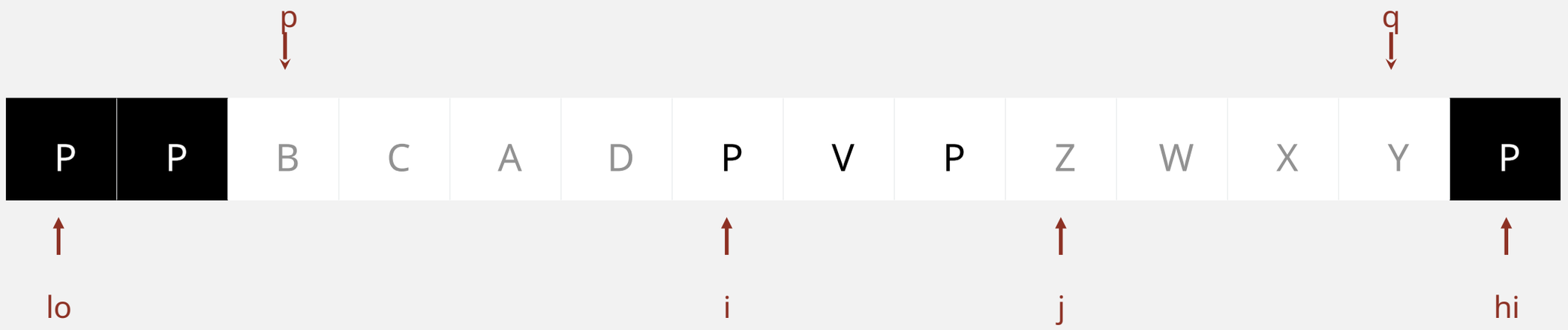

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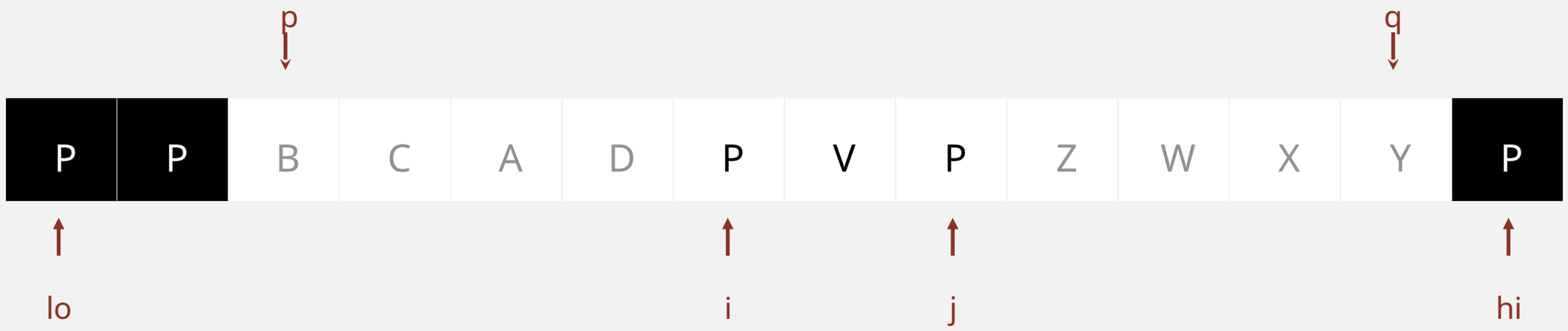
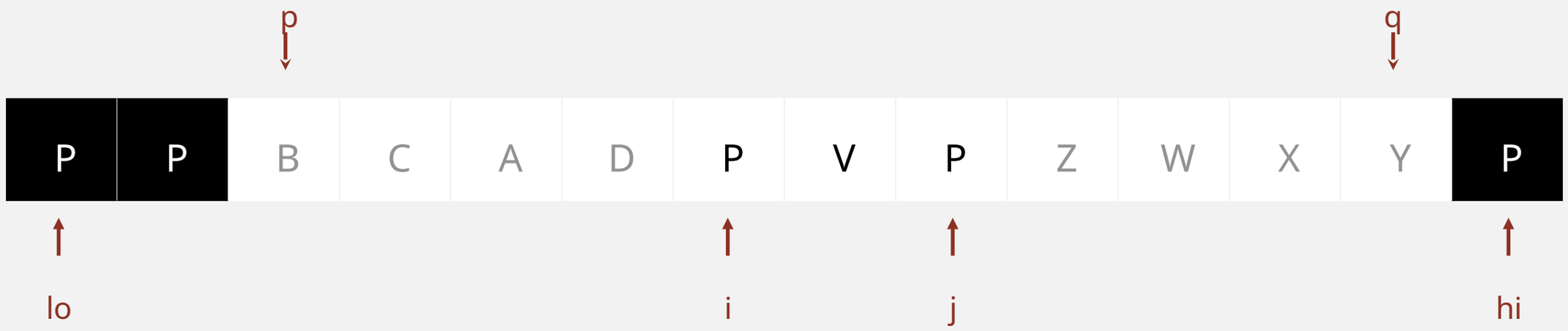


exchange a[i] with a[j]

Bentley-McIlroy 3-way partitioning demo

Phase I. 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[i] > a[lo]).
- Exchange a[i] with a[j].
- If (a[i] == a[lo]), exchange a[i] with a[p] and increment p.
- If (a[j] == a[lo]), exchange a[j] with a[q] and decrement q.



exchange a[i] with a[p] and increment p

Bentley-McIlroy 3-way partitioning demo

Phase I. Repeat until i and j pointers cross.

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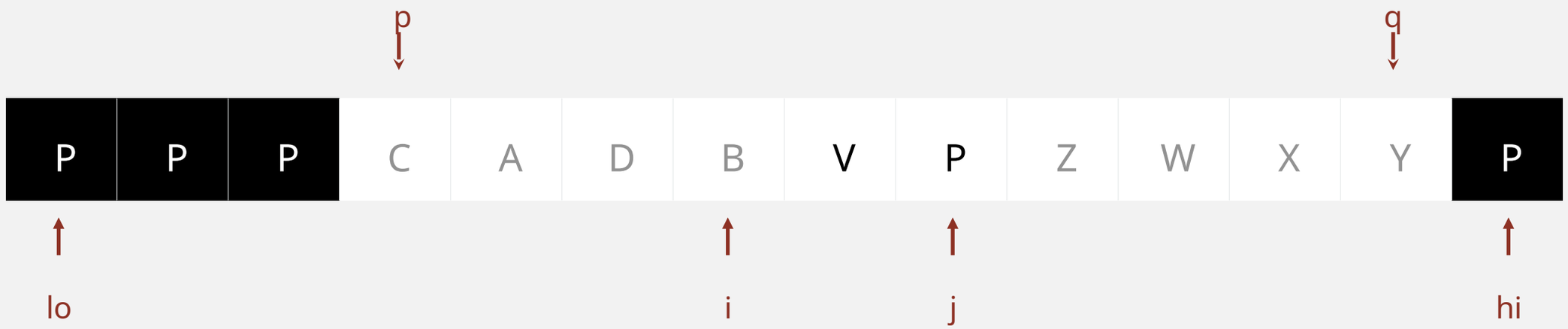

exchange a[j] with a[q] and decrement q

Bentley-McIlroy 3-way partitioning demo

Phase I. Repeat until i and j pointers cross.

