CSE 373 QuickCheck 7 Name: ______________________ Student ID: _______________

Suppose you work on a droid assembly line. You have a supposedly sorted array of N `Droid` objects that implement `Comparable`. However, when looking through your array, you realize these aren't the droids you're looking for! The machine malfunctioned and made at most k mistakes: there are no more than k inversions, where we define an inversion as a pair of droids that is not in the right order.

> *Hint*: The array [0 1 1 2 3 4 8 6 9 5 7] has 6 inversions: 8–6, 8–5, 8–7, 6–5, 9–5, 9–7.

For the questions below, give the typical or expected runtime. For example, for quicksort, assume that the pivot choices result in $O(\log N)$ recursive depth.

1. For each k, give the most efficient sorting algorithm and its simplified asymptotic runtime.

   (a) $k \in O(N)$ Algorithm: ______________________________ Runtime: $\Theta($__________$)$

   (b) $k \in O(N^2)$ Algorithm: ______________________________ Runtime: $\Theta($__________$)$

   (c) $k \in O(\log N)$ Algorithm: ______________________________ Runtime: $\Theta($__________$)$

2. Two weeks later, you're given another batch of droids that are supposed to be sorted on a 32-bit `int ID`, an instance variable of `Droid`. The machine hasn't been fixed and again made at most k mistakes. For each k, give the most efficient sorting algorithm and its simplified asymptotic runtime.

   (a) $k \in O(N^2)$ Algorithm: ______________________________ Runtime: $\Theta($__________$)$

   (b) $k \le 5$ Algorithm: ______________________________ Runtime: $\Theta($__________$)$