Assignment 2

csci2200, Algorithms

Instructions:

- Honor code: Work on this assignment alone, or with one partner. Between different teams, Collaboration is at level 1 [verbal collaboration only]
- Check out the Homework guidelines on class website.

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1. Formally prove that big-O is transitiive, that is, if $f(n)$ is $O(g(n))$ and $g(n)$ is $O(h(n))$, then $f(n)$ is $O(h(n))$.
2. Prove or disprove: $n^2 \log^{10} n \leq O(n^{2.1})$
3. Prove or disprove: $2^{2n} \leq O(2^n)$
4. Prove or disprove: $4^n = \Theta(2^n)$
5. For each of the following functions, prove whether $f = O(g), f = \Omega(g)$ or both ($f = \Theta(g)$).
   (a) $f(n) = n \lg(n^3), g(n) = n \lg n$
   (b) $f(n) = 2^{2n}, g(n) = 3^n$
   (c) $f(n) = \sum_{i=1}^{n} \lg i, g(n) = n \lg n$
6. An algorithm solves problems by dividing a problem of size n into 3 sub-problems of one fourth the size and recursively solves the smaller sub-problems. It takes constant time to combine the solutions of the sub-problems. Find the asymptotic running time of the algorithm.