CSCE 750, Homework 0

September 2, 2023

This assignment is a review of some algorithm analysis techniques. Page, exercise, and problem numbers refer to the **fourth edition** of the textbook. Numbers in the third edition, if different, are given in brackets. The acronym, "NIT" stands for "not in textbook." This homework is not to hand in.

Pages 15–16 Problem 1-1 [3rd ed pages 14–15]

NIT.1 Examine the pseudocode for INSERTIONSORT on page 19 [3rd ed 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 Θ notation to classify the order of growth of this expression. Repeat these steps for the best case number of comparisons.

Page 44 Exercise 2.3-5 [3rd ed page 39, Ex 2.3-4]

NIT.2 Examine the pseudocode for MERGESORT on page 39 [3rd ed page 34] and its MERGE subroutine from page 36 [3rd ed 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 Θ notation—using your favorite (correct) method.

NIT.3 Arrange the following functions from left to right in descending order by asymptotic growth rate:

$$0.1n^4 + n^3 \qquad 2^{2n} \qquad 2^{\left((\lg n)^2\right)} \qquad 2^{\lg n} \qquad 3^n \qquad 3^{n+1} \qquad 5\left(\lg(n+100)\right)^{10}$$

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

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