CSC 225 SPRING 2016
ALGORITHMS AND DATA STRUCTURES I
ASSIGNMENT 1
UNIVERSITY OF VICTORIA

1. Indicate for each pair of expressions (A,B) in the table below, whether A is O or Ω of B. Your answer should be in the form of a "yes" or "no" in each box.

A	B	O	Ω
$(\log n)^3$	n		
$2n^2 + 4n$	$4n^2$		
$n!$	2^n		
n^5	n^4		
100	100000		
n^2	$(1.5)^n$		

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

3. 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.

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

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

6. 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.