CSc 345: Analysis of Discrete Structures  
Fall 18 (Lewis)  

Week 2 Quiz  

Solutions

Name: ________________________________ NetID (email): ________________________________

Fill in your name and NetID.  
Please do not open the quiz until I tell you to do so.

Directions: Answer the following questions to the best of your ability. When appropriate, we encourage you to show your work, to help us understand your thought process. Quizzes count toward your grade; please take them seriously.

WARNING: This quiz includes one trick question.

1. Sometimes, when people write naïve Quicksort implementations, they work well for random data but do poorly for some very common input patterns. We’ve discussed an example in class; explain what the input pattern is, and what was wrong with the implementation (that lead to an $O(n^2)$ runtime cost).

Solution: If the data is sorted, and the code always chooses the first (or last) value as the pivot, then it will always choose a terrible pivot, and not split the data well.

2. Explain how to redesign Quicksort so that it will never, under any input, encounter the $O(n^2)$ runtime cost.

Solution: It can’t be done.

3. Name one of the downsides of Merge Sort. Then name one of its excellent features (which Quicksort doesn’t have).

Solution: Downside: memory overhead (have to allocate the temp buffer)  
Upsides: stable sort, never goes to $O(n^2)$ runtime

4. The Selection Sort algorithm runs $n$ times over the data. What does it do on each of the passes?

Solution: It searches through the not-yet-sorted data, looks for the min (also OK answer: max), and then moves it into its proper place in the array.