- Scan i from left to right so long as (a[i] < a[lo]).
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Bentley-McIlroy 3-way partitioning demo

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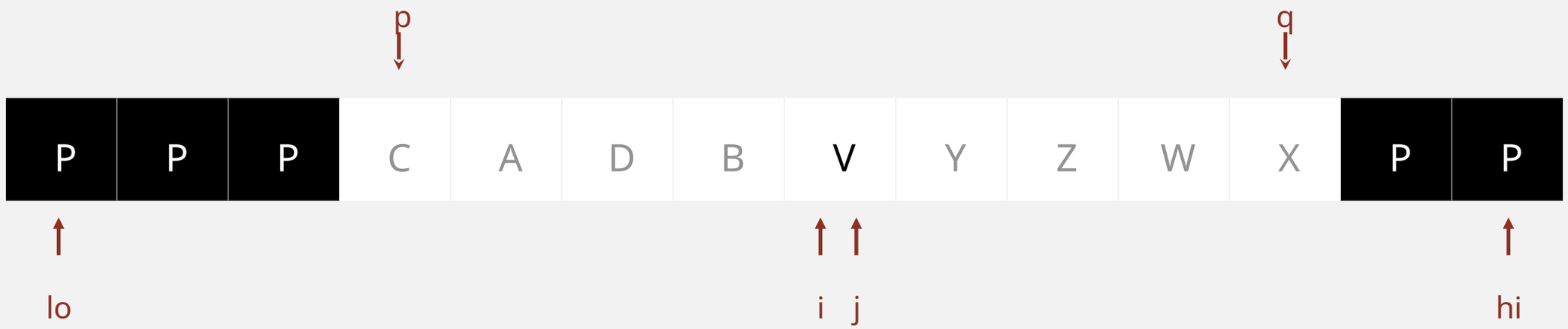

Bentley-McIlroy 3-way partitioning demo

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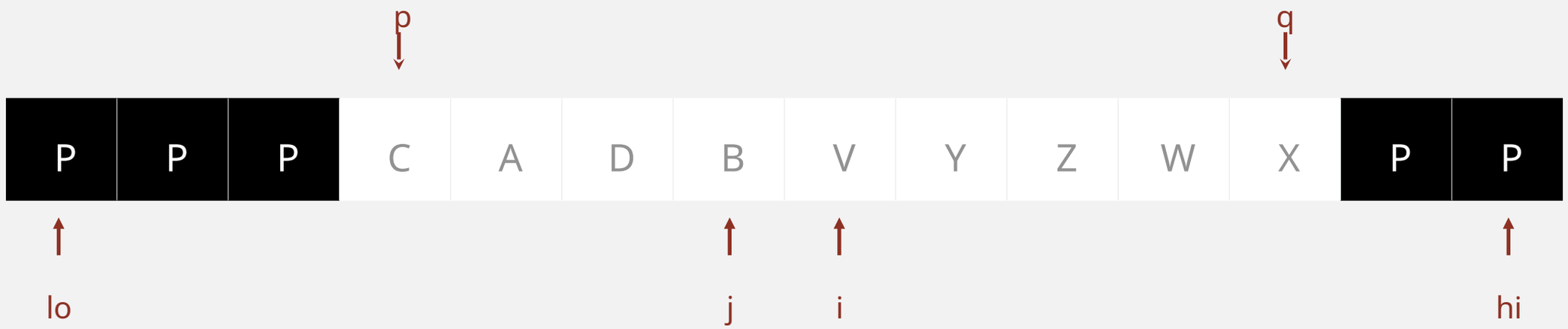
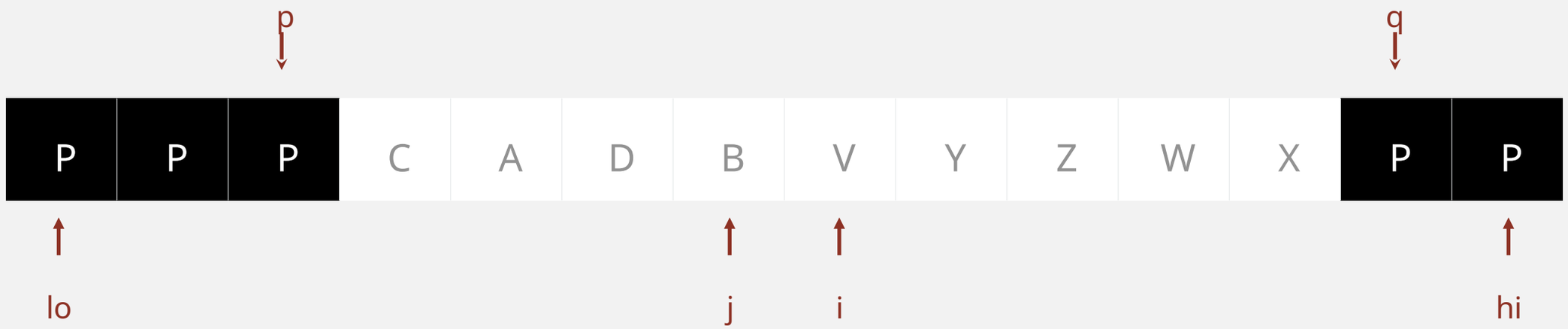


pointers cross

Bentley-McIlroy 3-way partitioning demo

Phase II. Swap equal keys to the center.

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



exchange a[j] with a[p]

Bentley-McIlroy 3-way partitioning demo

Phase II. Swap equal keys to the center.

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

exchange a[j] with a[p]

Bentley-McIlroy 3-way partitioning demo

Phase II. Swap equal keys to the center.

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

exchange a[j] with a[p]

Bentley-McIlroy 3-way partitioning demo

Phase II. Swap equal keys to the center.

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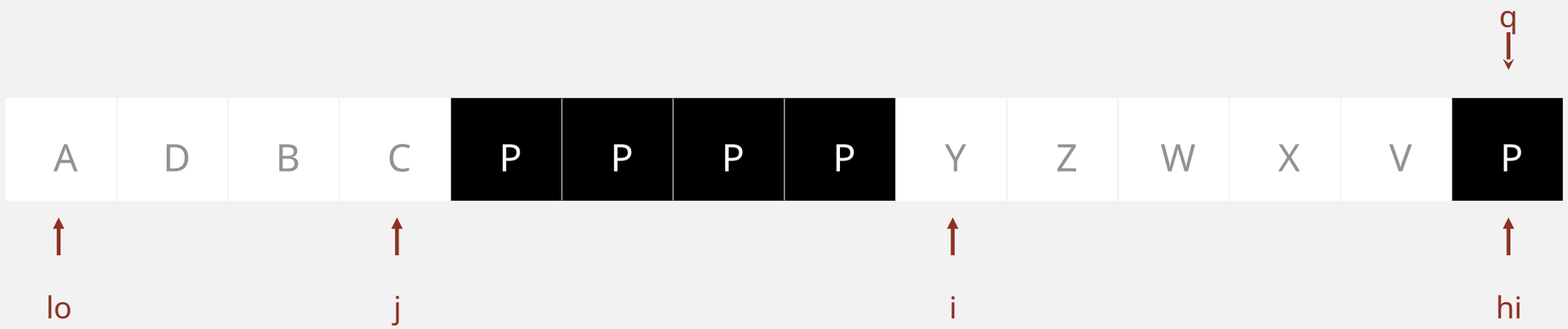

exchange a[i] with a[q]

Bentley-McIlroy 3-way partitioning demo

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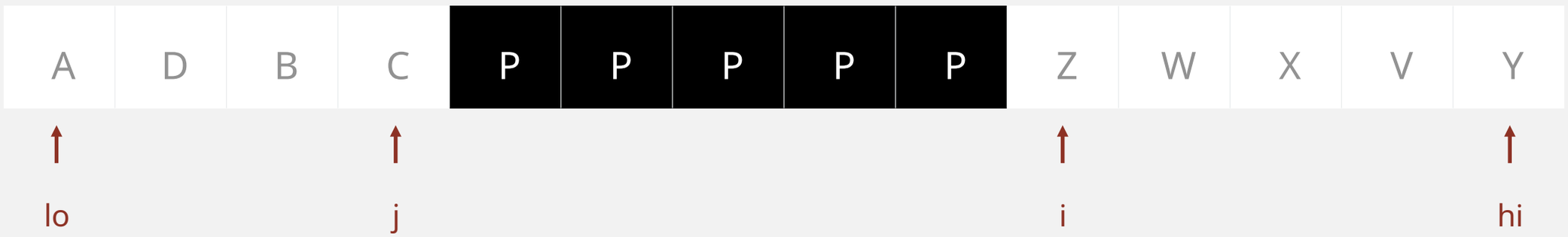


