

# CSCI 3110 Tutorial 1

Reviewed May 17, 2019

- Sort the following functions by increasing order of growth. For every pair of consecutive functions  $f(n)$  and  $g(n)$  in the sorted list, prove that  $f(n) = o(g(n))$ .

$$n^3 \quad \lg n \quad n$$

Hint: recall the limit rule for  $o(\cdot)$ :

$$\lim_{n \rightarrow \infty} \frac{f(n)}{g(n)} = 0 \iff f(n) = o(g(n))$$

- For each of the following functions  $f(n)$ , prove the stated claim by providing constants  $n_0$ ,  $c_1$ , and  $c_2$  such that for all  $n \geq n_0$ ,  $c_1g(n) \leq f(n)$  or  $f(n) \leq c_2g(n)$ , and provide a calculation that shows that this inequality does indeed hold.
  - $f(n) = n^2 + 2n^3 - 100n \lg n + 10 = O(n^3) = O(g(n))$
  - $f(n) = n^2 + 2n^3 - 100n \lg n + 10 = \Omega(n^3) = \Omega(g(n))$
  - $f(n) = n^2 + 2n^3 - 100n \lg n + 10 = \Theta(n^3) = \Theta(g(n))$