

CS325: Analysis of Algorithms, Winter 2024

Practice Assignment 1 (Due: Thur, 1/18/24)

Homework Policy:

1. Students should work on practice assignments individually. Each student submits to CANVAS one set of typed solutions in pdf format.
2. Practice assignments will be graded on effort alone and will not be returned. Solutions will be posted.
3. The goal of the assignments is for you to learn solving algorithmic problems. So, I recommend spending sufficient time thinking about problems individually before discussing them with your friends.
4. You are allowed to discuss the problems with others, and you are allowed to use other resources, but you must cite them. Also, you must write everything in your own words, copying verbatim is plagiarism.

Submit solutions to problems 1, 2, 3, 4. The rest of the problems are for your practice.

Problem 1. For each of the following, indicate whether $f = O(g)$, $f = \Omega(g)$ or $f = \Theta(g)$.

- (a) $f(n) = 12n - 5$, $g(n) = 1235813n + 2017$.
- (b) $f(n) = n \log n$, $g(n) = 0.00000001n$.
- (c) $f(n) = n^{2/3}$, $g(n) = 7n^{2/3} + n^{1/10}$.
- (d) $f(n) = n^{1.0001}$, $g(n) = n \log n$.
- (e) $f(n) = n6^n$, $g(n) = (3^n)^2$.

Problem 2. Prove that $\log(n!) = \Theta(n \log n)$. (Logarithms are based 2)

Problem 3. Write a recursive algorithm to print the binary representation of a non-negative integer. Try to make your algorithm as simple as possible. Your input is a non-negative integer n . Your output would be the binary representation of n . For example, on input 5, your program would print '101'.

Problem 4.

- (a) Read tree traversal from wikipedia: https://en.wikipedia.org/wiki/Tree_traversal, the first section, Types.
- (b) Recall that a binary tree is *full* if every non-leaf node has exactly two children. Describe and analyze a recursive algorithm to reconstruct an arbitrary full binary tree, given its preorder and postorder node sequences as input. (Assume all keys are distinct in the binary tree)

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