Homework Assignment 2

MCS/CS 401 Computer Algorithms I **due on Thursday, 06/30/2022 at 11:59 PM**

Tag all questions on Gradescope after submitting the PDF file!

Read Chapters 4, 6 and 7 thoroughly and solve the following problems.

Problem 1. *Draw a tree for the recurrence* $T(n) = T(\frac{n}{2}) + T(\frac{n}{4}) + n$ *and determine the appropriate guess for the solution to the recurrence. Do not prove your solution, just determine it based on the recursion tree.*

Problem 2. *Using method of your choice, determine and prove the solution to the following recurrences.*

1. $T(n) = 3T(\frac{n}{3}) + \frac{n}{2}$
2. $T(n) = 2T(\frac{n}{4}) + n^{0.51}$
3. $T(n) = 4T(\frac{n}{2}) + n^2$
4. $T(n) = 4T(\frac{n}{2}) + n$
5. $T(n) = 7T(\frac{n}{3}) + n^2$

Problem 3. *In this problem we focus on the BUILD-MAX-HEAP operation.*

1. *Illustrate the operation of BUILD-MAX-HEAP on the array* $A = [6,3,12,9,25,17,4,22,8,5]$.
2. *Prove that the running time of the BUILD-MAX-HEAP operation is* $O(n \lg n)$. *Note, this is not a tight bound.*

Problem 4. *Determine the height of an n-element heap and prove its correctness.*

Problem 5. *Consider the recurrence* $T(n) = T(n-1) + \Theta(n)$. *Prove that T(n) is* $\Theta(n^2)$.

Assignment Guidelines and Plagiarism Warning

This assignment will consist of 5 Problem and it is due on **Thursday, 06/30/2022 at 11:59 PM**!

Your solution of this assignment must consist of a single, continuous PDF file, which you will upload to Blackboard/Gradescope on or before the above specified deadline.

This assignment must be solved **individually**. Under no circumstances are you allowed to copy or to collaborate with anyone else. **All submitted files will be automatically checked for plagiarism**. Regardless of who copied from whom, all caught in the act of plagiarism will be penalized, as specified in the course syllabus.

In particular, using internet resources of any kind is **not** allowed. Internet sites are routinely checked for similarity to your submission for content. Changing order or variable names will not prevent plagiarism detection. In addition, do not post any content of this assignment to any internet sites or make it public in any other form. **The content of this assignment is not in the public domain**!

You are free, however, to use our course resources, such as lecture notes and our text book, during the solving of this assignment. If you have questions about this assignment come to my online office hours, or those of the Teaching Assistants, using the usual Blackboard links.