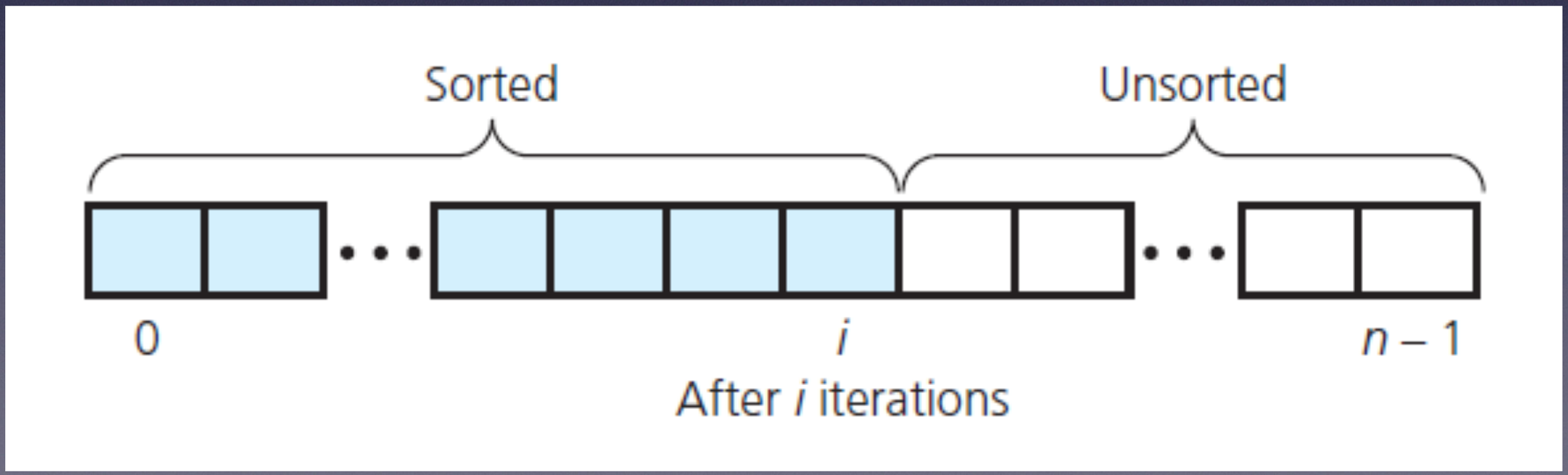
Insertion Sort

CS110C

Max Luttrell, CCSF

insertion sort

- Take the first item from the unsorted region, and **insert** it into the correct space in the sorted region
- In the beginning, the sorted region is simply the first element (an array with one element is always sorted)



insertion sort

Initial array:

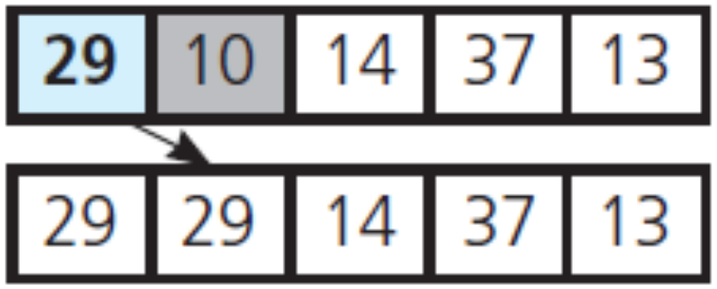
Copy 10

S

Blue: sorted -- White: unsorted

insertion sort

Initial array:



