

CS531
Spring 1998
Homework #1

(No credit will be given for unsupported answers.)

1. Rank the following by growth rate:
 $n, n^{1/2}, \log n, \log(\log n), \log^2(n), (1/3)^n, 4, (3/2)^n, n!$
2. Prove or disprove each of the following.
 - a) $f(n) = O(g(n)) \Rightarrow g(n) = O(f(n))$
 - b) $f(n) + g(n) = \Theta(\min(f(n), g(n)))$
 - c) $f(n) = O((f(n))^2)$
 - d) $f(n) = O(g(n)) \Rightarrow g(n) = \Omega(f(n))$
 - e) $f(n) + o(f(n)) = \Theta(f(n))$
3. Use $o, \omega, \Omega, \omega, \text{and } \Theta$ to describe the relationship between the following pairs of functions:
 - a) $\log^k n, n^e$
 - b) n^k, c^n
 - c) $2^n, 2^{n/2}$
4. Prove that $17n^{1/6} = O(n^{1/5})$.
5. Prove that $\sum_{k=1}^n \frac{1}{k} = \Theta(\log n)$.