

Homework Assignment 1

1. **Exercise 2.2–2** The loop invariant is that for any iteration i , the smallest $i - 1$ elements will be sorted in ascending order. Thus, we only need to run the algorithm on the first $n - 1$ elements because the smallest $n - 1$ elements will be sorted at that point. In other words, the n th remaining number must be the greatest in our array. In both best and worst cases, the running time of the algorithm is $\theta(n^2)$.

Algorithm 1 Selection Sort Pseudocode

Input: Unsorted Array x

Output: Sorted Ascending Order Array x

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1: function SELECTIONSORT( $x$ )
2:   for  $i \leftarrow 0$  to  $\text{length}(x)-1$  do
3:      $\text{smallest} \leftarrow x[i]$ 
4:     for  $j \leftarrow i + 1$  to  $\text{length}(x)$  do
5:       if  $x[j] < \text{smallest}$  then
6:          $\text{smallest} \leftarrow x[j]$ 
7:       end if
8:     end for
9:      $x[i] \leftarrow \text{smallest}$ 
10:     $x[j] \leftarrow x[i]$ 
11:  end for
12:  return  $x$ 
13: end function

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2. **Exercise 2.3–3**
3. **Problem 2–3**
4. **Prove or disprove** $f(n) + g(n) = \Theta(\max(f(n), g(n)))$
5. **Problem 3.3a**
6. **Exercise 4.1–5**
7. **Exercise 4.2–4**
8. **Exercise 4.3–7**
9. **Exercise 4.4–9**
10. **Problem 4.3bfhj**