CSCI 241

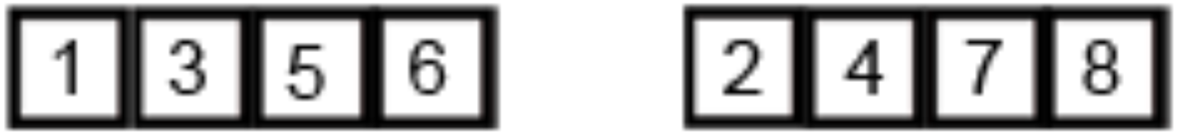
Scott Wehrwein

Merge Sort: Merge Step

Goals

Be prepared to implement the `merge` helper method of mergesort.

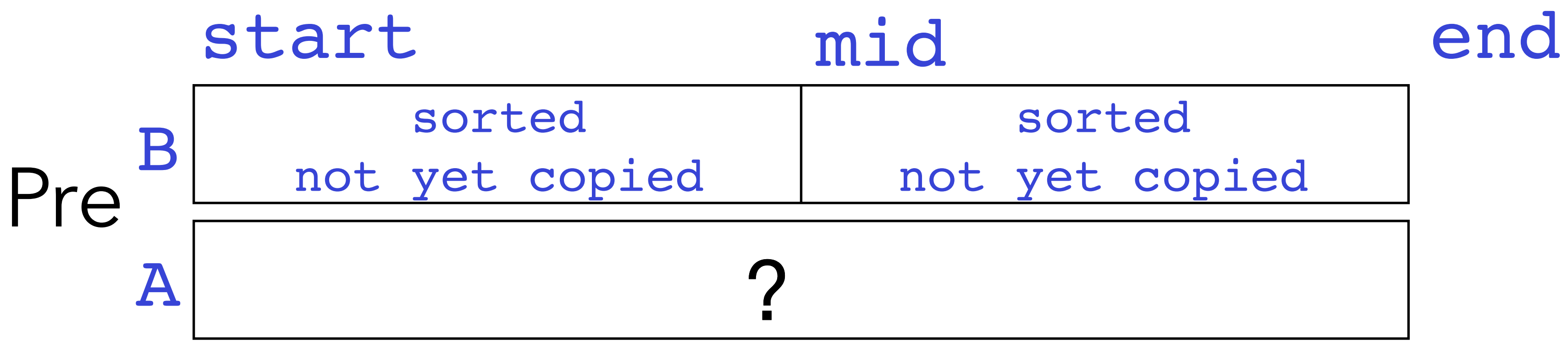
Merging two sorted arrays



1	3	5	6

2	4	7	8

Merge Step: Loop Invariant



start mid end

Pre

B

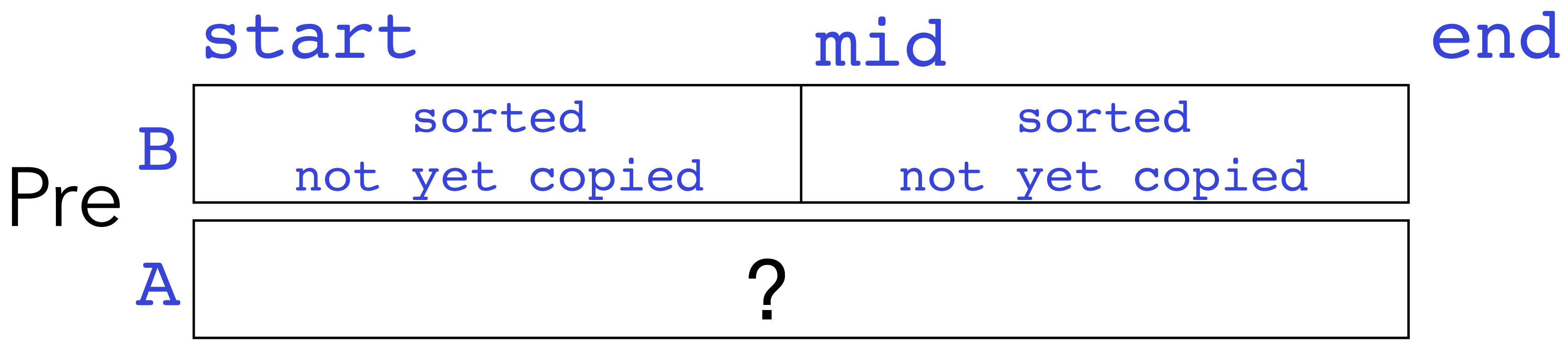
sorted not yet copied

sorted not yet copied

A

?

