

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 transitive, 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.

Evaluation

This assignment (and all subsequent assignments) will be evaluated along several criteria:

1. **Correctness:** Is your answer correct?
2. **Justification:** Is your answer justified?
3. **Style:** Does it look professional and neat? Is the explanation written carefully in complete sentences, and well-organized logic? Is it easily human-readable? Is it complete yet concise? Is it easy to understand?