Problem Set 1

This problem set is due at **10:00 am** on **Tuesday, January 31st**.

Problem 1- 1: Growth

Sort the following functions so f appears before g if $f = O(g)$:

$$n^{0.99},\ \log_{1.1} n,\ 10^{1249},\ (\log_2 n)^2,\ 2^{(\ln \ln n)^2},\ 10^n,\ \ln \ln n,\ 2^{n^2},\ (\log_{10} n)^n,\ 1000n + 10^{10}.$$

Provide a one line explanation for each pair of consecutive functions in the sorted list.

Problem 1- 2: A New Order

Let G be an undirected graph on N vertices where each vertex has degree at most 2.

(a) Suppose that we perform a BFS of G. Let $v_1, \ldots, v_N$ be the vertices of G in the order they are visited in the search. Prove or disprove: every edge in G is of the form (v_i, v_{i+1}) or (v_i, v_{i+2}) for some i.

(b) Suppose that we perform a DFS of G. Let $v_1, \ldots, v_N$ be the vertices of G in the order they are visited in the search. Prove or disprove: every edge in G is of the form (v_i, v_{i+1}) or (v_i, v_{i+2}) for some i.