3-way partitioned

http://algs4.cs.princeton.edu

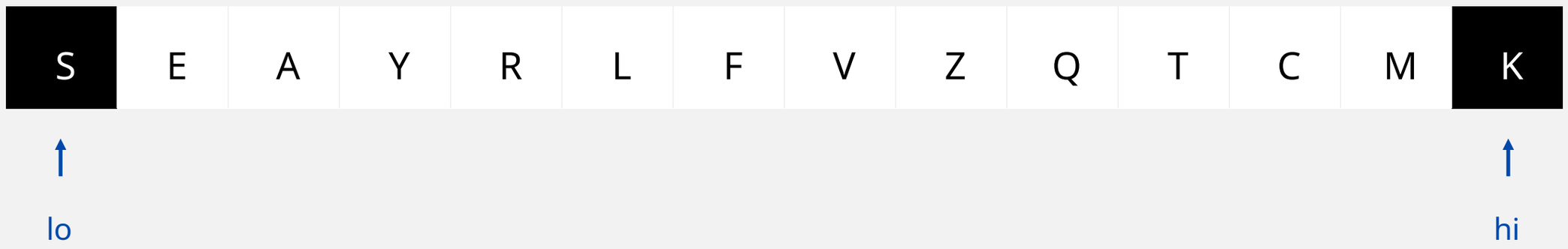
2.3 Partitioning Demos

- *Sedgewick 2-way partitioning*
- *Dijkstra 3-way partitioning*
- *Bentley-McIlroy 3-way partitioning*
- *dual-pivot partitioning*

Dual-pivot partitioning demo

Initialization.

- Choose a[lo] and a[hi] as partitioning items.
- Exchange if necessary to ensure a[lo] ≤ a[hi].



exchange a[lo] and a[hi]

Dual-pivot partitioning demo

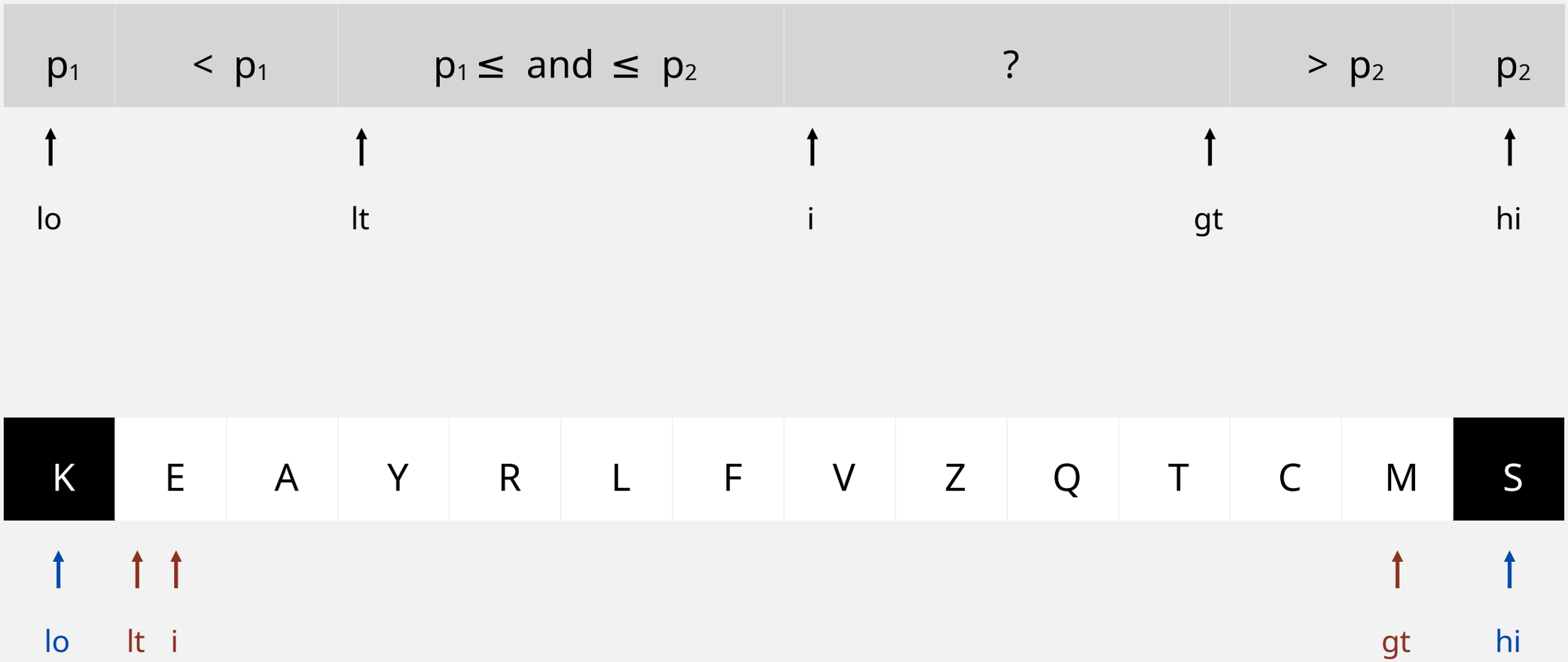
Initialization.

- Choose a[lo] and a[hi] as partitioning items.
- Exchange if necessary to ensure a[lo] ≤ a[hi].

Dual-pivot partitioning demo

Main loop. Repeat until i and gt pointers cross.

- If (a[i] < a[lo]), exchange a[i] with a[lt] and increment lt and i.
- Else if (a[i] > a[hi]), exchange a[i] with a[gt] and decrement gt.
- Else, increment i.



exchange a[i] and a[lt]; increment lt and i

Dual-pivot partitioning demo

Main loop. Repeat until i and gt pointers cross.

- If (a[i] < a[lo]), exchange a[i] with a[lt] and increment lt and i.
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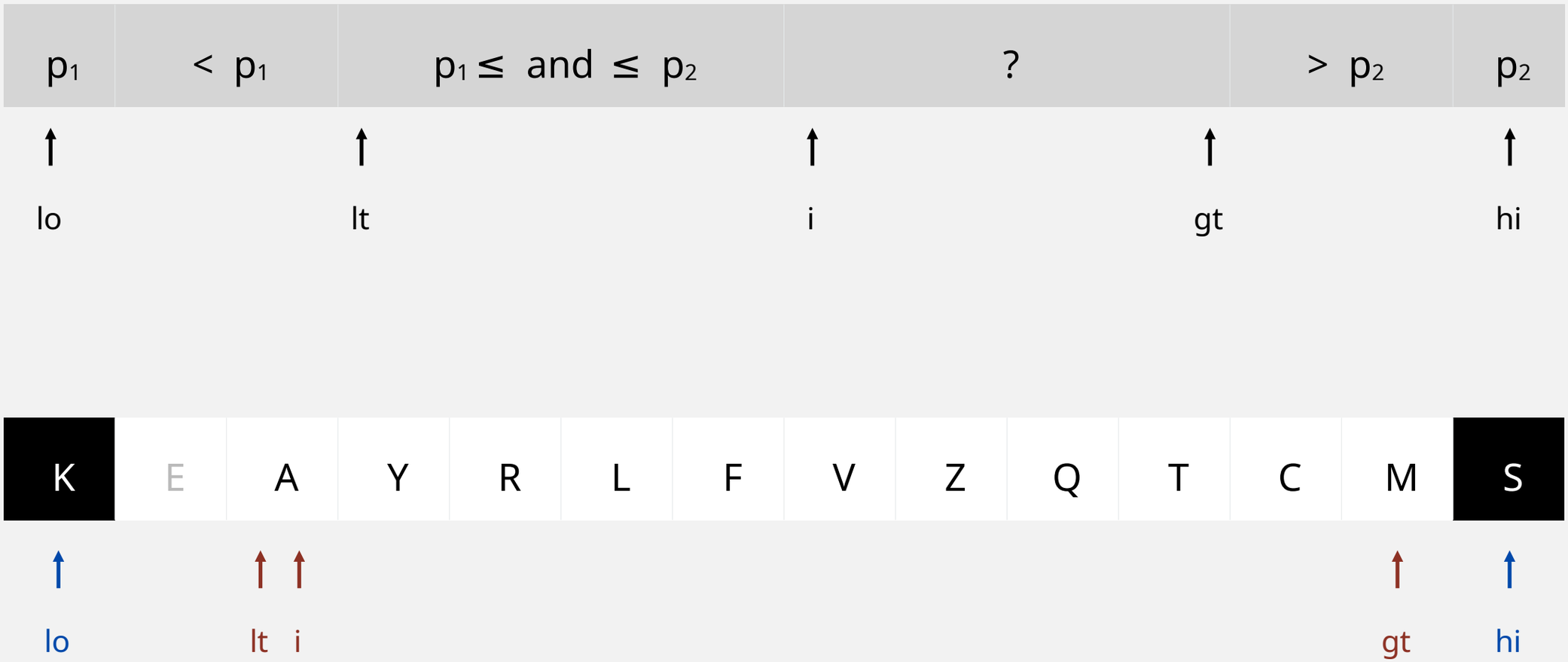