Merge Step: Loop Invariant



Pre

start mid end

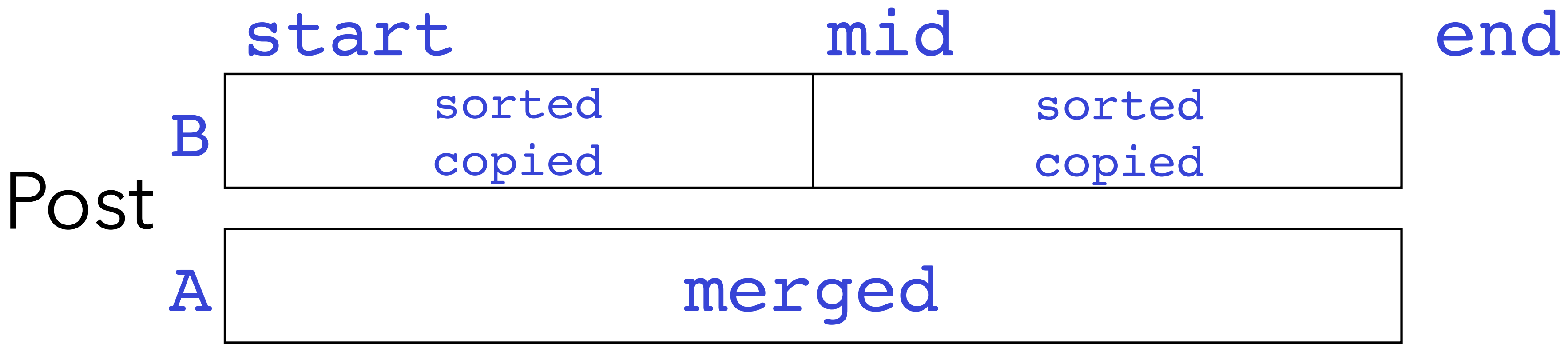
B

sorted
not yet copied

sorted
not yet copied

A

?



