UMass Boston CS 310 Homework 1
Due in class on Thursday, February 2, 2017

It is recommended that you typeset your answers by LaTeX(`https://www.latex-project.org/get/`) or Word. Handwritten answers will be accepted only if clearly legible.

1. Solve this sum of a geometric series: $\sum_{i=1}^{\infty}(2/5)^i$.
2. (a) How many binary digits are there in 2^{50} and 10^{50}? How are the two numbers related? Hint: This is a question about logarithm.
   (b) Show that $\log_a(x) = c * \log_b(x)$ for some constant c expressed only in terms of constants a and b.
3. (a) Problem 5.19 of the textbook. Except in the obvious cases, give reasons for your ranking.
   (b) Rank the following functions: $\log n$, $\log(n^2)$, $\log\log n$, and $\log^2 n$. Explain reasons for your ranking.

   You may find it useful to remember that one way to compare the relative growth rates of $f(n)$ and $g(n)$ is to look at the ratio $f(n)/g(n)$ as $n \to \infty$. If that ratio approaches 0, then g grows faster than f: $f(n) = O(g(n))$. If it approaches infinity then f grows faster than g: $f(n) = \Omega(g(n))$. If the ratio approaches a constant different from both 0 and ∞, then f and g grow at the same rate.
4. Problem 5.26 of the textbook.
5. Use the telescoping technique to derive this equation:

$$\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$$