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Dual-pivot partitioning demo

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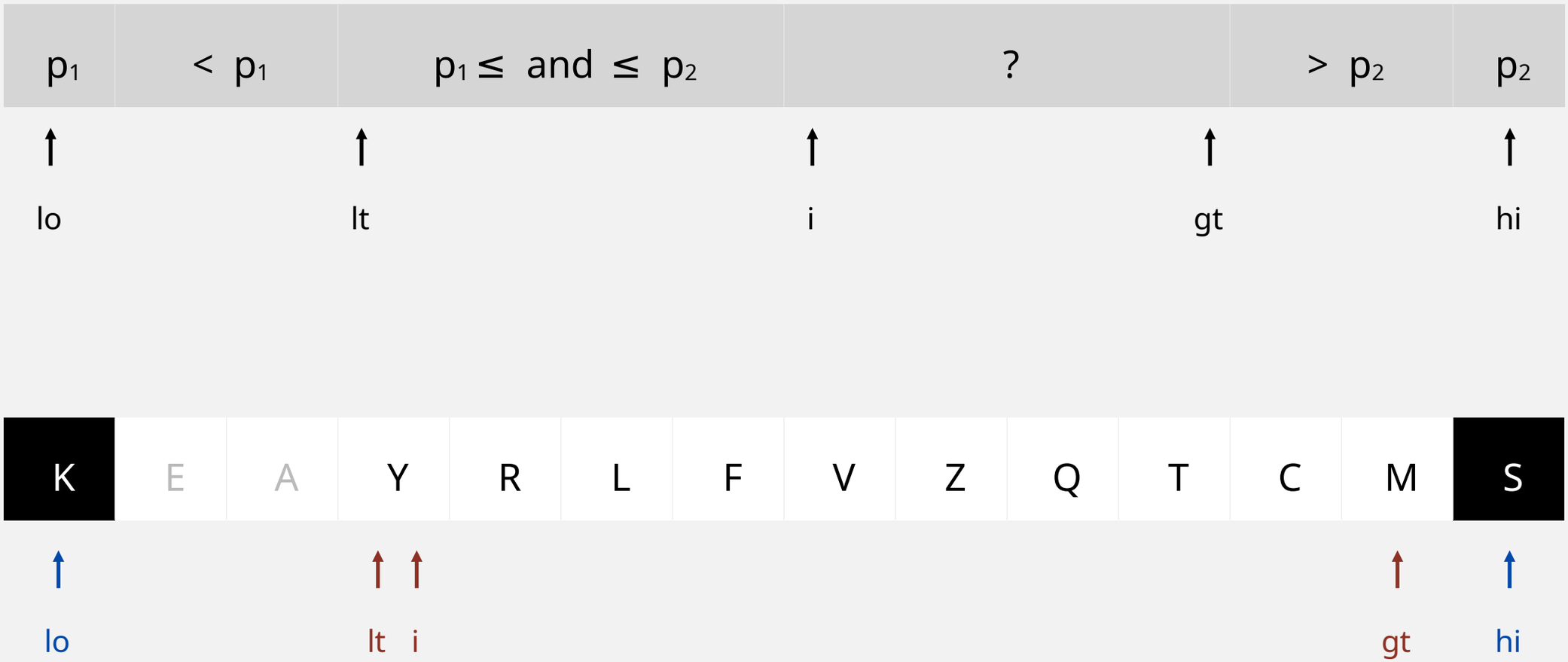

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Dual-pivot partitioning demo

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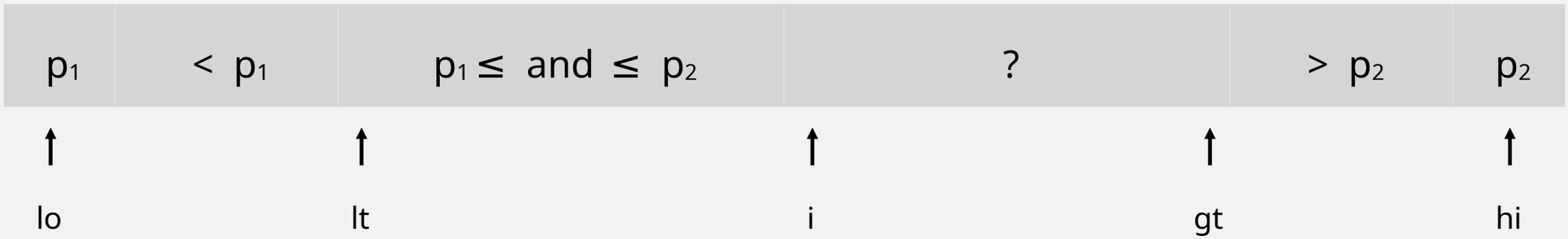

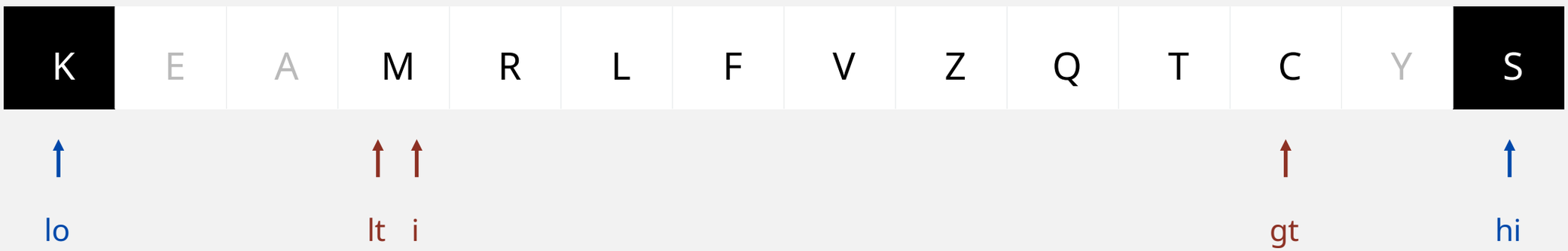

increment i

Dual-pivot partitioning demo

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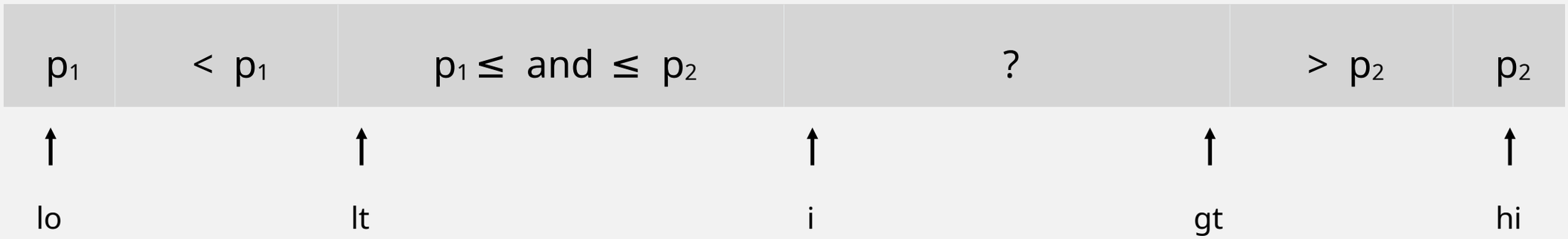