Post

start mid end

B

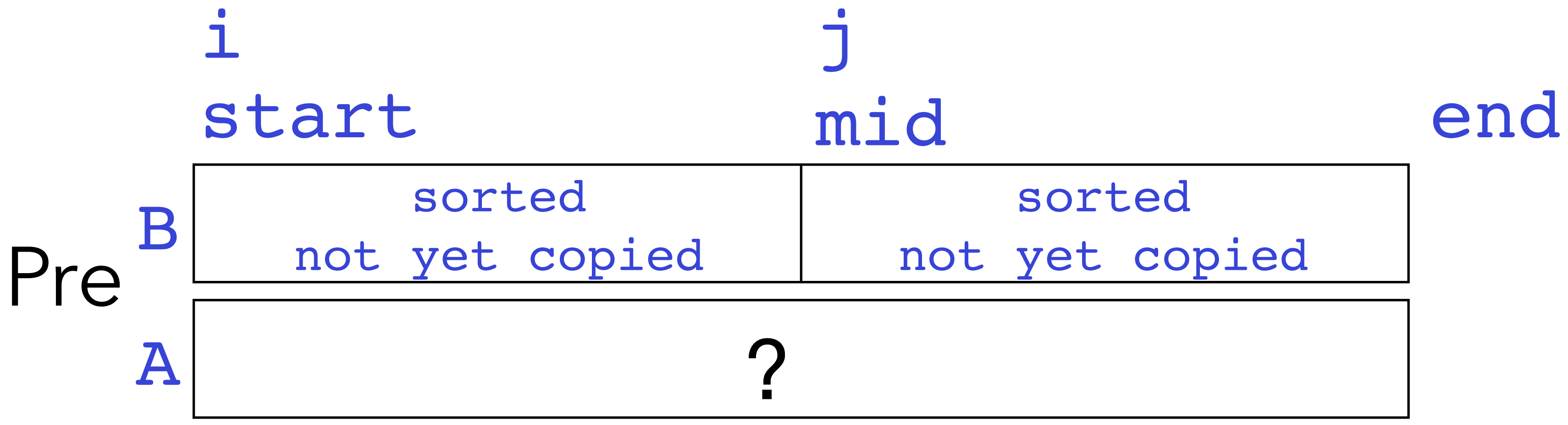
sorted
copied

sorted
copied

A

merged

Merge Step: Loop Invariant



i start

j mid

end

Pre

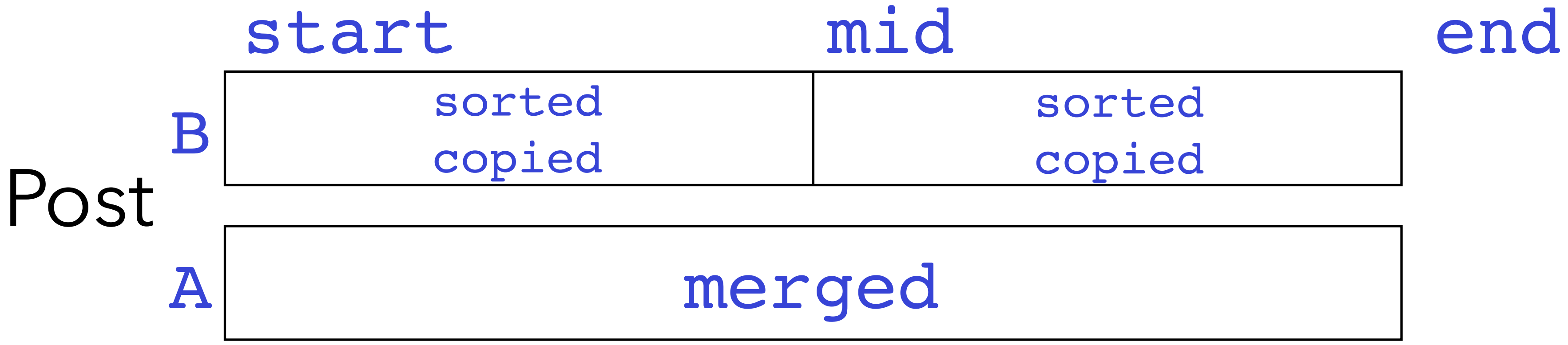
B

sorted
not yet copied

sorted
not yet copied

A

?



