

1 Insertion sort example

Suppose that we want to sort the following array according to the alphabetical order using Insertion Sort.

CAB

In the first iteration, Insertion Sort starts moving *C*. Where does *C* end up after this iteration?

CAB

- ☒ Position 1
- ☐ Position 2
- ☐ Position 3

Correct

Now we start moving *A*. Where does *A* end up after we are done with this iteration?

CAB

- ☒ Position 1
- ☐ Position 2
- ☐ Position 3

Correct

In the next iteration, we move *B*. Where does it end up?

ACB

- ☐ Position 1
- ☒ Position 2
- ☐ Position 3

Correct

The final array looks as follows.

ABC

2 Insertion sort questions

Can you see a pattern? When sorting an array using Insertion Sort, which of the following is correct after having iterated over the first *i* items.

- ☐ Item *i* is in its final position and will never move again.
- ☒ The first *i* items are in sorted order.
- ☐ The first *i* items are in their final positions.
- ☐ All of the above.

Correct

What is the smallest exponent *x* such that Insertion Sort on an array of size *n* always takes time $O(n^x)$?

2

Correct

What if we run insertion sort on an already-sorted array. What is the smallest exponent *x* such that Insertion Sort on a sorted array takes time $O(n^x)$?

1

Correct

Which of the following describes the worst case runtime of Insertion Sort?

- ☐ $O(n^2)$
- ☐ $\Omega(n^2)$
- ☐ $\Omega(n)$
- ☒ All of the above

Correct

3 Merge sort

The Merge operation takes two arrays *A* and *B* of size *n* which are already sorted and outputs the union of the two in sorted order. What is the smallest bound on the runtime of the Merge algorithm?

- ☐ $O(n \log n)$
- ☒ $O(n)$
- ☐ $O(n^2)$

Correct

In Merge Sort run on array of size *n*, how many calls (in total across all levels of recursion) are made to the Merge subroutine?

- ☒ $\Theta(n)$
- ☐ $\Theta(n \log n)$
- ☐ $\Theta(\log n)$

Correct

Is Merge Sort faster than Insertion Sort on all input arrays?

- ☐ Yes
- ☒ No

Correct

Is Merge Sort faster than Insertion Sort on some arrays?

- ☒ Yes
- ☐ No

Correct

If algorithm *A* is faster than algorithm *B* on some inputs, does that mean *A*'s worst case runtime is better than *B*'s worst case runtime?

- ☐ Yes
- ☒ No

Correct

Is Merge Sort's worst case runtime asymptotically faster than Insertion Sort's worst case runtime?

- ☒ Yes
- ☐ No

Correct