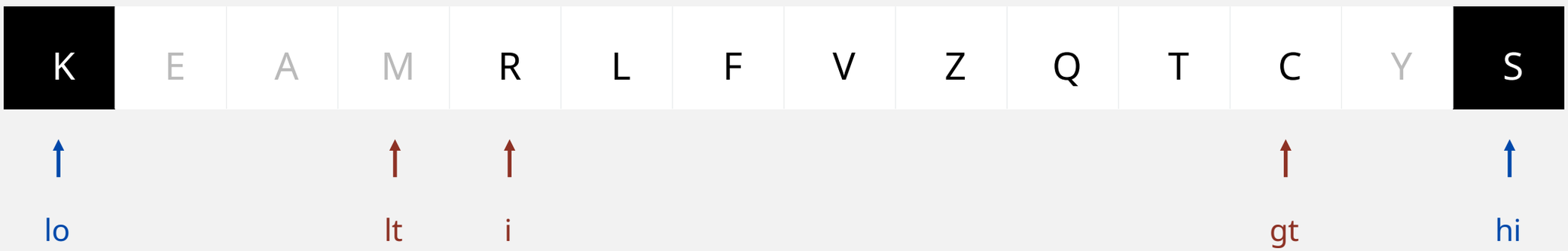

increment i

Dual-pivot partitioning demo

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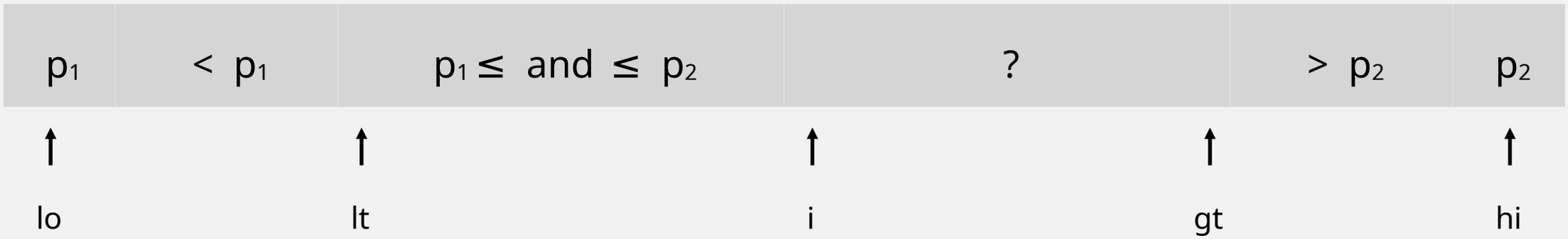

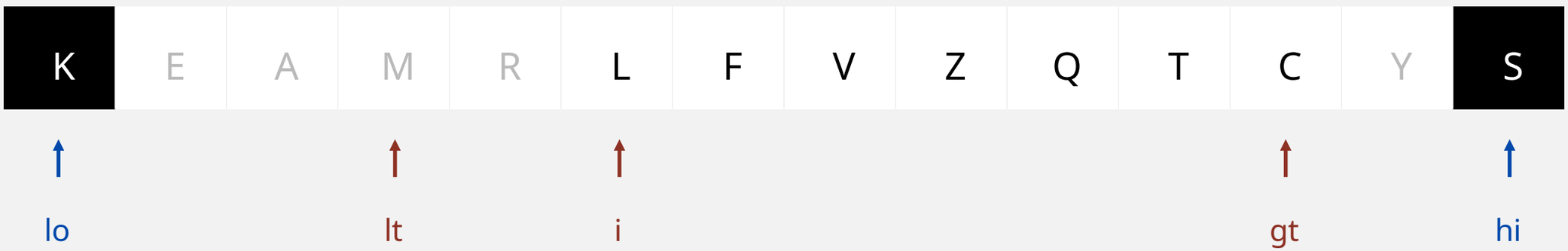

increment i

Dual-pivot partitioning demo

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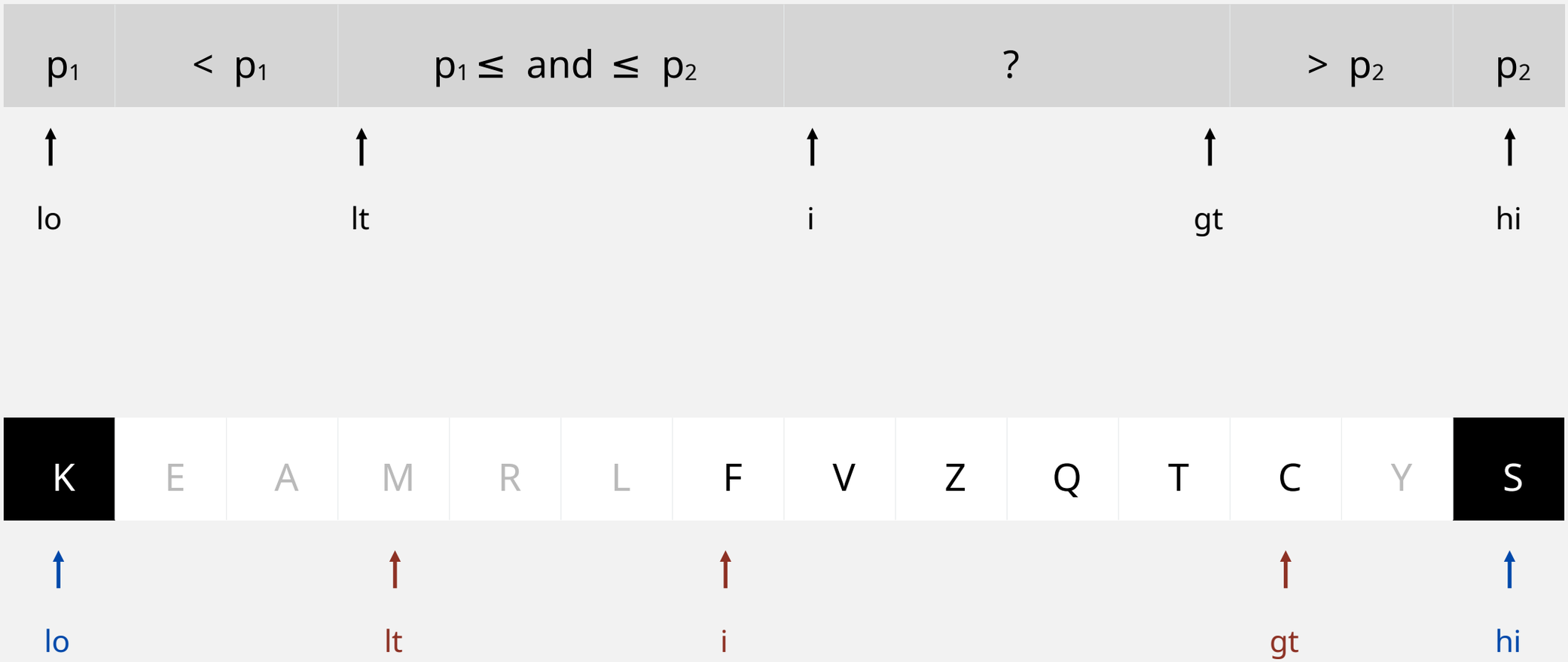