start

mid

end

Post

B

sorted
copied

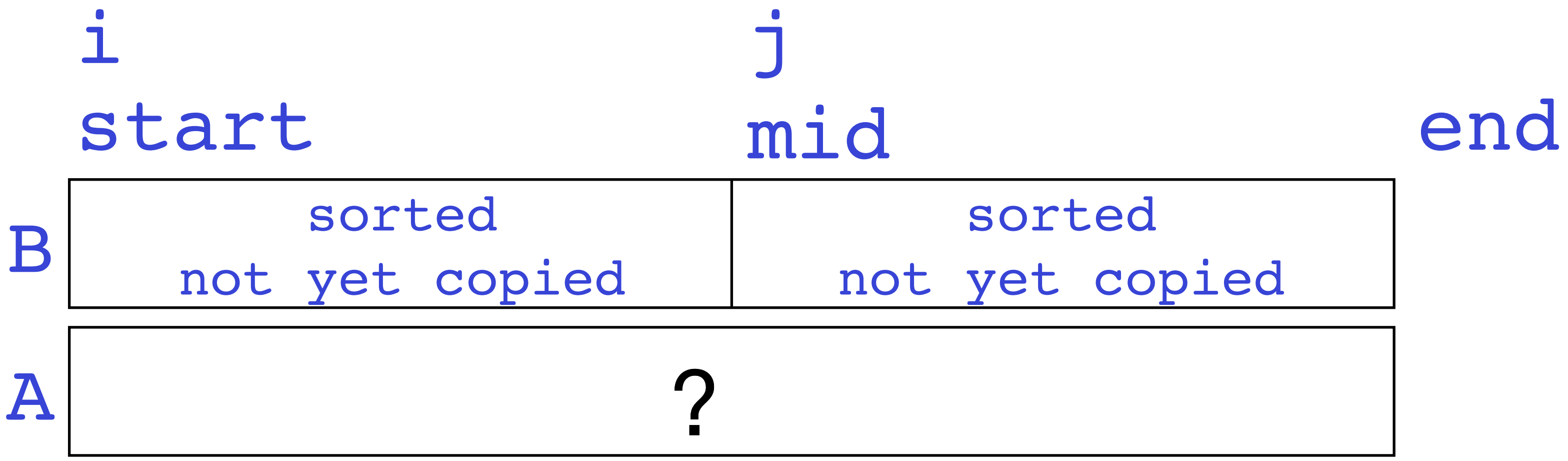
sorted
copied

A

merged

Merge Step: Loop Invariant

Pre



i

start

j

mid

end

B

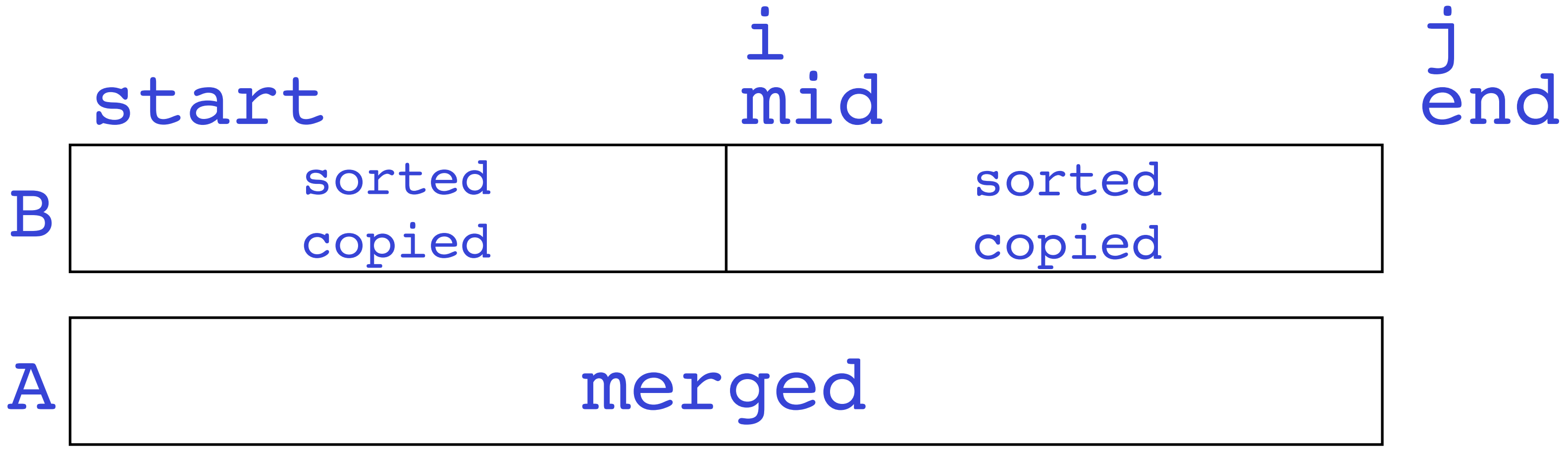
sorted
not yet copied

sorted
not yet copied

A

?

