Tutorial 04: February 6

1. [E] Assume that you call *QuickSort* on an array of size n where all elements are the same. Derive (with an explanation) an asymptotically tight bound on the run-time, presuming you use Hoare's partition-algorithm from class.

2. [M] Let $0 < \epsilon < 1$. Suppose that we have an array A of n items such that the first $n - n^\epsilon$ items are sorted. Describe an $O(n)$ time algorithm to sort A.

3. [H] Give the best-case, worst-case, best-case expected and worst-case expected runtime of the following function:

Algorithm 1: IsSortedGuess($A, currmax = 0$)

Input: Array A of n nonnegative integers, integer $currmax$ which is initially set to 0
Output: A guess on whether A is sorted or not.

1   **if** $n == 0$ **then**
2 | Return "Probably Sorted"
3   **end**
4   $i \leftarrow random(n)$
5   **if** $A[i] \geq currmax$ **then**
6 | $currmax \leftarrow A[i]$
7 | Return IsSortedGuess($A[i+1 \ldots n], currmax$)
8   **end**
9   Return "Definitely Not Sorted"