Assignment 6

CSCI 3110: Design and Analysis of Algorithms

Due June 25, 2019

Banner ID: _____ Name: _____

Banner ID: _____ Name: _____

Banner ID: _____ Name: _____

Assignments are due on the due date before class and have to include this cover page. Plagiarism in assignment answers will not be tolerated. By submitting their answers to this assignment, the authors named above declare that its content is their original work and that they did not use any sources for its preparation other than the class notes, the textbook, and ones explicitly acknowledged in the answers. Any suspected act of plagiarism will be reported to the Faculty's Academic Integrity Officer and possibly to the Senate Discipline Committee. The penalty for academic dishonesty may range from failing the course to expulsion from the university, in accordance with Dalhousie University's regulations regarding academic integrity.

1. (14 points) Solve each of the following recurrences using the Master Theorem or, if the Master theorem is not applicable to the recurrence, state why. If the Master Theorem applies, *state which case is applicable* and show that the recurrence satisfies the conditions of this case.

   (a) $T(n) = 5T(n/3) + n \log n$

   (b) $T(n) = 4T(n/4) + n/\log n$

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

   (d) $T(n) = 16T(n/4) + n^2$

   (e) $T(n) = T(n/3) + T(2n/3) + n$

   (f) $T(n) = 3T(n-5) + n \log n$

   (g) $T(n) = \begin{cases} 2T(n/2) + n^3 & \text{if } n \text{ is an even integer} \\ 2T(n/2) + n^2 & \text{if } n \text{ is an odd integer} \end{cases}$

2. (12 pts) Solve each of the following recurrences using substitution or a recursion tree. Do not only state your solution—Show how you obtained it. That is, if you use substitution, you must present the complete inductive proof that your solution is correct. If you use a recursion tree, show the recursion tree and discuss how you obtained the solution from the tree. *Note that you are to prove matching upper and lower bounds.*

   (a) $T(n) = 4T(n/2) + n^2$

   (b) $T(n) = T(n/4) + T(n/2) + n$

3. (Bonus: 4 pts) What is the solution to $T(n) = 2T(n-1) + T(n-2) + 1$? You do not need to prove your solution but provide some justification for it.