Post



start

i

mid

j

end

B

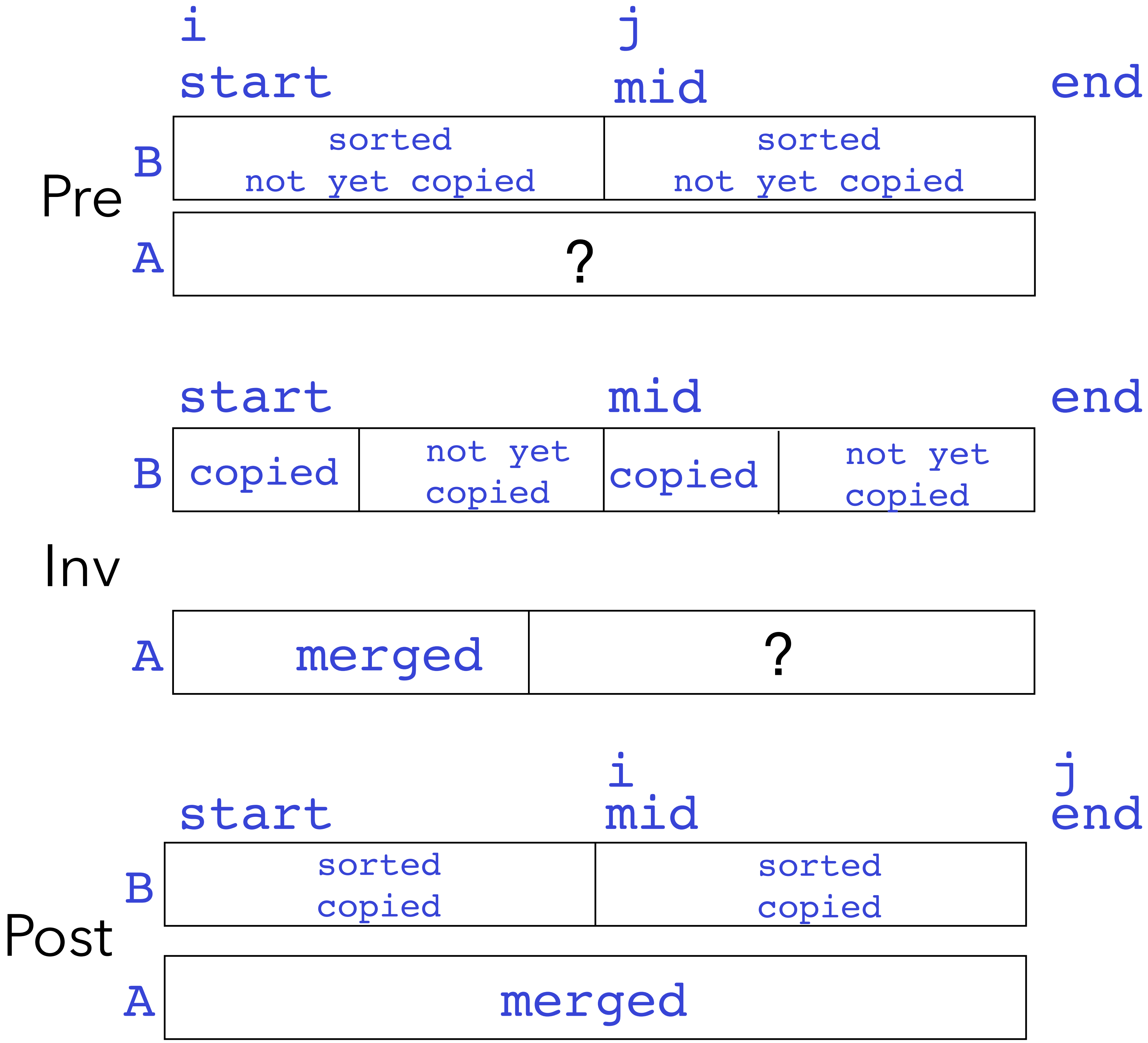
sorted
copied

sorted
copied

A

merged

Merge Step: Loop Invariant



Pre

i

start

j

mid

end

B

sorted
not yet copied

sorted
not yet copied

A

?

Inv

start

mid

end

B

copied

not yet
copied

copied

not yet
copied

A

merged

?

