

02-713 Homework #2: Asymptotic Analysis
Due: Feb. 4 by 9:30am

You may discuss these problems with your classmates, but you **must write up your solutions independently**, without using common notes or worksheets. You must indicate at the top of your homework who you worked with. Your write up should be clear, and concise. You are trying to convince a skeptical reader that your answers are correct. Your homework should be submitted via Autolab (<https://autolab.cs.cmu.edu/02713-s13/>) as a typeset PDF. A LaTeX tutorial and template are available on the class website if you choose to use that system to typeset.

AD = “Algorithm Design” by Kleinberg&Tardos

1. Solve problem 2.5 in AD.
2. Solve problem 2.6 in AD.
3. Rank the following functions in order of their asymptotic growth. That is if $f_i(n) = O(f_j(n))$ then $f_i(n)$ should come before $f_j(n)$ in your list. If $f_i(n) = \Theta(f_j(n))$ then the two functions should be given the same rank.
 - $f_1(n) = n^3$
 - $f_2(n) = n!$
 - $f_3(n) = n \log_2 n$
 - $f_4(n) = 1$
 - $f_5(n) = 2^{\log_2 n}$
 - $f_6(n) = 10n \log_{10} n$
 - $f_7(n) = (n + 1)!$
 - $f_8(n) = 2^{\log_{50} n}$
 - $f_9(n) = 4^{\log_2 n}$
 - $f_{10}(n) = n^{\log_2 \log_2 n}$
4. Let $f(n)$ and $g(n)$ be positive functions. Prove or disprove the following statements:
 - (a) $2^{n+1} = O(2^n)$
 - (b) $2^{2n} = O(2^n)$
 - (c) $3^n = O(2^n)$
 - (d) $f(n) = \Theta(f(n/2))$
 - (e) $f(n) = O(g(n))$ implies $g(n) = \Omega(f(n))$