Copy 10

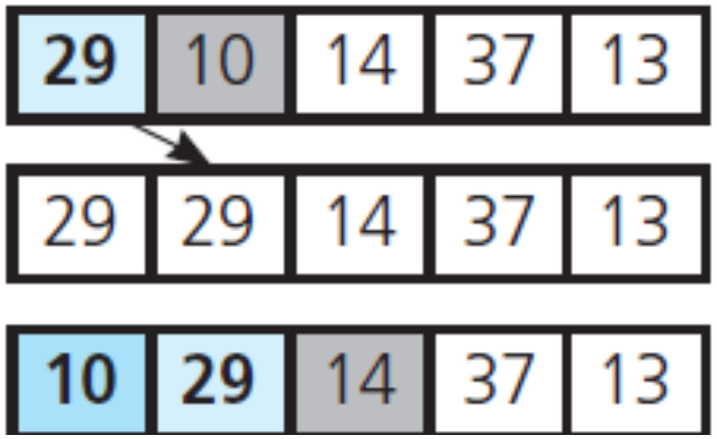
Shift 29

S

Blue: sorted -- White: unsorted

insertion sort

Initial array:



Copy 10

Shift 29

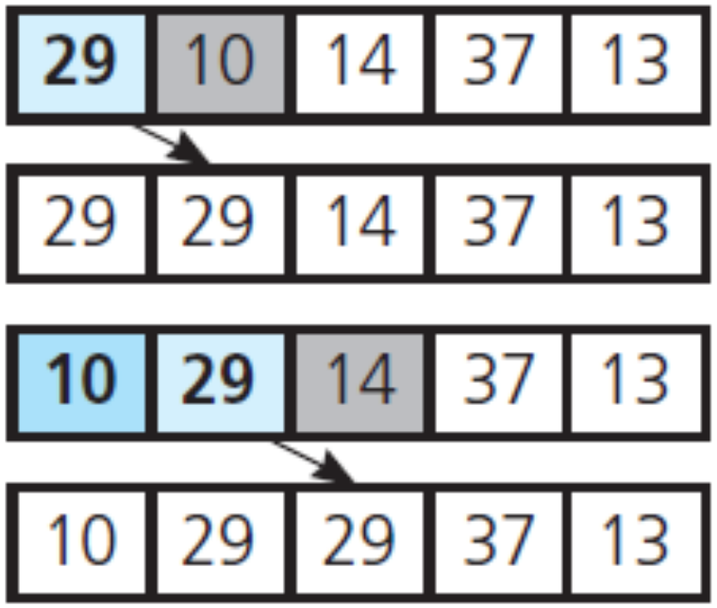
Insert 10; copy 14

S

Blue: sorted -- White: unsorted

insertion sort

Initial array:



Copy 10

Shift 29

Insert 10; copy 14

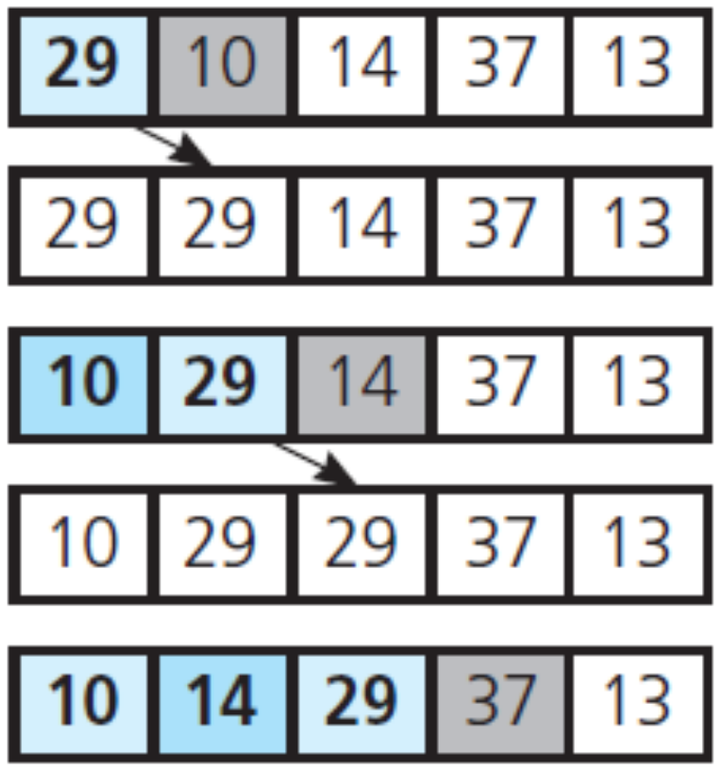
Shift 29

S

Blue: sorted -- White: unsorted

insertion sort

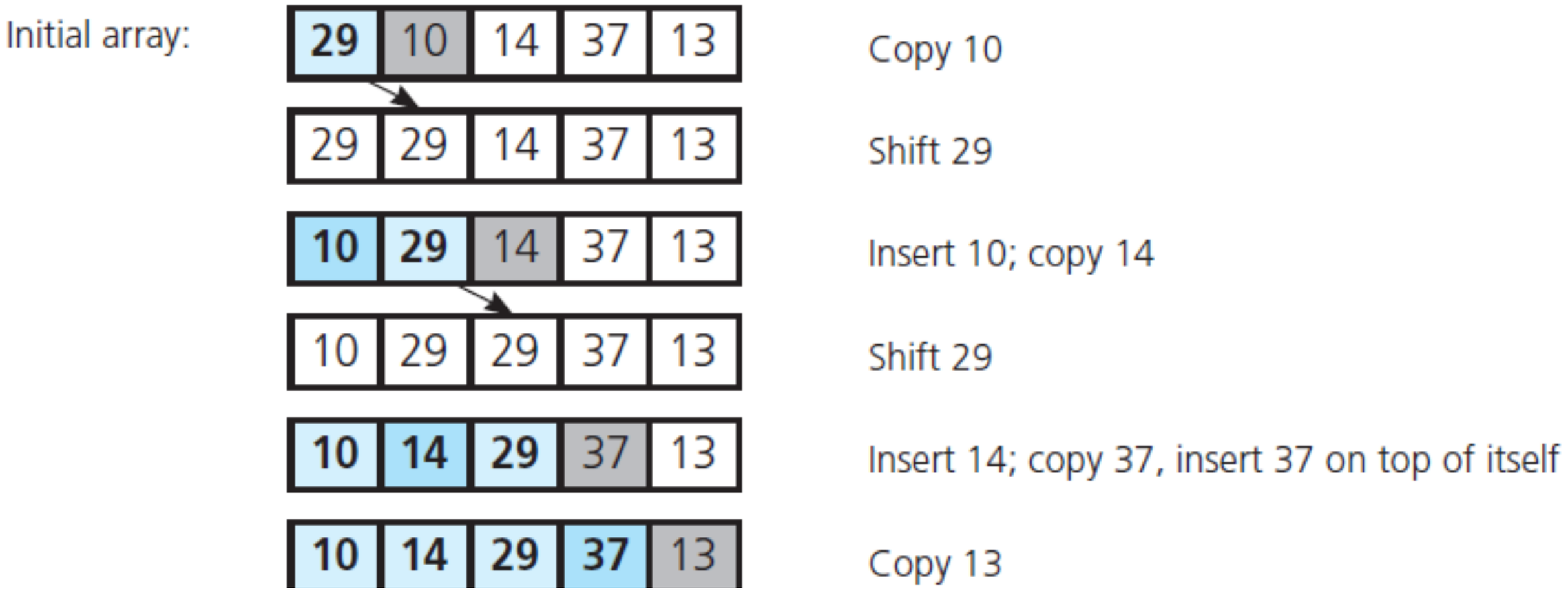
Initial array:



