

Computer Science 3650
Spring 2020
February 26 Class Exercises

Suppose we have an algorithm A that does comparison-based sorting. Answer true or false for each of the following. Assume our input size is n , and that each of the n inputs is distinct.

1. There can be an input ordering for which algorithm A executes no more than n comparisons to determine the sorted order.
2. There can be an input ordering for which algorithm A executes no more than $2n$ comparisons to determine the sorted order.
3. There a total of $n!$ different input orderings.
4. There is at least one input ordering that requires $\Omega(n \lg n)$ comparisons to determine the sorted order.

Answer true or false for each of the following questions about asymptotic analysis fundamentals.

5. If an algorithm has a run time bounded by $\Omega(n \lg n)$, then $\Omega(n)$ is necessarily also a bound for its run time.
6. If an algorithm has a run time bounded by $\Omega(n)$, then $\Omega(n \lg n)$ is necessarily also a bound for its run time.
7. If an algorithm has a run time bounded by $O(n \lg n)$, then $O(n)$ is necessarily also a bound for its run time.
8. If an algorithm has a run time bounded by $O(n)$, then $O(n \lg n)$ is necessarily also a bound for its run time.
9. For sorting, given a problem size of n items, if we are guaranteed that no more than $n/100,000$ are out of order, we would consider that a proportional bound on the number of unordered items.
10. For sorting, given a problem size of n items, if we are guaranteed that no more than 1 million items are out of order, we would consider that a proportional bound on the number of unordered items.