Homework Assignment: 2
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1. XSort Algorithm

   (a)
   $$EXAMPLE \Rightarrow AXEMPLE \Rightarrow AEXMPLE \Rightarrow AEEMPLX$$
   $$\Rightarrow AEELPMX \Rightarrow AEELMPX$$

   (b) Time Efficiency: $O(n^2)$
   Space Efficiency: $O(1)$

   (c) Stability in an algorithm refers to the ordering of elements of same values in the final sorted list. A stable algorithm will keep elements of the same value in the same order as they appeared in the unordered list. This algorithm is not stable. This is shown when givent the list [2, 2, 1]; the first 2 element is swapped with 1 resulting in [1, 2, 2] and the original order of the equal elements is now changed.

2. Bubble Sort

   (a)
   $$EXAMPLE \Rightarrow EAXMPLE \Rightarrow EAMXPLE \Rightarrow EAMPXLE$$
   $$\Rightarrow EAMPLXE \Rightarrow EAMPLEX \Rightarrow AEMPLEX \Rightarrow AEMPLEX$$
   $$\Rightarrow AEMPLEX \Rightarrow AEMLPEX \Rightarrow AEMLEPX \Rightarrow AEMLEPX$$
   $$\Rightarrow AEMLEPX \Rightarrow AELMEPX \Rightarrow AELEMPX \Rightarrow AELEMPX$$
   $$\Rightarrow AELEMPX \Rightarrow AEELMPX \Rightarrow AEELMPX \Rightarrow AEELMPX$$
   $$\Rightarrow AEELMPX \Rightarrow$$

   (b) Bubble sort works by progressively swapping larger elements with smaller elements to the right. If no swaps occur during the pass through the array, then the list is sorted.

   (c) This sort is stable because the comparison is testing to see if $alist[x] > alist[x+1]$ rather than $list[x] \geq list[x+1]$. Thus, a swap is only made if element x is larger than element x+1.

3. Show that $n^2 \in O(n^2 + 10n), n \geq 0$

   Choose $c = 1$

   $n^2 \leq n^2 + 10n$, while $n > 0$

   $\Rightarrow 0 \leq c10n$

   because this holds true, $n^2 \in O(n^2 + 10n)$

4. Show that $n \notin \Omega(n^2)$

    if $f(n) \in \Omega(g(n))$, then $f(n) \geq cg(n)$

    $\Rightarrow$n $\geq cn^2$, while $c > 0$

    $\Rightarrow$1 $\geq cn$ $\Rightarrow$n$\leq \frac{1}{c}$

    because $n > \frac{1}{c}$, then $n \notin \Omega(n^2)$