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*csce750 — Analysis of Algorithms*  
*Fall 2020 — Homework 00*

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**Assigned:** August 20

**Due:** never

This assignment is a review of some algorithm analysis techniques.

Page 14: Problem 1-1

Not in textbook: Examine the pseudocode for INSERTIONSORT on page 18. Write a summation expressing the number of element comparisons made by this algorithm, in the worst case, for an input size  $n$ . Simplify this summation to a form that does not include any summation symbols. Use the simplest possible  $\Theta$  notation to classify the order of growth of this expression. Repeat these steps for the best case number of comparisons.

Page 39: Exercise 2.3-4

Not in textbook: Examine the pseudocode for MERGESORT on page 34 and its MERGE subroutine from page 31. Write a recurrence, with an appropriate base case, expressing the number of element comparisons made by this algorithm, in the worst case, for an input size  $n$ . Solve this recurrence—that is, express its growth using the simplest possible  $\Theta$  notation—using your favorite (correct) method.

Not in the textbook: Arrange the following functions from left to right in descending order by asymptotic growth rate:

$$0.1n^4 + n^3 \quad 2^{2n} \quad 2^{(\lg n)^2} \quad 2^{\lg n} \quad 3^n \quad 3^{n+1} \quad 5 \lg(n + 100)^{10}$$
$$(\lg n)^2 \quad (n - 2)! \quad n^{20} \quad n^{20}(\lg n)^{20} \quad n^4 + 0.1n^3 \quad \sqrt[3]{n}$$

If two or more functions have the same growth rate (that is, if one is  $\Theta$  of another), arrange them vertically within the list.