Assignment 1

CS 350
Due: October 9, 2019

Your solutions must be typed (preferably typeset in \LaTeX) and submitted as a hard-copy at the beginning of class on the day its due.

Problem 1: [10 points] List the functions below from lowest order of growth to highest. If any two or more are the same, indicate which.

\[
\begin{align*}
\sqrt{n} & \quad m & \quad 2^n \\
n \log n & \quad n - n^3 + 7n^5 & \quad k^2 + \log k \\
m^2 & \quad n^3 & \quad \log n \\
n^{\frac{1}{3}} + \log n & \quad (\log n)^2 & \quad n! \\
\ln n & \quad \frac{n}{\log n} & \quad \log \log k \\
\left(\frac{1}{3}\right)^n & \quad \left(\frac{3}{2}\right)^n & \quad 6
\end{align*}
\]

Problem 2: [10 points] Suppose that \( f(n) \) and \( g(n) \) are non-negative functions. Prove or disprove the following: if \( f(n) \in O(g(n)) \) then \( 2f(n) \in O(2g(n)) \).

Problem 3: [10 points] Prove that for any positive integer constants \( a \) and \( b \).

\[(n + a)^b \in \Theta(n^b)\]

You will need to show that \((n + a)^b \in \Omega(n^b)\) and that \((n + a)^b \in O(n^b)\). (Warning: do not trust the internet’s answer for this question.)