exchange a[i] and a[lt]; increment lt and i

Dual-pivot partitioning demo

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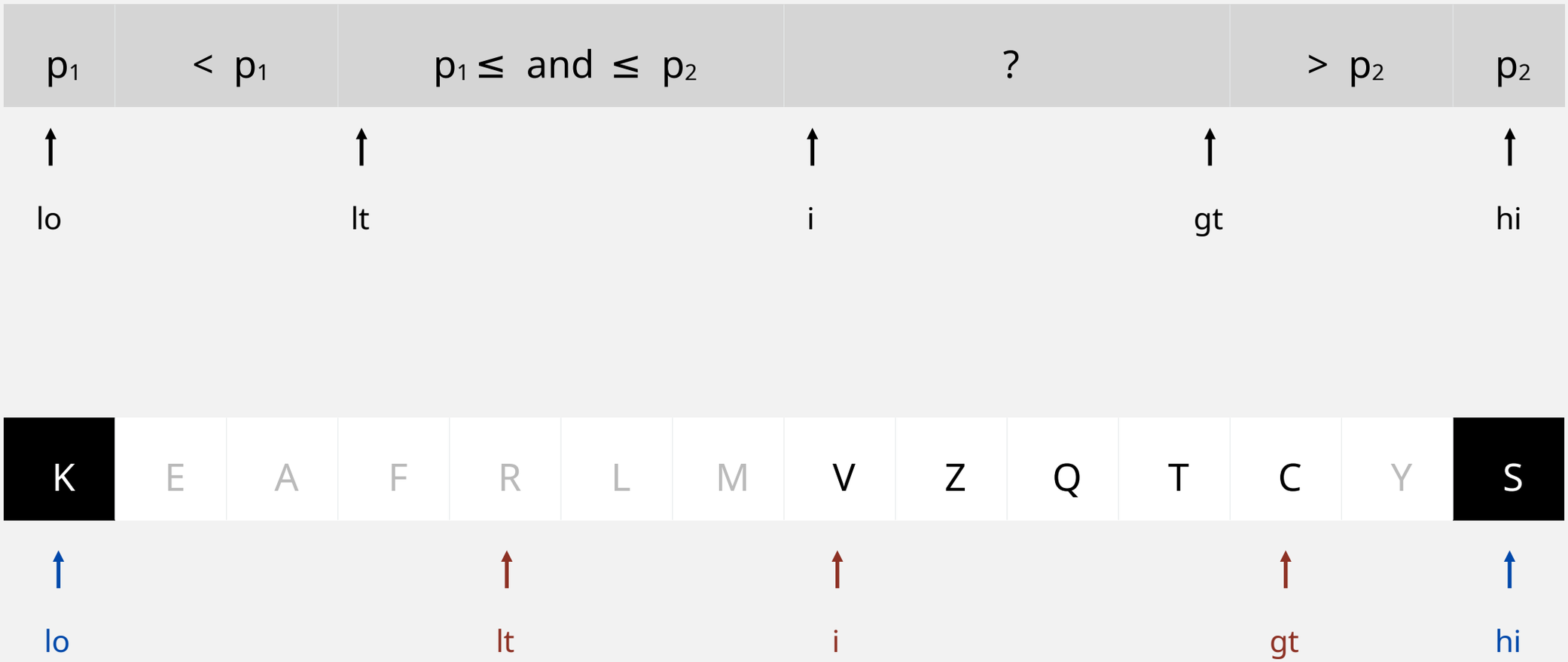

exchange a[i] and a[gt]; decrement gt

Dual-pivot partitioning demo

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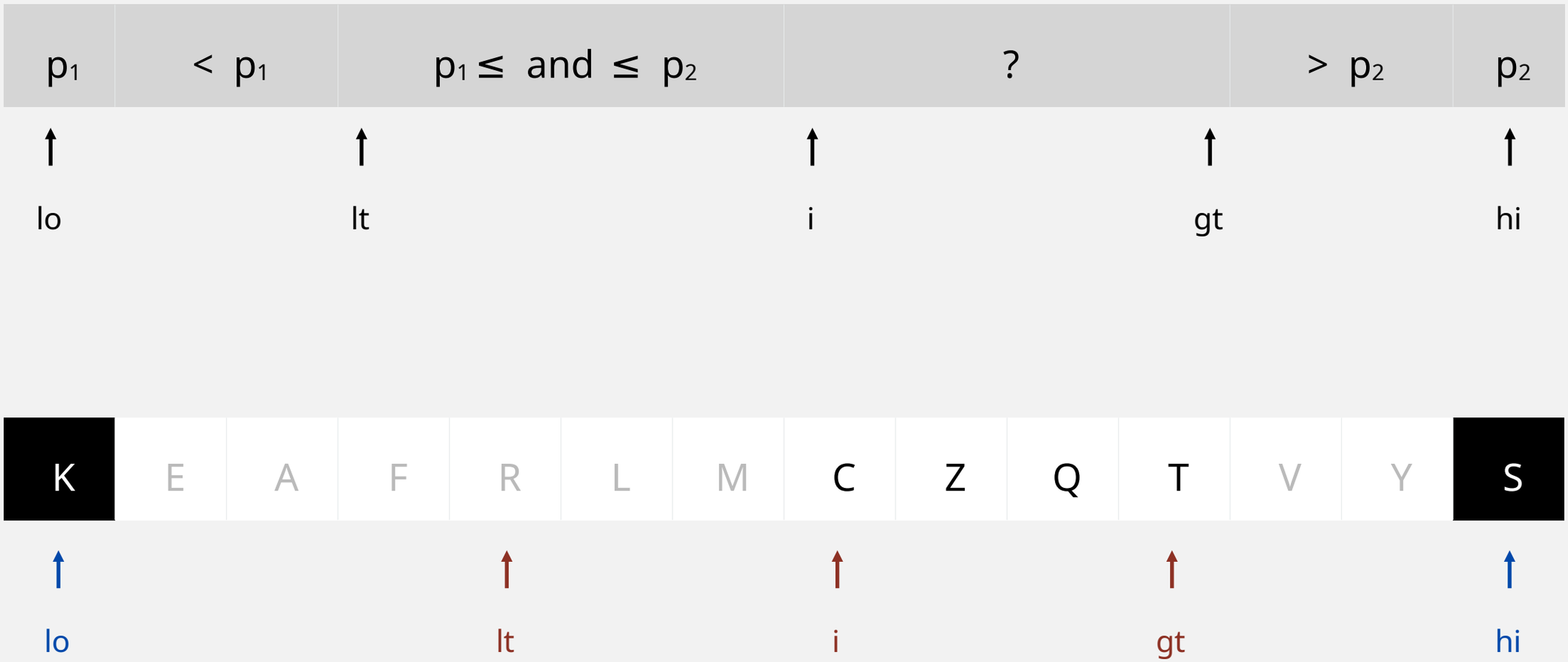

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Dual-pivot partitioning demo

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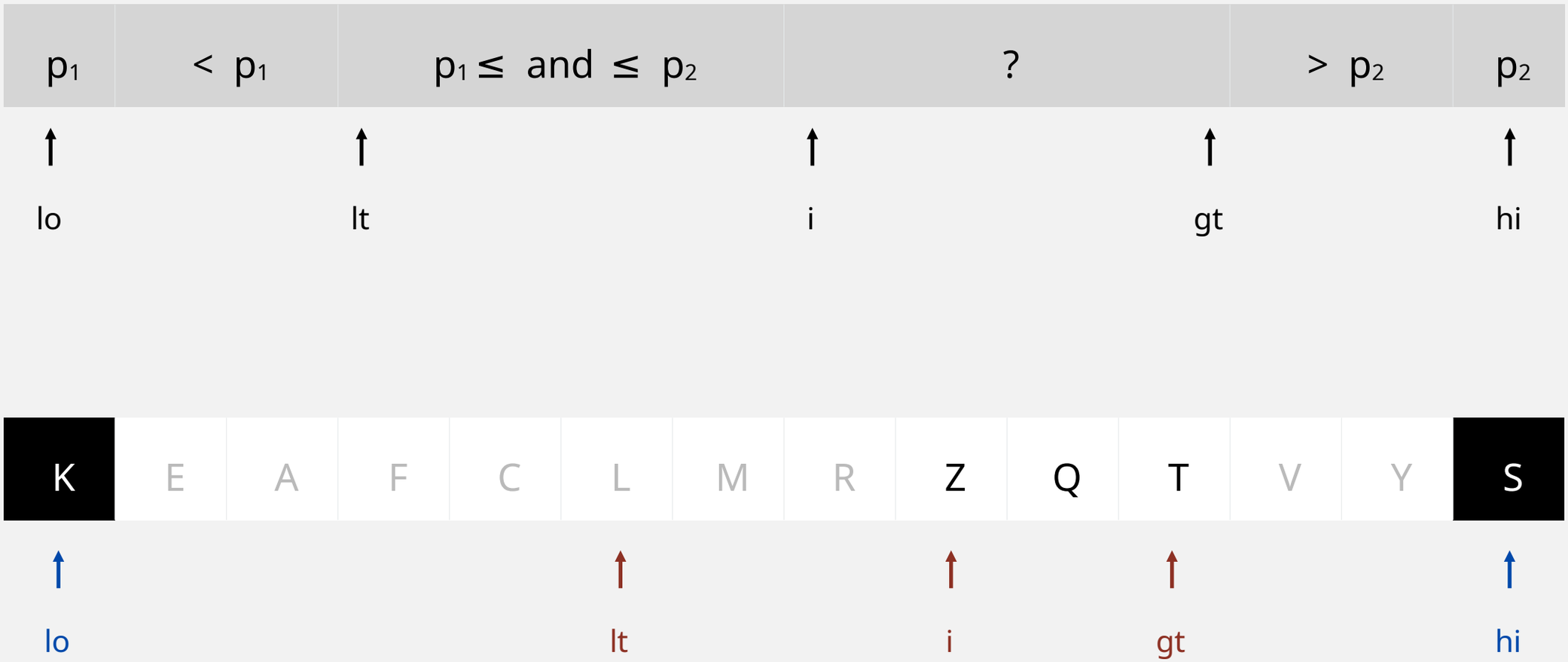