Post

i

mid

start

j

end

B

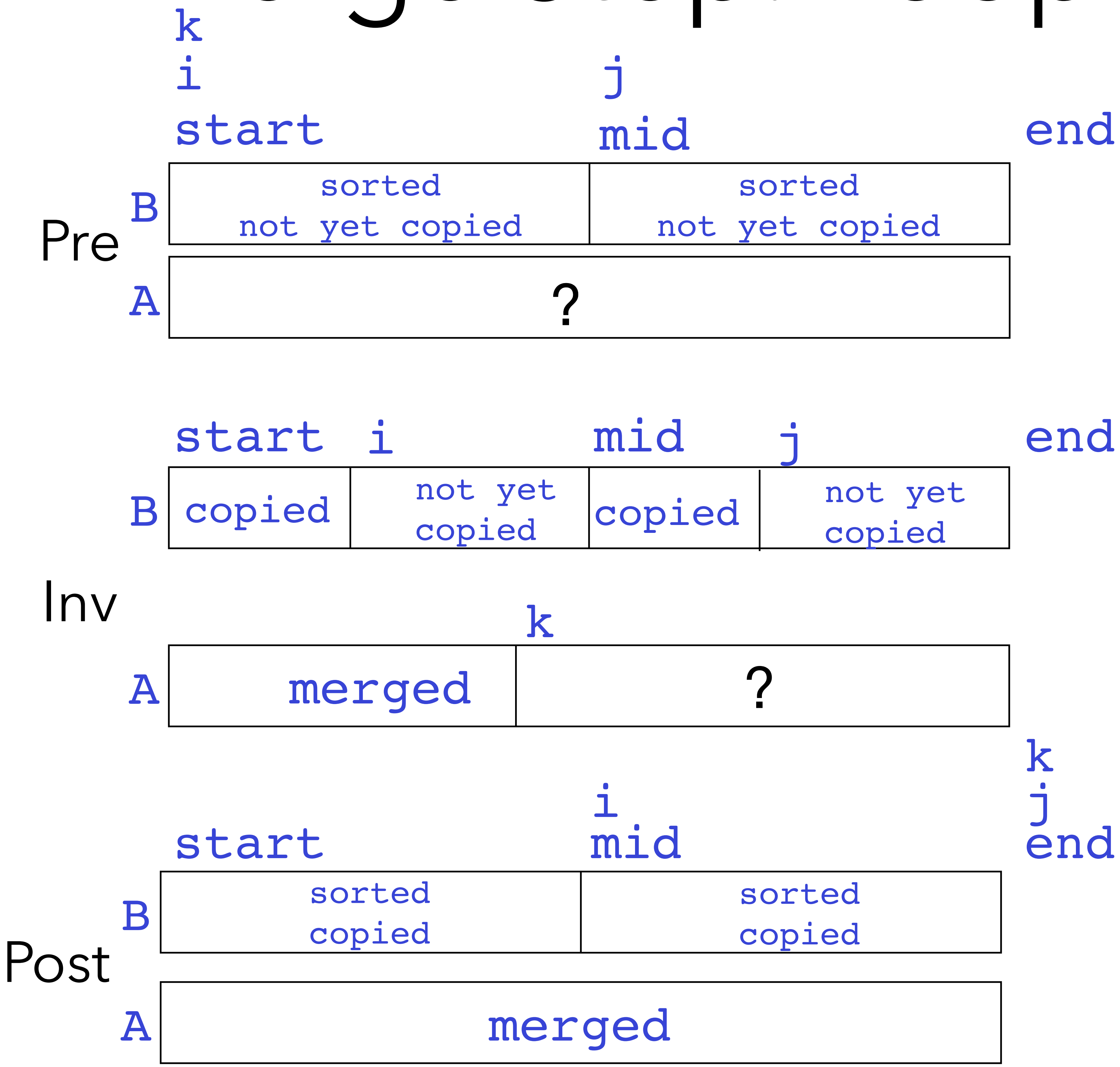
sorted
copied

sorted
copied

A

merged

Merge Step: Loop Invariant



Pre

k
i
start

j
mid

end

B

sorted
not yet copied

sorted
not yet copied

A

?

Inv

start i mid j end

B

copied

not yet
copied

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not yet
copied

k

A

merged

?

