CSC 225 FALL 2015
ALGORITHMS AND DATA STRUCTURES I
ASSIGNMENT 1
UNIVERSITY OF VICTORIA

1. Order the following list of functions by the big-Oh notation. All logarithms are to the base 2.
   $6n \log n, \log \log n, 2^{100}, 2^{2^n}, 3n^{0.5}, 4^{\log n}, (\log n)^2, n^3, \sqrt{\log n}, 4^n$

2. Solve Problem 1.4.6 on Page 208 in the textbook. It asks you to give the order of growth (as a function of N) of the running times for three code fragments.

3. Prove by Induction:
   $$\sum_{i=1}^{n}(2i-1) = n^2 \quad \forall n \geq 1$$

4. Prove by Induction:
   $$\sum_{i=1}^{n} \frac{1}{i(i+1)} = \frac{n}{n+1} \quad \forall n \geq 1$$

5. An Array A contains $n-1$ unique integers in the range $[0, n-1]$. That is, there is one number in this range that is not in A. Describe in pseudo-code an $O(n)$-time algorithm for finding that number. You are only allowed to use $O(\log n)$ bits of additional space besides the array A itself.

6. Describe in pseudo-code an $O(n \log n)$ algorithm that determines the number of pairs of values in an input array A that are equal.