exchange a[i] and a[gt]; decrement gt

Dual-pivot partitioning demo

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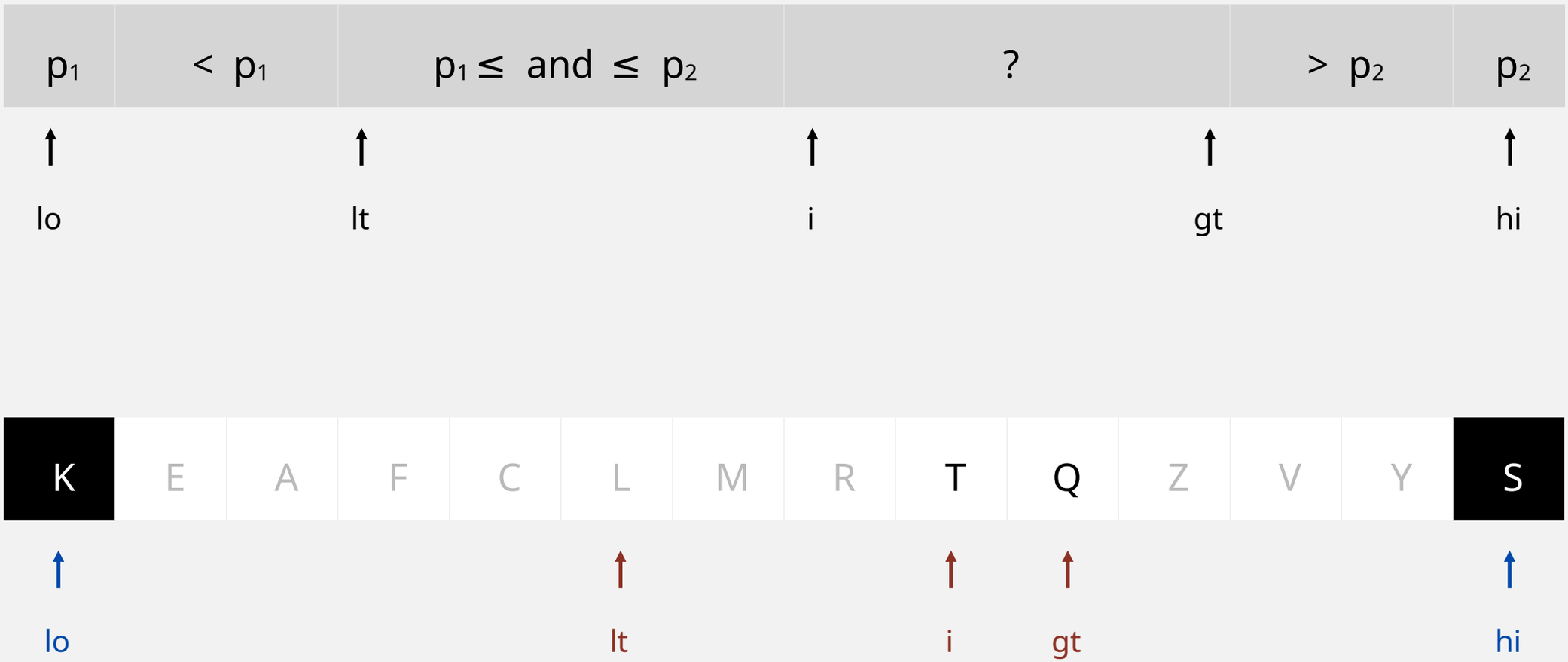

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Dual-pivot partitioning demo

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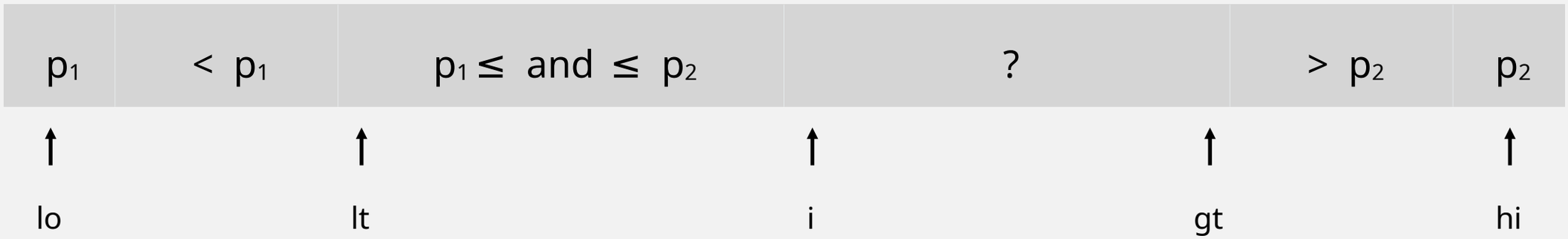

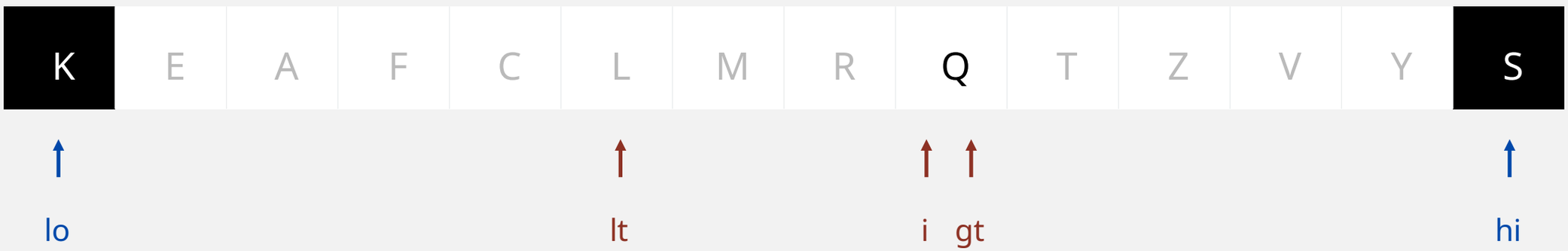

increment i

Dual-pivot partitioning demo

Main loop. Repeat until i and gt pointers cross.

- If (a[i] < a[lo]), exchange a[i] with a[lt] and increment lt and i.
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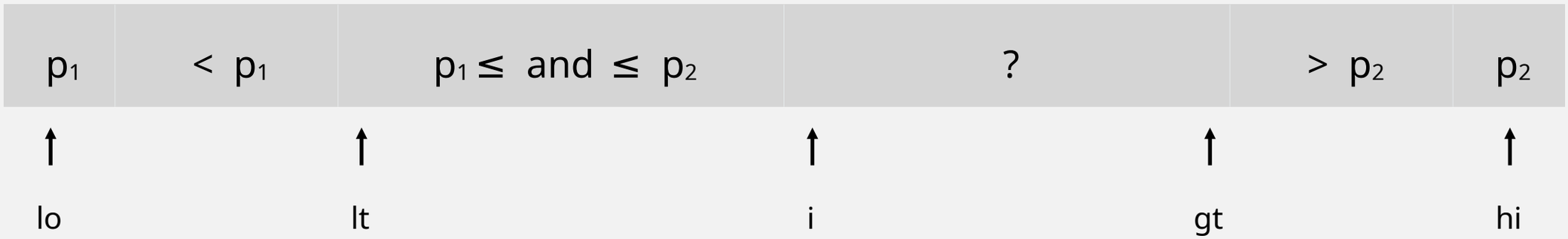
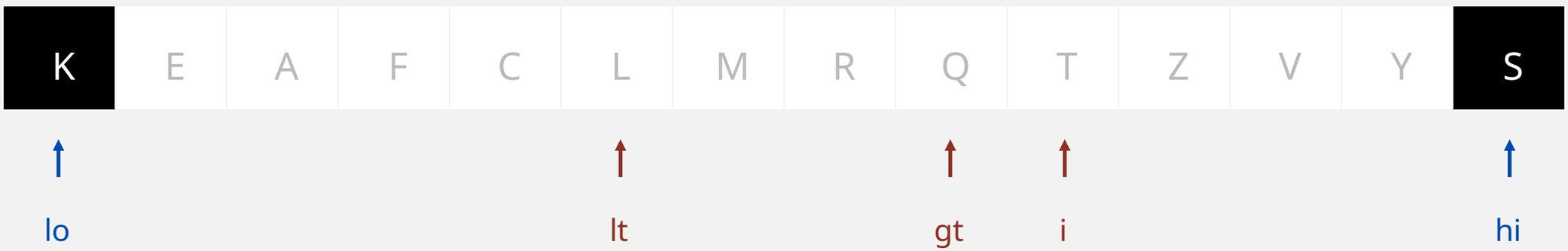