Post

start

i
mid

k
j
end

B

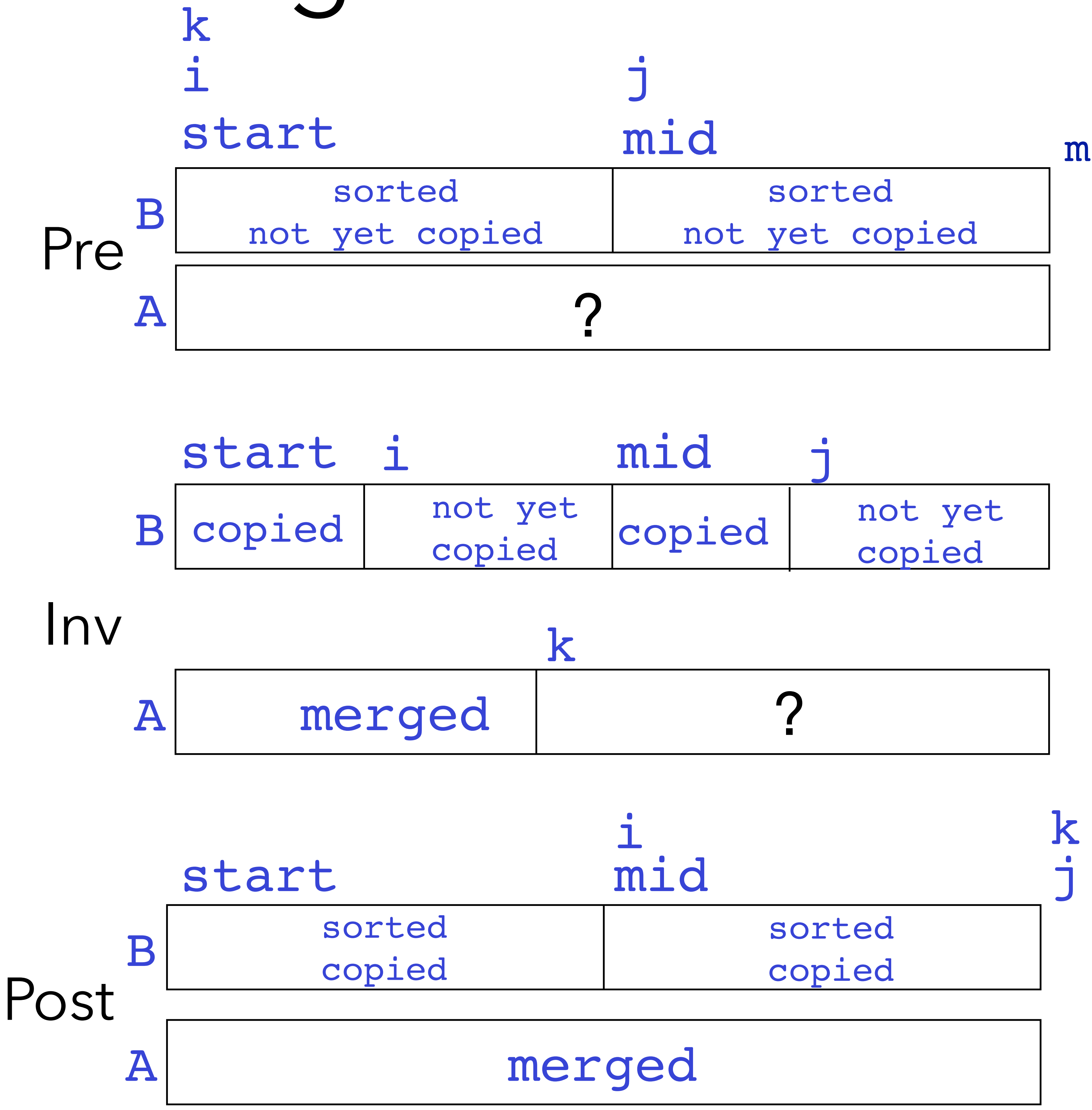
sorted
copied

sorted
copied

A

merged

Merge Pseudocode: Initialization



k
i
start

j
mid

Pre

B

sorted
not yet copied

sorted
not yet copied

A

?

start i mid j

B

copied

not yet
copied

copied

not yet
copied

Inv

k

A

merged

?

