CSCI36200 **Student Name:** _____
Spring 2015 **Student ID:** _____
Homework Assignment 1
Due Date: Feb 9 (hand in BEFORE class)

Instructions:

This homework assignment contains 6 pages (including this cover page) and 3 questions.

Please **PRINT** your name in the "Student Name" box, and your student ID (as it appears in Canvas) in the "Student ID" box and on the running header of each page. Make sure your handwriting is **UNDERSTANDABLE**. If the TA or the graders cannot recognize your name, ID or your handwriting when they do the grading, you will lose 20 points (nonnegotiable!).

Please **print** out the sheets and answer the questions on the sheets like you do in an exam.

Grade Table (for TA/grader use only)

Question	Points	Score	Grader
1	0		
2	20		
3	32		
Total:	52		

1. (0 points) Indicate, for each pair of expressions (A, B) in the table below, whether A is O, Ω or Θ of B. Assume that $k \geq 1$, $\epsilon > 0$ and $c > 1$ are constants. Your answer should be in the form of the table with "yes" or "no" written in each box. Please prove all the "yes" cases either based on the definitions or using L'Hospital's rule (that is, you cannot use any conclusions we discussed in the lectures). All the correct decisions for each (A, B) pair as a whole deserve 2 points (that is, all the three boxes for each (A, B) pair have to be correctly filled. No partial grades will be allowed), and each proof deserves 5 points. If you miss a proof, you will not get the 5 points for that proof. (I mask off the total points for this question so you have to figure out how many proofs you need to do by yourself.) Please present the proofs in right order and clearly indicate which proof is for which case.

	A	B	O	Ω	Θ
1	$\log^k N$	N^ϵ			
2	N^k	c^N			
3	2^N	$2^{N/2}$			
4	$N^{\log c}$	$c^{\log N}$			
5	$\log(N!)$	$\log(N^N)$			
6	$\log\log N$	$\sqrt{\log N}$			
7	$N^{\log\log N}$	$N^{\frac{1}{\log N}}$			
8	$N\log N$	$N^{1+\epsilon/\sqrt{\log N}}$			
9	e^N	$(\frac{3}{2})^N$			
10	$(\log N)!$	$\log\log N$			

Proof:

2. (20 points) Problem 2.14, P73 (3 points for a), 5 points for b), 12 points for c))

3. (32 points) Give asymptotic upper bounds (i.e., in O notation) for T(N) in each of the following recurrences. Assume that T(N) is constant for sufficiently small N. Make your bounds as tight as possible and justify your answers (8 points for each question; if the bound is correct but not tight, and your justification is correct, you will lose 2 points for the loose bound).

   1) $T(N) = T(N-3) + 3\log N$

   2) $T(N) = 4T(N/2) + N^2\sqrt{N}$

3) $T(N) = T(N/2) + T(N/4) + T(N/8) + N$

4) $T(N) = 5T(N/5) + N/\log N$