CSSE 220 – Object-Oriented Software Development
Rose-Hulman Institute of Technology

Quiz Practice

Name (Print):________________________________ Section:________________

1. **Selection Sort (trace & concept)**
   Given the array $[7, 3, 5]$:

   (a) Show the array *after each outer-loop iteration* of Selection Sort.

   (b) Clearly show the boundary between sorted and unsorted parts at each iteration.

   (c) What is the worst-case time complexity (Big-O) of Selection Sort?

Trace (after each outer iteration)
Iter. 0: $\Rightarrow ||[7,\ \ 3,\ \ 5]$

Iter. 1: $\Rightarrow [3, ||7, 5]$

Iter. 2: $\Rightarrow [3, 5, ||7]$
(Last position already determined.)

Complexity: $O(n^2)$ (regardless of worst/best case input order)

2. **Insertion Sort (trace & best/worst)**
   Given the array $[4, 1, 3]$:

   (a) Show the array *after each outer-loop iteration* of Selection Sort.

   (b) Clearly show the boundary between sorted and unsorted parts at each iteration.

   (c) State the best-case and worst-case time complexities (Big-O) for Insertion Sort.

Start: $[4 \,|\, 1, 3]$

Insert 1: shift 4 right $\Rightarrow [\underline{1}, 4 \,|\, 3]$

Insert 3: compare with 4, shift 4 $\Rightarrow [1, \underline{3}, 4]$

Best case - Already sorted array: $O(n)$ moves (each key compares once, performs a constant move).
Complexities: Best $O(n)$ (already sorted), Worst $O(n^2)$ (reverse order).

3. **Merge Sort (splits, merges, and cost)**
Consider running Merge Sort on $[8, 4, 2, 6]$.

   (a) Draw the split structure down to single-element arrays.

   (b) After the split, list the pairs merged at each level.

   (c) Give the worst-case time complexity for Merge Sort.

$[8, 4, 2, 6]$

$[8, 4]$ $[2, 6]$

$[8]$ $[4]$ $[2]$ $[6]$

Merge order

$[4, 8]$ $[2, 6]$

$[2, 4, 6, 8]$

Cost Time: $O(n \log n)$ (each level costs $O(n)$, and there are $\log_2 n$ levels).