i
mid

k
j

start

B

sorted
copied

sorted
copied

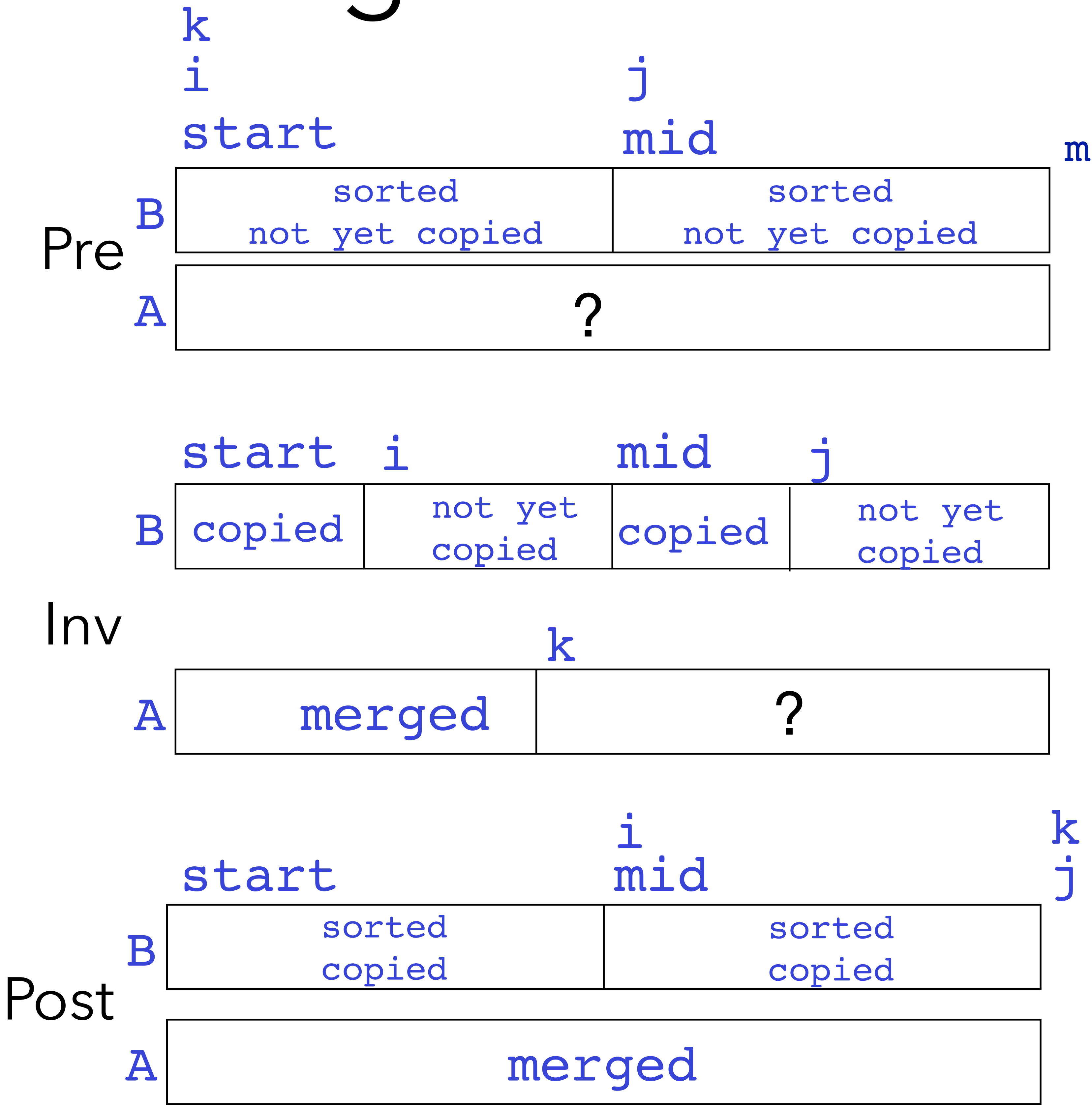
Post

A

merged

```
merge(A, start, mid, end):
    B = deep copy of A
    initialize i, j, and k
```

Merge Pseudocode: Progress



Pre

k
i
start
j
mid

B
sorted
not yet copied
sorted
not yet copied

A
?

Inv

start
i
mid
j

B
copied
not yet copied
copied
not yet copied

k

A
merged
?

Post

i
mid
start
k
j

B
sorted
copied
sorted
copied

A
merged

```
merge(A, start, mid, end):
  B = deep copy of A
  initialize i, j, and k

  while neither half is empty
    copy the smaller
    “front” element into A

  copy any remaining
  left half elements

  copy any remaining
  right half elements
```