CSE 332: Data Structures and Parallelism

Exercises (Asymptotics)

Directions: *Submit your solutions on **Canvas**. You may use either a txt file or a pdf file.*

EX02. Hell-$\mathcal{O}$! (20 points)

Use the formal definitions of Big-Oh, Big-Omega, and Big-Theta to *prove or disprove* each of the following statements. You should assume that the domain and co-domain of all functions in this exercise are the natural numbers. Note: You should not be using calculus to solve these, use the definitions as given on the course slides. For disproving, proof by contradiction may be useful.

(a) [6 Points] If we have an algorithm that runs in $\mathcal{O}(n)$ time and make some changes that cause it to run 10 times slower for all inputs, it will still run in $\mathcal{O}(n)$ time.

(b) [7 Points] $(2^n)^{1/3} \in \Theta(2^n)$

   Note that this one is harder than the others. As a general strategy, you will want to negate the statement and prove the negation. We expect a fully formal proof here. You may not use Calculus (e.g., limits, differentiation, integrals) for this question, because it skirts around the actual formal proof.

(c) [7 Points] $2^{n+3} \in \Theta(2^n)$