CSCE 5150 – Analysis of Computer Algorithms

Homework No. 2 – Divide & Conquer

Due on Friday, September 30, 2022

Q1. [*10 points*] Give asymptotic upper and lower bounds for $T(n)$ in each of the following recurrences. Assume that $T(n)$ is constant for $n \leq 3$. Make your bounds as tight as possible, and justify your answers. (*Hint*: You can use the best matching case of Master Method to determine the tight bounds of Θ notation)

(a) $T(n) = 2T(n/3) + n \lg n$

(b) $T(n) = 3T(n/5) + \lg^2 n$

(c) $T(n) = 7T(n/2) + n^3$

(a) $T(n) = T(\sqrt{n}) + \Theta(\lg \lg n)$

(b) $T(n) = 10T(n/3) + 17n^{1.2}$

Q2. [*5 points*] By using the substitution method, show that the solution of the recurrence $T(n) = T(n-1) + n$ is $O(n^2)$. (Exercise 4.3-1)

Q3. [*5 points*] Use a recursion tree to determine a good asymptotic upper bound on the recurrence $T(n) = T(n/2) + n^2$. You can use the substitution method to verify your answer. (Exercise 4.4-2)

Q4. [*5 points*] Use Strassen's algorithm to compute the matrix product, and show your work. (Exercise 4.2-1)

$$\begin{pmatrix} 1 & 3 \\ 7 & 5 \end{pmatrix} \begin{pmatrix} 6 & 8 \\ 4 & 2 \end{pmatrix}$$

Instructions:

1. Prepare a MS-Word document or a clear scanned-handwritten pdf.
2. Write your **name** & **UNT ID**, the **course number**, and **Homework No. 2** on the top.
3. Name your file as **HW2-LastName-FirstName**.
4. Upload your file to the dropbox of this assignment on Canvas.