S

Blue: sorted -- White: unsorted

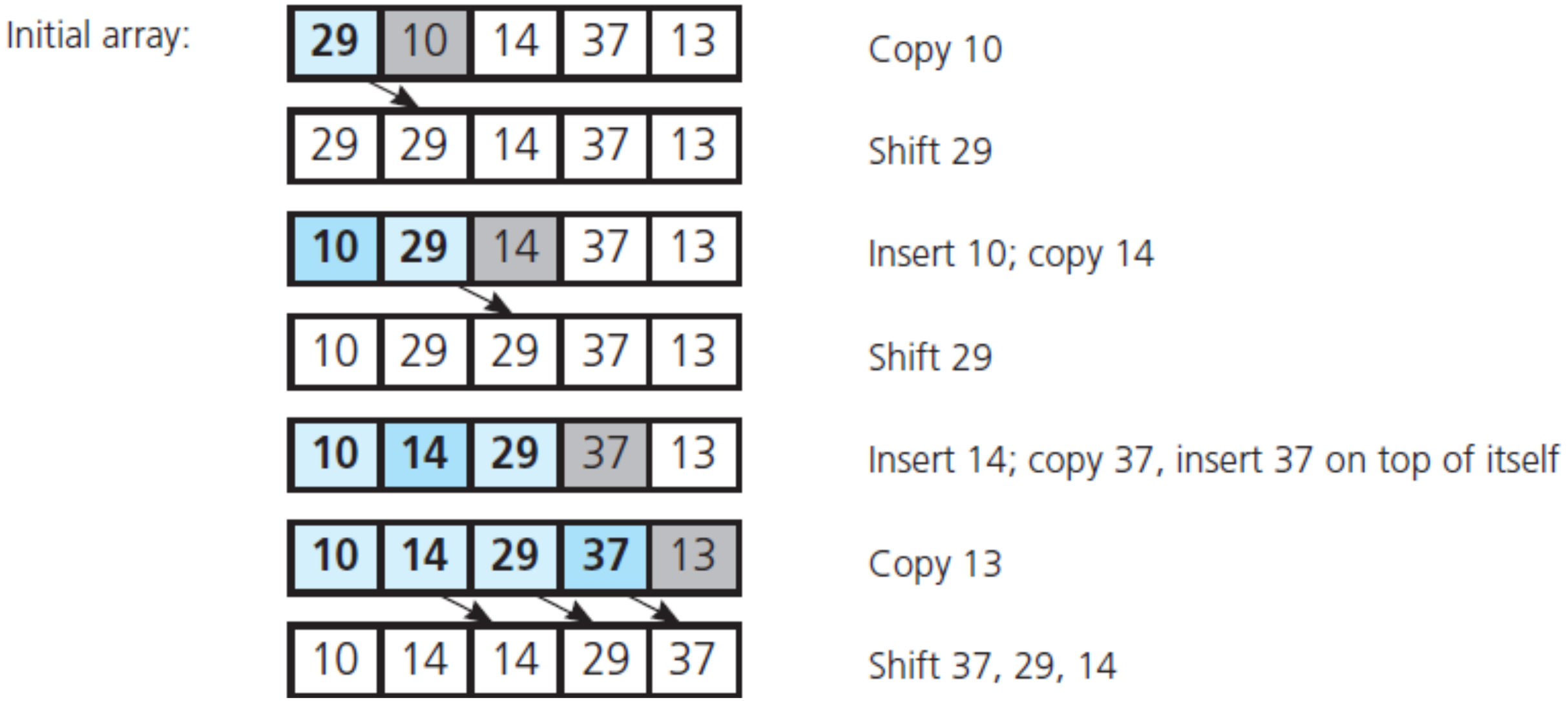
insertion sort



S

Blue: sorted -- White: unsorted

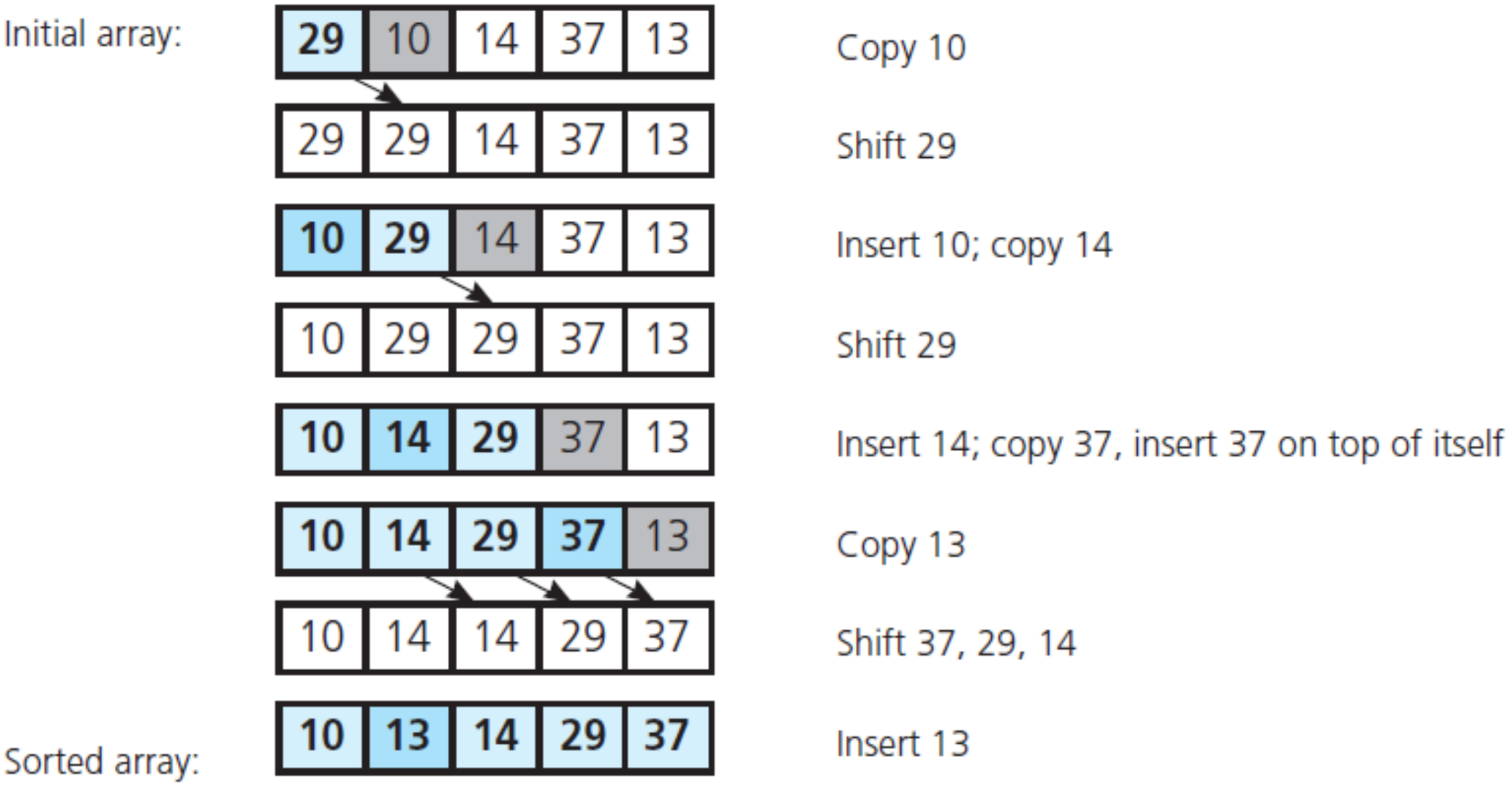
insertion sort



S

Blue: sorted -- White: unsorted

insertion sort



Blue: sorted -- White: unsorted

```
void insertionSort(int theArray[], int n)
{
   // unsorted = first index of the unsorted region,
   // loc = index of insertion in the sorted region,
   // nextItem = next item in the unsorted region.
   //
   // Initially, sorted region is theArray[0],
   // unsorted region is theArray[1..n-1].
   // In general, sorted region is theArray[0..unsorted-1],
   // unsorted region theArray[unsorted..n-1]
   for (int unsorted = 1; unsorted < n; unsorted++)
   {
      // At this point, theArray[0..unsorted-1] is sorted.
      // Find the right position (loc) in theArray[0..unsorted]
      // for theArray[unsorted], which is the first entry in the
      // unsorted region; shift, as necessary, to make room
      int nextItem = theArray[unsorted];
      int loc = unsorted;
      while ((loc > 0) && (theArray[loc - 1] > nextItem))
      {
         // Shift theArray[loc - 1] to the right
         theArray[loc] = theArray[loc - 1];
         loc--;
      }  // end while

      // At this point, theArray[loc] is where nextItem belongs
      theArray[loc] = nextItem; // Insert nextItem into sorted region
   }  // end for
}  // end insertionSort
```