COSC 302: Analysis of Algorithms — Spring 2018
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Problem Set 3 — Solving Recurrences and Divide and Conquer I

Due by 4:30pm Friday, Feb. 16, 2018 as a single pdf via Moodle (either generated via LaTeX, or concatenated photos of your work). Late assignments are not accepted.

This is an *individual* assignment: collaboration (such as discussing problems and brainstorming ideas for solving them) on this assignment is highly encouraged, but the work you submit must be your own. Give information only as a tutor would: ask questions so that your classmate is able to figure out the answer for themselves. It is unacceptable to share any artifacts, such as code and/or write-ups for this assignment. If you work with someone in close collaboration, you must mention your collaborator on your assignment.

Suggested practice problems (not to be turned in): 4.3-1, 4.3-8, 4.4-2, 4.4-4, 4.4-6, 4-3

1. Problem 4-1 from CLRS 3rd edition.
2. Using one of the methods discussed in lecture, give a tight asymptotic bound for the recurrence $T(n) = 8T(n/2) + n^3 \lg n$.
3. Problem 4.3-9 from CLRS 3rd edition.
4. *Revisiting the pinePhone.* You are still hard at work testing the quality of pinePhones for Pineapple.
   (a) Suppose now that you are given 3 pinePhones. Present a strategy to find the highest safe rung with $\Theta(\sqrt[3]{n})$ pinePhone drops.
   (b) Now show that you can find the highest safe rung with 4 pinePhones with $\Theta(\sqrt[4]{n})$ pinePhone drops.
   (c) Suppose you continue your strategy to k pinePhones: Define the number of pinePhone drops as a recurrence in terms of n, the number of rungs on the ladder, and k, the number of pinePhones you are given. *Hint:* Make sure to give at least one base case. Do you need multiple base cases?

Challenge: Solve this recurrence without using substitution.