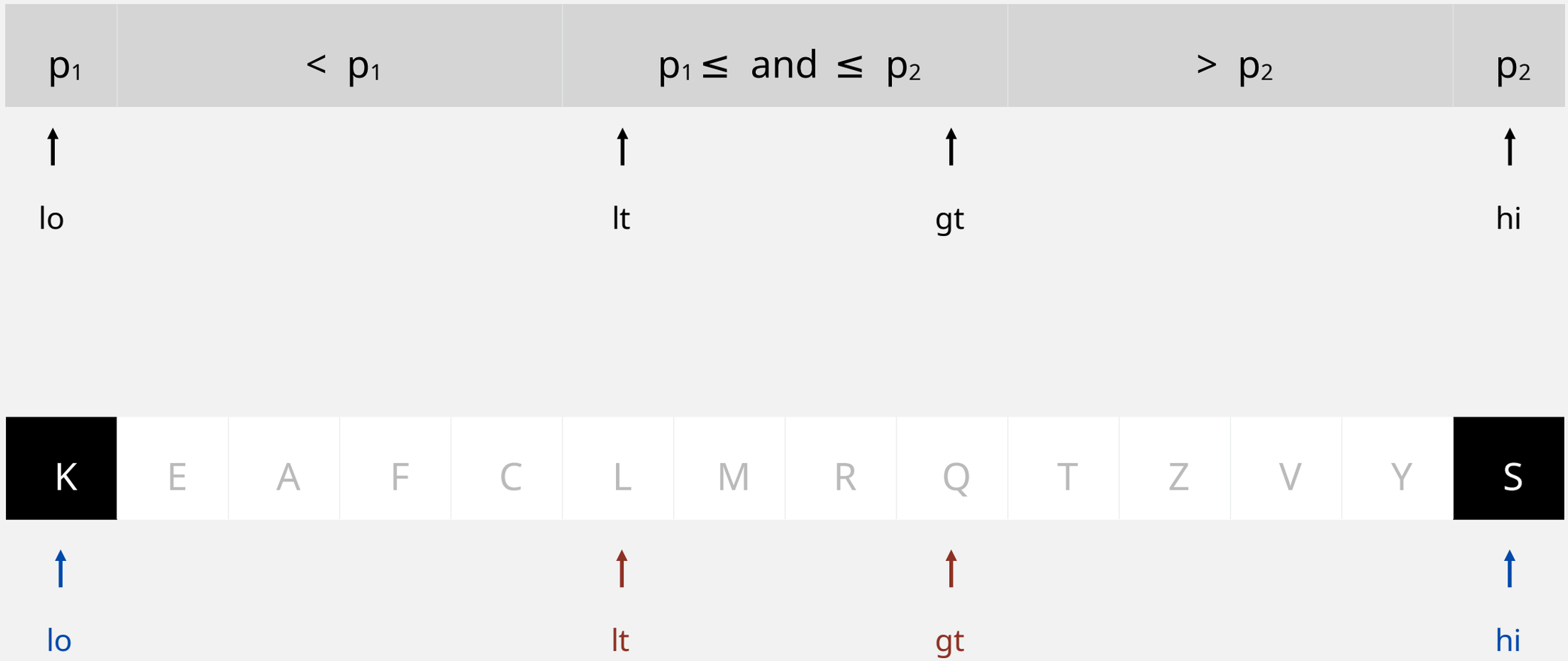


stop when pointers cross

Dual-pivot partitioning demo

Finalize.

- Exchange a[lo] with a[--lt].
- Exchange a[hi] with a[++gt].



Dual-pivot partitioning demo

Finalize.

- Exchange a[lo] with a[--lt].
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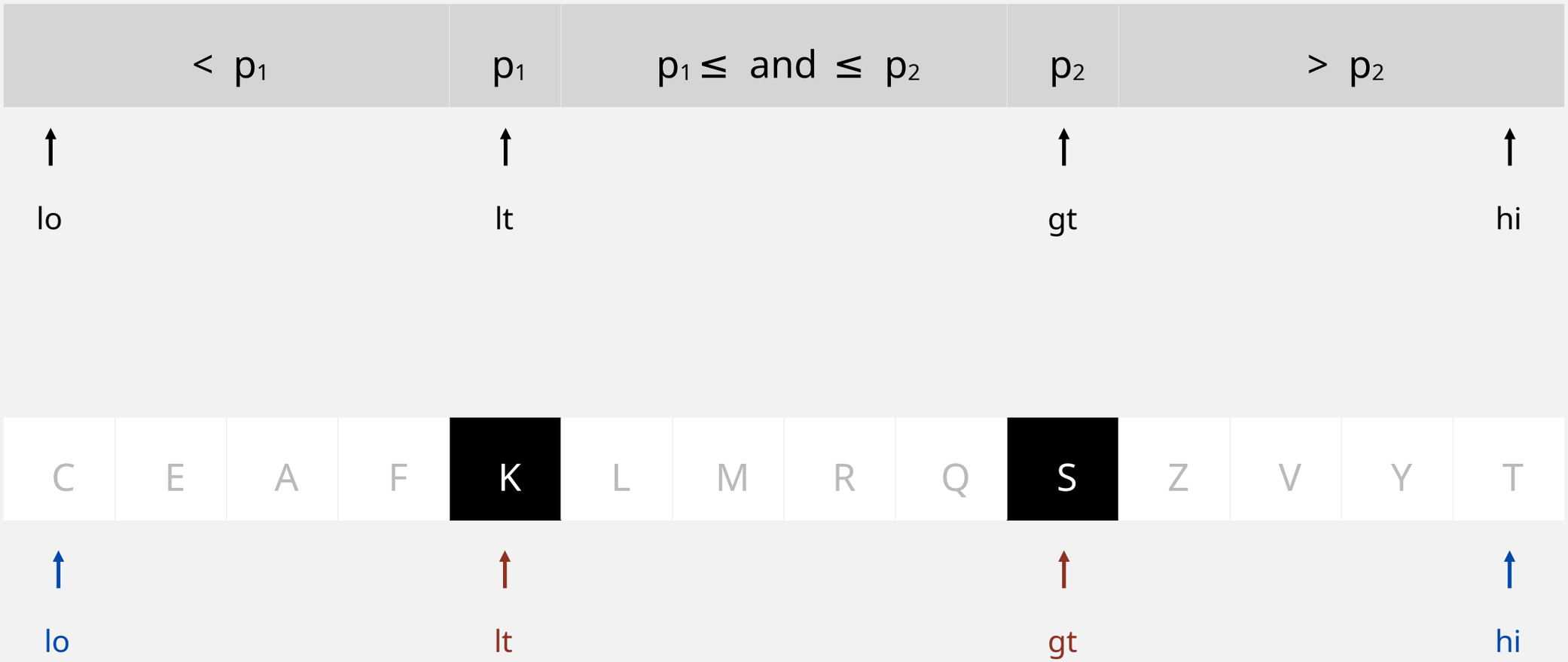

3-way partitioned